Free Pictorial Blueprint | The Truth About Television

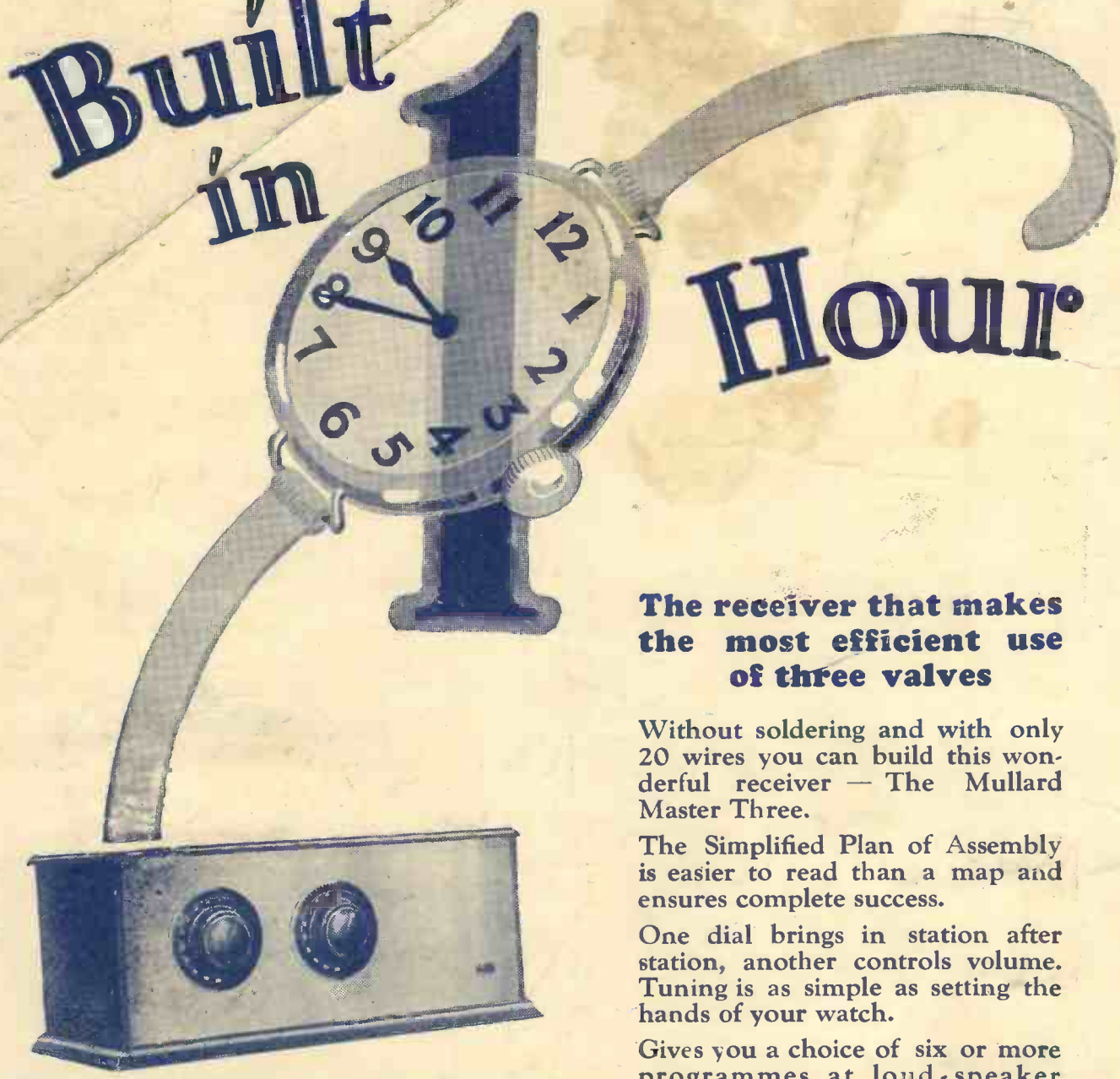
MODERN WIRELESS

1/- MONTHLY

Edited by
NORMAN EDWARDS
M.I.R.E., M.R.S.L., F.R.G.S.

Vol. IX. No. 15. MARCH, 1928.

Built in 1 Hour



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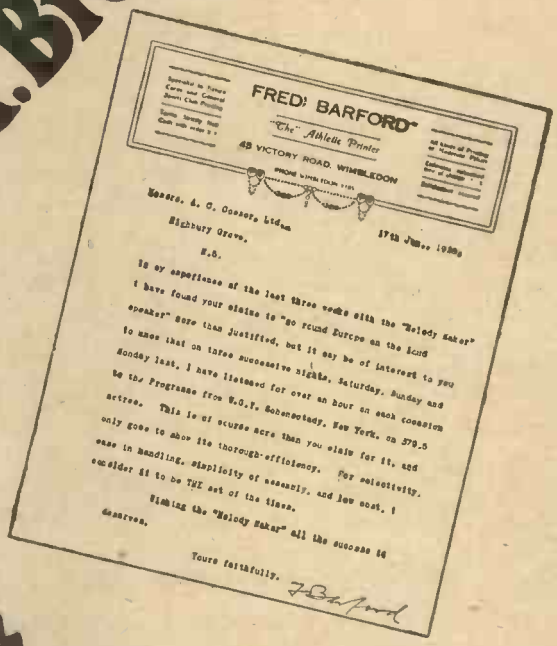
Edited by NORMAN EDWARDS, M.I.R.E., M.R.S.L., F.R.G.S.

Technical Editor: G. V. DOWDING, Grad.I.E.E.

Scientific Adviser: J. H. T. ROBERTS, D.Sc., F.Inst.P.

TIME was when to claim "seven countries on the loud speaker" from a home-built Set was a remarkable statement. The Cossor "Melody Maker" has proved it to be a modest claim. Hundreds are spontaneously writing to us every week to tell us of results far exceeding anything we have ever said of the Cossor "Melody Maker." Now comes a letter from a user who has actually heard American broadcasting on three successive nights. Read his letter . . . "For selectivity, ease in handling, simplicity of assembly and low cost," he considers the Cossor "Melody Maker" to be THE Set of the Season. How simple it really is you can only know when you have built it yourself. Ask your Dealer (or send a post-card to A. C. Cossor, Ltd.,) for the free Chart, "How to build the Cossor 'Melody Maker,'" and begin to-day.

NO! we don't claim U.S.A. Broadcasting


FRED BARFORD
The Athletic Printer
48 VICTORY ROAD, WIMBLEDON

Messrs. A. C. Cossors Ltd.
Highbury Grove.
N.5.

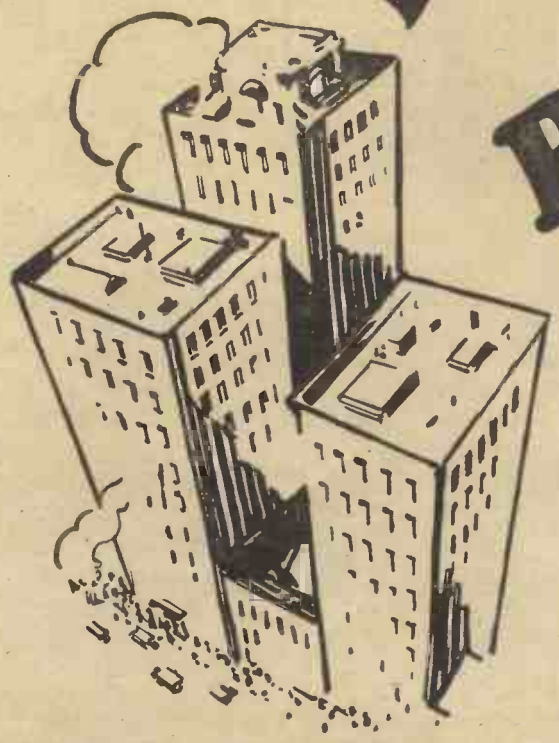
17th June 1928

In my experience of the last three weeks with the "Melody Maker" I have found your claims to "go round Europe on the Loud speaker" more than justified, but it may be of interest to you to know that on three successive nights, Saturday, Sunday and Monday last, I have listened for over an hour on each occasion to the Programme from W.G.Y. Schenectady, New York, on 379.5 metres. This is of course more than you claim for it, and only goes to show its thorough efficiency. For selectivity, ease in handling, simplicity of assembly, and low cost, I consider it to be THE set of the times.

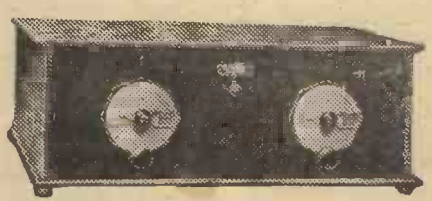
Wishing the "Melody Maker" all the success it deserves.

Yours faithfully,

F. Barford



But Mr. Barford gets it all the same



on his home-built Cossor Melody Maker

MODERN WIRELESS

Vol. IX. No. 15. March, 1928.

Three Popular Sets—The Question of Debates—The Regional Scheme.

Three Popular Sets

ANYTHING which legitimately enhances the popularity of radio, and at the same time helps foster the interest of the amateur and the prosperity of the radio trade, deserves encouragement.

During the last few months three well-known radio firms have done much to increase interest in radio. We refer to Messrs. Ediswan's, Mullard's, and Cossor's ; and in this issue we are pleased to pay them a tribute and to devote editorial space to a practical review of the three sets they have made so widely known and so justly popular—The Ediswan "R.C. Threesome," The Cossor "Melody Maker," and the Mullard "Master Three."

It is no exaggeration to say that, thanks to the publicity given to these sets, they have been built by hundreds of thousands of amateurs—many of them but newcomers to the great game of radio, but newcomers who's initiation has been rendered easy and attractive by the excellent propaganda of Cossor's, Ediswan's, and Mullard's.

Our Pictorial Blue Prints

ALTHOUGH the above firms have undoubtedly benefited by the success of their sets, it must not be forgotten that the radio trade as a whole has also benefited—and very considerably, too.

For the "R.C. Threesome," The "Melody Maker "and the "Master Three" receivers have been built by thousands and thousands of people who have purchased radio components for the first time, and so all branches of the trade have been stimulated.

In devoting space to these three sets we have in mind the new amateur who, having built his receiver, wants to know more about it—its operation, its maintenance—how, possibly, better results can be obtained, and how the circuit is "composed," etc.

The pictorial blue prints and the information given in Mr. Dowding's article should, therefore, prove very useful ; and if by chance some readers of this month's MODERN WIRELESS have not yet constructed one of the three sets dealt with, we advise them to make their choice and then write to the firm concerned for the necessary particulars, otherwise they will remain with the minority !

"Festoons of Red-Tape"

THE chance of hearing debates of a controversial nature seems as remote as ever, and judging by the statements issued from Savoy Hill, the B.B.C. Governors, despite lengthy deliberations, have given up the idea altogether.

"Playing safe" is an expresssion we are all familiar with—none more so than since the Governors of the B.B.C. came out of their shells and began to let listeners become aware of the fact that they were alive.

We hoped—when this manifestation of life was made—that the Governors would really exert themselves, and that, failing that, they would at least shut a blind eye, like Nelson, to the festoons of red-tape dangled as a warning sign before their eyes by the P.M.G.

But no ; the fact that certain gentlemen who had tentatively agreed to allow their debates broadcast decided that they could not guarantee to keep their remarks free from controversy evidently scared the Governors ; or perhaps the festoons of red-tape were dangled with more emphasis before their eyes.

Anyway, the result, after lengthy "deliberations," is another triumph for the "ca' canny" school—the abandonment of debates which might have proved really worth while and another example of an age which besides depriving a citizen of the rights to buy chocolates after 8 o'clock, etc., now decides that free speech, as expressed in a good argument, is unsafe and generally verboten.

If the P.M.G. would dangle his red-tape at some of the third-rate items in the programmes, we should all owe him a vote of thanks, but the loss of good stimulating debates is not only exasperatingly childish in origin, but seriously damaging to the prestige of those concerned.

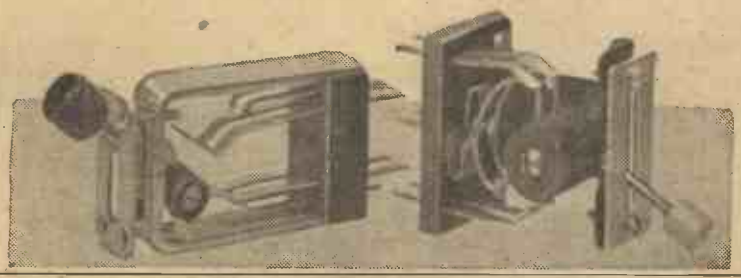
The Regional Scheme

EXPERIMENTS are still being carried out in connection with the proposed Regional Scheme which, one day, may provide the whole country with alternative programmes from a number of high-power stations.

But in spite of the time which has already lapsed since the Regional Scheme was first mooted, nothing definite has yet been done—and although there have been many rumours as to the sites of the new high-power stations, it is certain that, so far, none have been chosen.

Captain Eckersley made this quite clear at a recent meeting of the Institution of Electrical Engineers, and he also pointed out—during the reading of a very interesting paper—that it would be desirable to erect twin wave-length stations to give listeners the maximum opportunity of selection of alternative programmes.

But although discussions about the Regional Scheme are always interesting, and although Captain Eckersley's comments are always worthy of close attention and respect, we cannot help wondering whether the Regional Scheme will ever come to anything.

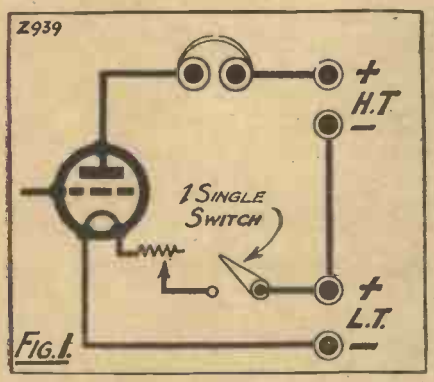


L.T. and H.T. Switching

An Article of Practical Value.

By H. W. BULSTRODE.

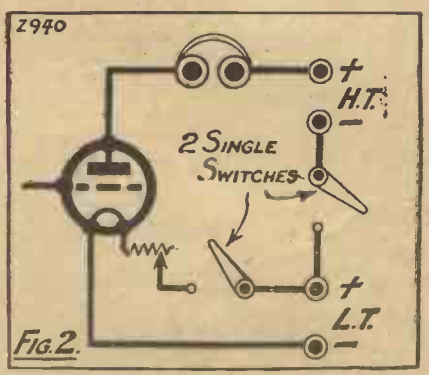
MOST users of valve sets dislike the operation of disconnecting the batteries when the set is not in use, and consequently most modern sets have a push-pull or other



single switch in one of the filament leads, as in Fig. 1.

Using Two Switches

It is generally imagined that by this process the batteries are cut out, but this is only partially true; for although the L.T. switch causes the filament circuit to be broken, the L.T. battery and the H.T. battery

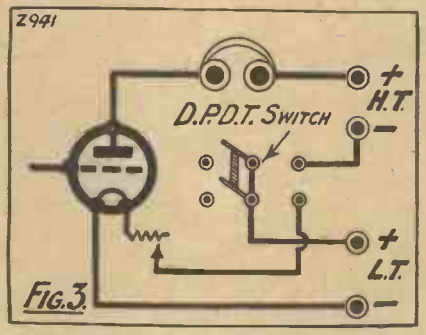


are still in circuit via the vacuum of the valve and 'phones. Where this fact is recognised another single switch is sometimes used, as in Fig. 2.

The double switching can be accomplished with one D.P.D.T. switch, as in Fig. 3, but this has the disadvantage of requiring six holes to be drilled in the panel.

The writer some time ago accomplished both switchings with one switch and one-hole fixing.

An ordinary two-way push-pull switch of the usual type should be obtained, and the longer spring



DISCOVERY DATES

Joseph Henry, the American scientist, was the first man to point out that the charge of a condenser is oscillatory. This was in 1840.

* * *

Marconi first came to England in 1896, and his first experiments in this country were carried out at Westbourne Park, London, W.

* * *

It is less than one hundred years since Michael Faraday discovered electro-magnetic induction between two entirely separate circuits.

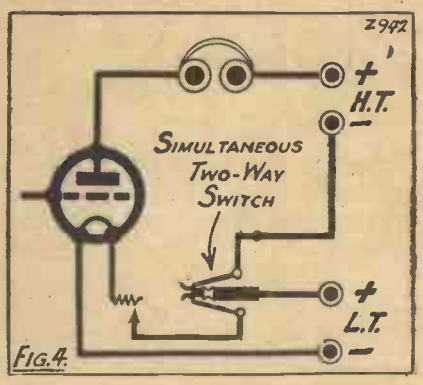
* * *

The first paid wireless telegram was sent on June 3rd, 1898, by Lord Kelvin from the Needles Station, Isle of Wight.

should be shortened to the length of the shorter one. Break the connection between H.T.— and L.T.+, connect L.T. + to the back screw of the switch, H.T. — to one spring and filament lead to the other, and then both batteries are disconnected when the push-pull is in (Fig. 4).

The writer calls this a *simultaneous* two-way switch, to distinguish it from the original which is really an *alternate* two-way switch.

It may be objected that this does not give a complete break, viz., that the current can still leak via the ebonite on the rod, but this is no different from any other switch where the ebonite panel is the connection between the parts.



ACCUMULATOR STOPPERS

AMATEURS generally fail to realise the importance of the accumulator stopper to the well-being of the battery, and the loss of such an article usually occasions little regret on account of the fact that it is replaced forthwith by a cork of similar dimensions.

However, a good accumulator stopper will be found to have a tiny hole or vent running through it; the object of which is to equalise the atmospheric pressure within and without the accumulator, and also to provide for the escape of any small traces of gases which may be produced while the accumulator is in use. Furthermore, the small hole in the accumulator stopper allows the escape of gases when the accumulator is being charged, but, at the same time, it prevents the escape of acid spray.

If, therefore, an accumulator stopper is lost, and a cork is used to replace it, the cork should have a small hole drilled through it. A hole of this type can readily be produced in the cork by burning through it with a red-hot knitting-needle.

NONSENSE ABOUT WIRELESS

BY ST. JOHN ERVINE

Mr. St. John Ervine is not only a dramatic critic and playwright of great distinction, but a writer who, in essays, articles, novels, and stories, has shown that, like Mr. Bernard Shaw, he has the refreshing gift of exposing the narrow-minded and intolerant failings of humanity in a way which make them look incredibly silly. In the following brilliant article Mr. St. John Ervine's pen flickers like forked lightning about those critics—if they can be dignified by such a title—who never lose an opportunity of talking, or writing, nonsense about the B.B.C. We have all met the "Piffling Percys" mentioned in the following article, and most of us have longed for something to happen to them—something rather sudden, and rather painful; but hard though their hides may be, and thicker than cocoanuts the self-complacency which protects their blatant "minds," it is doubtful whether any "Piffling Percy" reading Mr. St. John Ervine's pungent article will fail to squirm, and feel a trifle more piffling than usual. And if, by chance, any "Piffling Percy" thus affected mends his ways and, in future, refrains from snapping at the B.B.C.'s efforts to overcome a real difficulty in connection with the English language, then this article will not have been written in vain.—The Editor.

At regular intervals the newspapers are filled with tosh about wireless. This is understandable. The newspapers have, so to speak, been shivering in their shoes ever since the B.B.C. began to announce items of news to listeners. If this sort of thing continues and increases, they moan among themselves, "What will become of us?" Moreover, since the B.B.C. specialises, so far as news is concerned, in strict accuracy, the newspapers have been compelled to pay more heed to the facts.

It is perfectly useless to state that the whole of London is under water, when the announcer has informed the entire country that the floods have been confined to a narrow area.

Truth Compulsory

The B.B.C., in short, is seriously cramping the style of the descriptive reporter, who prefers to say that the whole of the Turner collection in the Tate Gallery has been ruined by flood rather than to acknowledge that a small portion of the pictures has been ruined. That is why the newspapers neglect no opportunity of belittling the B.B.C. and finding fault with it.

If piffling Percy Puggins of Biggleswade, having invested in a three-and-sixpenny crystal set which he is mentally incapable of understanding, finds himself one evening totally unable to hear anything from London or Daventry, piffling Percy immediately writes to one of the newspapers and asserts that the B.B.C. is governed by persons of an unintelligence that is beyond belief. The newspaper immediately places piffling Percy's complaint in a prominent place, causing that fool to go about with a swelled head for the best part of a fortnight.

Mr. St. John Ervine, the famous playwright and critic, who writes the accompanying trenchant article.

Or a gentleman—to whom heaven has given a mind which, however, he prefers not to use—writes, with great difficulty and frequent reference to a dictionary, to ask why on earth he should be obliged to listen to "talks." Why can't he have more music; meaning, by music, an infernal din called jazz?

A "Sick Hyena"

The newspapers "star" this ass's complaint, and wax very sarcastic over the fact that the B.B.C. is trying to "improve" people's minds for them. They do not take the trouble to scan the programmes and inform the mindless fellow that there is almost an excess of music of all sorts in the programmes, and that the "talks" are few. Nor do they ask him who the

deuce he thinks he is that programmes should be drawn up exclusively for his entertainment.

The multitudes of people, especially in the country, who thoroughly enjoy the "talks" are to be deprived of their pleasure because this idiot wants to listen all afternoon and evening to moans from a gang of epileptics calling themselves a jazz band. "I wanna go—I wanna go—I wanna go right down to where ma swee-ee-tie wan's a-go!" That sort of stuff. Heavens, that a creature should be born into the world in agony and hope, and be expensively and carefully nourished and educated, merely in order that, when he has achieved manhood, he should howl like a sick hyena that he wan's a-go, wan's a-go to see his swee-ee-tie!

Abysmal Ignorance

The latest attempt to discredit the B.B.C. has taken the form of a complaint against standardisation of accents and pronunciation. The B.B.C. having received many complaints from listeners all over the country at variations of pronunciation which are obviously confusing—particularly to people who are not quite certain of the way in which words should be spoken—resolved to appoint a committee of persons to make a list of agreed pronunciations of disputed or difficult words. Immediately there was an outcry.

Was the B.B.C. going to *impose* a standard pronunciation on the public? Freeborn Englishmen, with a passion for individuality, would never tolerate such an outrageous infringement of this right to do what they darn well pleased. And who were these committee men, anyway? Piffling Percy of Biggleswade wanted to know. The B.B.C. meekly answered, "Well, the Poet Laureate! . . ."

"Oh," Piffling Percy snorted, "an' oo might 'e be?"

"Dr. Bridges; who is not only a poet, but a very distinguished authority on English speech!"

"Oh, is 'e? Well, I've never 'eard of 'im. W'y didn't you put Bottomley on the committee? 'E knows a bit, 'e does!"

The B.B.C. was unable to appoint Bottomley for a sufficiently good reason: that great man was then enjoying the hospitality of His Majesty the King for a prolonged period.

"An' 'oo else 'ave you on your bloomin' committee?" Piffling Percy continued.

Mr. George Bernard Shaw, here shown making friends with the microphone, is a member of the B.B.C.'s committee on pronunciation.

"Bernard Shaw."

"Wot! Bernard Shawr! That chep Shawr wot writes plys? W'y, 'e issen even English! 'E's Irish!"

"He knows a good deal about the English language."

"Lawlummy! Fency a chep like thet attemptin' to teach me English. I mean to sy!"

"Then there is Sir Johnston Forbes-Robertson."

"Ow! Ector chep, isseny? Scotch!"

"Oh, yes, but he has the finest speaking voice that has been heard on the English stage for a great many years. He has acted in Shakespeare."

"Nah, down't talk to me abaht Shikespeare. I've 'eard all I want to 'ear about 'im. "Oo else 'ave you on your committee?"

"Mr. Logan Pearsall Smith and Professor Daniel Jones."

"Never 'eard of either of 'em!"

"Perhaps not, but they are nevertheless distinguished men who have studied the English language for years." At this point, the B.B.C should have continued in the following fashion. It did not do so, but I take the liberty

Three great authorities upon the English language—Sir Johnston Forbes-Robertson (left), Mr. George Bernard Shaw, and (right) Dr. Bridges, the Poet Laureate.

of telling Piffling Percy what the B.B.C. ought to have told him. "And now, Mr. Piffling Percy, let us tell you something. You are an ignorant, ill-bred and conceited ass. You know nothing, and are nearly incapable of learning anything. You think because the Daily Squeaker printed your semi-illiterate letter on its principal page that you are entitled to be impertinent to men who are your superiors in every respect.

"You are a typical product of a pseudo-democracy which encourages fools like you to imagine that you—who know nothing at all—may criticise and insult men who have given their lives to studying subjects of which you do not even know the names. Let us tell you exactly what you ought to do. You ought to accept instruction from your betters with gratitude and humility, and be extremely thankful that your betters take any notice of you at all. Now, go back to Biggleswade, and make an effort to realise just who and what you are, and in future do not waste our time with your impudence."

Preventing Confusion

How the B.B.C. manages to refrain from talking to some of the people who criticise its work in that fashion I cannot understand. The B.B.C. is not trying to impose a pronunciation upon the community, although it is perfectly obvious that the pronunciation adopted by the announcers will, in time, become the common pronunciation.

It is attempting—and very properly attempting—to prevent confusion in the minds of its listeners by pronouncing certain words in a variety of ways. Thousands of us are familiar both with the meaning and the spelling of some words which, however, we do not know how to pronounce because we have never been told how to pronounce them, nor have we ever heard them pronounced.

How many English people know how to pronounce the word "gillie"? I have heard an English novelist, speaking through the microphone, pronounce it in a way which must have made every Scottish gamekeeper who heard him roar with laughter. He pronounced it as if its "g"

had the sound of the " g " in " gentleman " or " general," whereas it has the sound of the " g " in " girl " or "get." The majority of people south of the Border perfectly well know what a gillie is, but thousands of them do not know how to pronounce the word because it has no relationship to anything that happens in their lives.

Does anybody suggest that the B.B.C. should allow its announcers to settle, each for himself, how he shall speak this word ? Are those who pronounce it incorrectly to be confirmed in their error by some of the announcers, and then completely confused by others who insist on pronouncing it correctly ? A great deal of infantile humour has been expended on the word " pejorative," which appears in the list of " standardised " pronunciations. Personally, I do not know what this word means, and I cannot find it in my edition of Webster's Dictionary ; so I am not worrying much about how it is pronounced, since it is extremely unlikely that I shall ever have to say it.

But there are a number of rare words that announcers may sometimes have to use in connection, perhaps, with some unusual announcement ; and common sense suggests that they should come to an agreement about the way in which these words are to be said.

Horror of Exaggerated Accent

The whole business of pronunciation is complicated by questions of snobbery. For some reason or other, people residing in the South of England imagine that *they* alone speak good English ; although the South of England voice has been so corrupted by Cockneyisms that even persons of good education flatten their vowels. I have lately been sent a number of gramophone records, in which authoritative persons speak what they fondly imagine to be " good English."

One of these speakers flattens every vowel he utters ! People whose way of speech resembles nothing so much as a squeak will assert, " Oo, yees, eh theenk the propah wey to speak Eengleesh ees to speak it lake the nace, refaned people in the South of Eenglan' ! Soo nace ! Soo refaned ! Oo, soo nace ! Oo, soo refaned ! " Surely the question of pronunciation is a question of clarity ?

America's Queen of Jazz is here shown with two well-known orchestral kings and Paul Whiteman, the Sultan of Syncopation.

We speak, presumably, to be heard and to be understood. We desire also to speak with some beauty in our voices. The " refaned " voice is almost an inarticulate voice : it is a most hideous bleat. A week or two ago I listened to a water-diviner describing his craft through the microphone. He had a West Country accent, with a strong burr, but he was a joy to hear, for not only was every word that he spoke clearly and intelligibly pronounced, but his accent itself was delightful.

The B.B.C will not compel us all to speak with a Tunbridge Wells accent, but it will accustom us to pronounce certain words in a way that will make them recognisable to all of us.

" Whether we like it or no," says Mr. St. John Ervine, " the B.B.C. is certainly going to affect the pronunciation of the English language." How true is this dictum will be realised when it is remembered that thousands of pupils now listen regularly to the educational broadcasts of the B.B.C.

VIA RADIO!

Some light on the meaning of Morse messages from ships at sea.

BY A WIRELESS OPERATOR.

MUCH has been said recently about the interference caused by "Spark," though wireless "fans" who can read Morse will find much to interest them among this interference.

But even though one is a Morse expert and can comfortably manage thirty words per minute, the rapid interchange of abbreviations which takes place between ship stations is rather confusing.

Sea-going operators are a hurried race, and abbreviation comes as second nature to them. GM, GA and GN are used in the place of the more understandable "Good morning," etc. (Dutch ships can be relied upon to give GM at any time of the day.) Please is given as "Pse," while thank you becomes "TU" or TKS."

"Nite and 'Smorning"

Outside actual radio-telegrams, phonetic spelling is used, and "GM OM AVE U ANI PX PSE" is sent much more rapidly than "Good morning, old man, have you any press, please?" Following this practice, night becomes "Nite," and this morning "'Smorning."

OM (Old Man) is often heard, but where the operators are more or less intimate it is often replaced by "Col," a rather obscure abbreviation, meaning, I believe, "colleague." "Cul" means "See you later." Weather reports become WX, time signals TS, and, for some unknown reason, position is ZP.

The signal HW ("how?") has almost universal application and means usually "Did you get that?" or "How are you receiving now?"

Much use is made of the official "Q" abbreviations, which all transmitters are familiar with. By the commercial "ops" some of these are still further abbreviated. QSU (I will call you later) is almost always sent as SU, while QRU (I have nothing for you) takes second place to Nil.

These "Q" abbreviations are also given meanings which were not intended by the Powers at the Berne Conference. For example, the operator who wishes to know the name of the man with whom he is working will ask, "QRA? OPS." The operator who achieved "QRX (am standing by) eating an orange" is supposed to hold the record for original meanings.

"Feeling" Through Jamming

QRM (I am experiencing interference) is a very over-worked call, and may mean anything from its official indication to the fact that the operator cannot read Morse.

The signal IE, sent very rapidly, is often heard in areas where traffic is heavy. This is really a "feeler" sent out by a vessel having traffic to transmit. Should any station within range be busy with received traffic it will answer this IE signal with AS (wait). This "feeler" signal, introduced by the operators themselves, is instrumental in saving a lot of needless QRM.

Speed in clearing traffic is, of course, the primary reason for all these contractions, and in areas where the traffic is very heavy, such as the English Channel and the American coast, some time-saving devices are necessary if absolute chaos is to be avoided.

Experience has taught operators to ignore some of the official regulations, and any operator who worked strictly to the "book" would cause consternation in the ranks.

The C.W. Merchants

The official prefixes for the different types of traffic are, "A" for service messages, "ST" for paid service messages, "Presse" for press messages, and "Radio" for ordinary traffic.

In actual use we find "Svce" for service messages of either type, "MSG" prefixing a message relating to the ship's business, and for which there is no ship charge. "P" indicates a private message with full charges, and "PDH" a message sent by a member of the crew on which there is no transmitting ship tax.

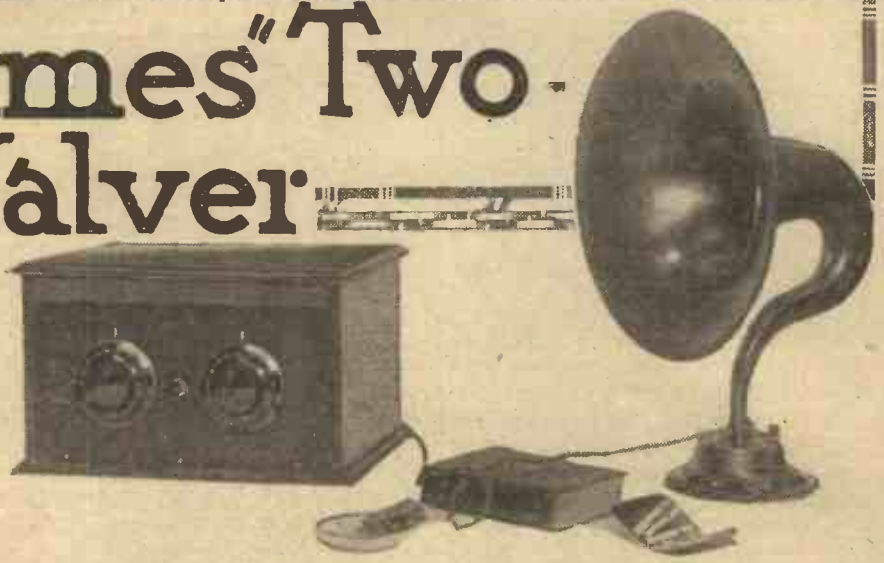
The large liners working regular schedules have their own abbreviations, arrived at by mutual agreement with the coast stations which take all their traffic, whilst the long-wave C.W. merchants seem to spend most of their time pumping out unintelligible combinations such as "ZHC" and "RQ."

On and around 18,000 metres you are almost certain to hear someone sending an endless series of "ABC's," interspaced with "V's" and "RQ's." You will get tired of listening to them before they tire of sending.

A BATTLESHIP WITHOUT A CREW!

The above photograph depicts H.M.S. "Centurion," formerly a battleship and now converted into a target ship controlled by wireless. Without a single man on board her, she steers and manœuvres in accordance with the marvellous machinery in her control room. The vessel automatically obeys the wireless instructions given by an officer on board another warship, even though the latter is miles away.

The "James" Two-Valver



An easily made and selective two-valve set that is capable of receiving several stations on the loud speaker, and many others at good 'phone strength.

By W. JAMES.

A LARGE number of listeners find a two-valve receiver well suited to their needs, for such a set is cheap to build and maintain, and gives a quality of reproduction that is pleasing. No one would claim that the results given by a two-valve set, and a loud speaker of moderate cost, approach perfection, but what we do say is that this combination exactly meets the requirements of a considerable number of listeners.

LIST OF PARTS.

1 Radion panel, 14 in. × 7 in. (Any good branded material. Becol, Ebonart, Radion, etc.).
1 Baseboard 14 in. × 9 in. × ½ in.
1 Terminal strip 14 in. × 1½ in.
2 Tuning condensers, ·0005 mfd., with dials.
1 L.F. transformer (Eureka Concert Grand in set. Any good make).
2 Valve holders (Ashley, Benjamin, Bowyer-Lowe, B.T.H., Burndept, Burne-Jones, Igranic, Lotus, V.B., etc.).
1 ·0001-mfd. fixed condenser.
1 ·0002-mfd. fixed condenser with grid-leak clips.
1 ·2-mfd. fixed condenser with grid-leak clips.
NOTE.—Fixed condensers in set are T.C.C. Other good makes, such as Dubilier, Igranic, Lissen, Mullard, etc., can, of course, be used).
Materials for coils and coil holder as described.
9 Terminals, suitable engraved, such as Belling and Lee, Eelex, Igranic, etc.
1 "On" and "off" switch.
1 Grid battery of 4½ or 9 volts, according to the valves.
1 Grid-battery holder.

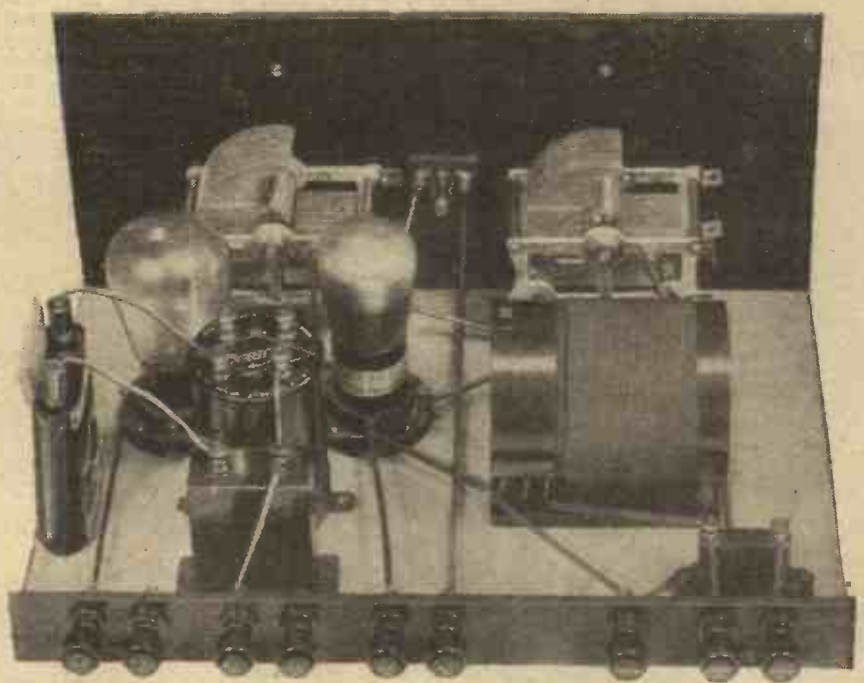
Superior Results

One two-valve receiver must necessarily look very much like another, for the best combination is undoubtedly a detector, with reaction, transformer-coupled to the second valve. But it is possible by careful design to obtain superior results. We have to consider how best to secure a reasonable degree of selectivity, sufficient volume, and ease of handling.

Selectivity and volume depend a good deal on the design of the tuner, for the set will naturally use valves and a transformer that are readily obtainable. The single-layer type of tuning coil is undoubtedly the most efficient for the broadcast band of wave-lengths, and by correctly proportioning the coil we can be sure that the tuner will work most effectively. We can vary selectivity by altering the point on the coil to which the aerial is connected and, of course, so arrange matters that the reaction is easy to control.

The Circuit Employed

From the theoretical circuit of Fig. 1 you will see that two aerial terminals are provided. With the aerial joined to terminal 1 a direct connection is made with a tap on the coil, while when the aerial is joined to terminal 2, a fixed condenser of ·0001 mfd. is included. Ordinary leaky-grid rectification is used with condenser-controlled reaction.

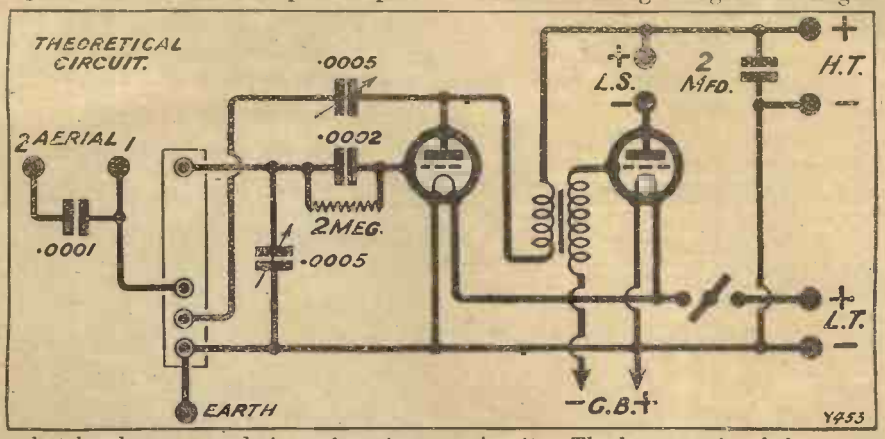


It s difficult to imagine a more simple and efficient layout than that employed in this receiver. The use of the solenoid tuning coil enables it to be made at home without the slightest trouble, and is one of the main features contributing to the success of the set.

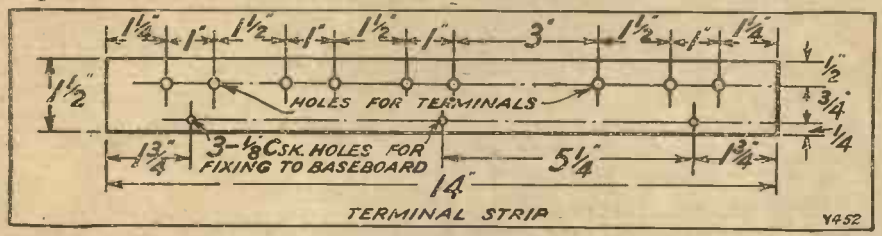
It is good practice to use a large condenser for the reaction circuit. A small reaction coil may then be used. This adds greatly to the effectiveness of the tuner. It enables an extremely smooth control of the reaction to be had, and, further, the setting of the reaction condenser remains more nearly constant over the tuning range of the set.

Constant Reaction

In fact, it is possible by altering the tapping of the aerial on the tuning coil to obtain a condition approximating to constant reaction. It is, for example, a simple matter to find the position where the circuit is just not oscillating over the range from London to Daventry Experimental.



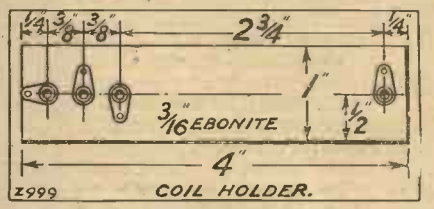
I wish to emphasise that reaction *does not* compensate for the losses of a badly-designed tuner. The results as to signal strength and selectivity will not be so good when the aerial coil is a poor one as compared with a good one. This is an important point that has been proved time after time. Reaction does not entirely compensate for circuit losses.



Bearing these points in mind, good coils have been designed. They are of the single-layer type and have one pin at one end, and three at the other. The single pin is connected to that end of the coil remote from the reaction winding and goes to the grid circuit. The bottom pin of the group of three is connected to the earth end of the circuit. The inside pin is connected to a tapping on the short-wave coil, and to the grid end of the coil in the case of the long-wave one. Between the centre pin of the group of three and the earthed end of the coil is joined the reaction winding.

Easily Made

These two coils are therefore easily made. Both of them comprise a former of any good insulating material, such as Paxolin or Pirtoid, 3 in. in diameter and 4 in. long, and the four pins should be put in the same straight line so as to fit properly into the coil holder. The single pin is ¼ in. from the outer end, and the first of the group of three pins is ¼ in. from the outer edge. The other two are spaced by ⅜ in. each. For the short-wave coil a winding of 55 turns of No. 20 D.S.C. is required. Commence the winding at the grid end of the coil (the end having one pin).

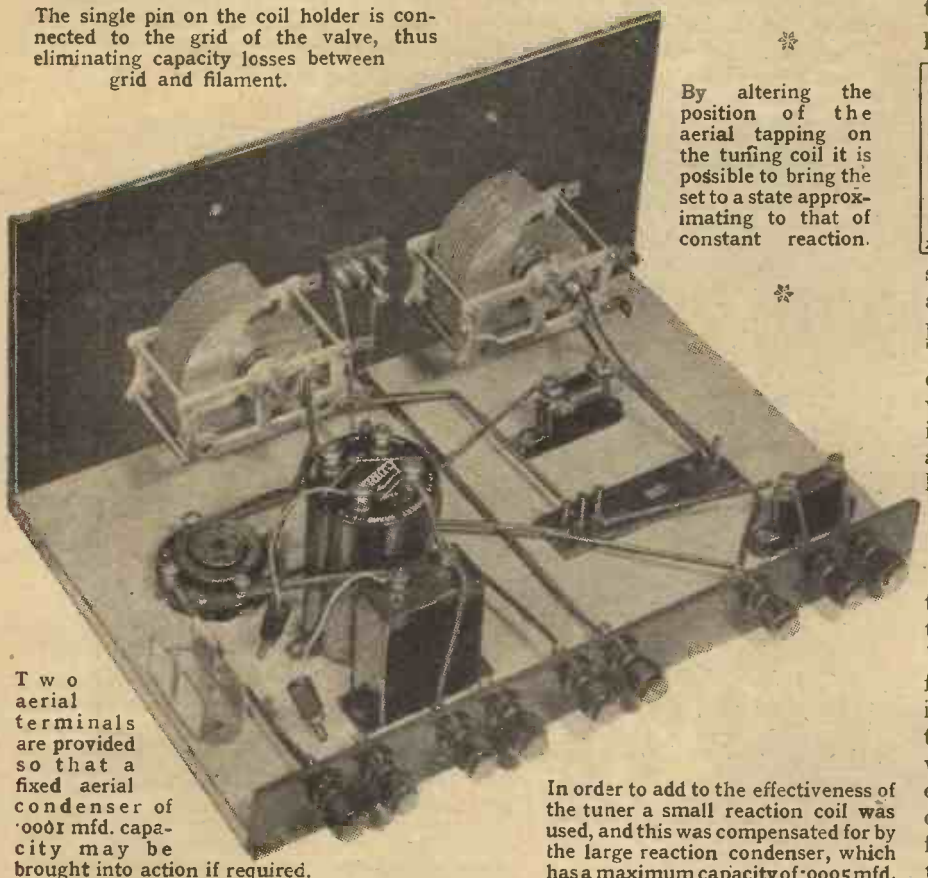


The Reaction Winding

Drill a small hole by the side of this pin and pass the end of the wire through it and fasten it to the pin. Wind on 40 turns, drill a hole in the former and take a loop of wire to the inside contact pin of the group of three. This is for the tapping. Now wind on a further 15 turns. Finish off the coil by passing the end of the wire through a hole in the former and connect it to the outer terminal.

The single pin on the coil holder is connected to the grid of the valve, thus eliminating capacity losses between grid and filament.

By altering the position of the aerial tapping on the tuning coil it is possible to bring the set to a state approximating to that of constant reaction.



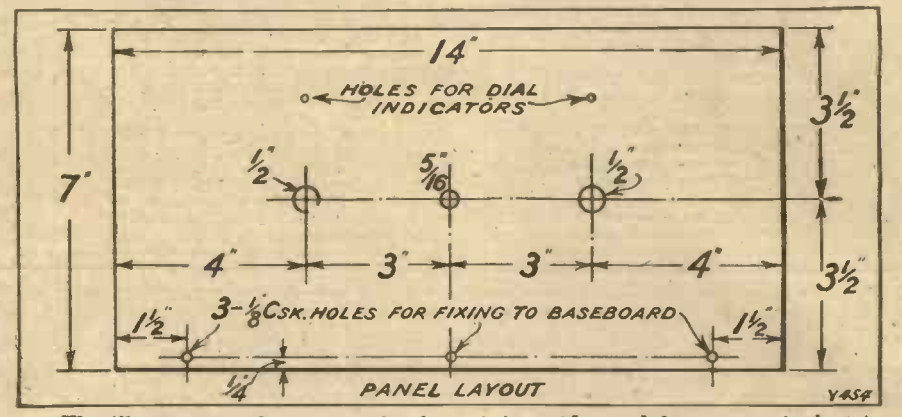
Two aerial terminals are provided so that a fixed aerial condenser of ·0001 mfd. capacity may be brought into action if required.

In order to add to the effectiveness of the tuner a small reaction coil was used, and this was compensated for by the large reaction condenser, which has a maximum capacity of ·0005 mfd.

You will now have to put on the reaction winding. This is of No. 32 D.S.C., and one end is connected to the outer pin of the three (the earth end of the coil). There are 10 turns, and the end of the coil is connected to the centre pin.

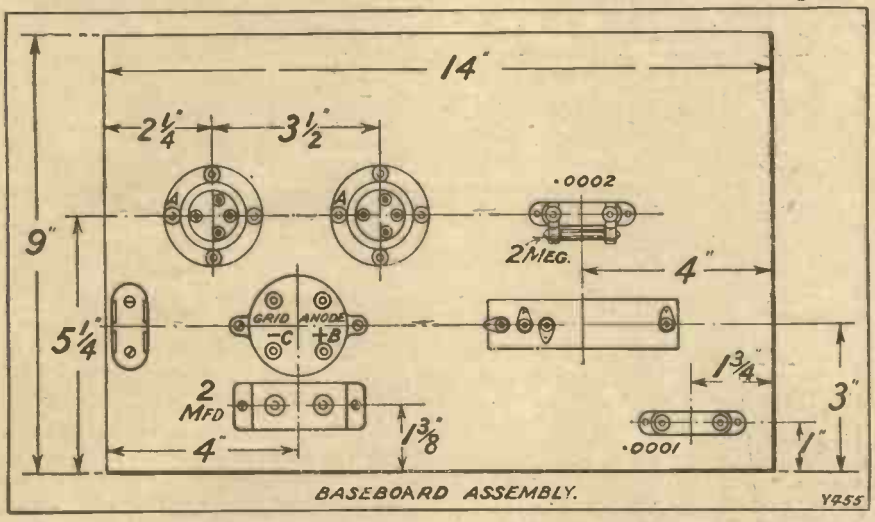
For Long Waves

The long-wave coil is a single winding of No. 32 D.S.C. One end of the wire is connected to the single pin (that connects to the grid), and 175 turns are wound on. Put a hole in the former and take the loop of wire to the outside pin of the group of three. Now continue the winding, putting on 40 turns. The end is taken to the centre pin. Also connect the top pin to the inside one; that is, the grid end of the coil is connected to the inside pin of the group of three.



The illustrations show very clearly how the receiver is assembled. The two tuning condensers of ·0005 mfd. are mounted on an ebonite front panel measuring 14 in. by 7 in., and so is the "on" and "off" switch. There are two dial indicators as well, and their positions are best determined after the dials have been fitted.

The baseboard is 14 in. long and 9 in. wide, and has a terminal strip along its back edge. Two of the terminals are for alternative aerial connections, one for the earth, two for L.T., two for H.T., and two for the loud speaker. On the baseboard near the aerial terminals is fitted the ·0001-mfd. fixed condenser, and between the coil holder and the panel is a ·0002-mfd. fixed condenser and 2-megohm grid leak. The remaining parts are easily identified and the whole assembly will not take many minutes.



The best position for the tapping on the short-wave coil depends on a number of factors.

If you live within three or four miles of a main station it would be better to make the aerial tap at the 10th instead of the 15th turn from the earth end. The tap at the 15th turn is suitable when a moderately-sized or small aerial is used within four or five miles of a main station, but if you live, say, ten to fifteen miles from a main station the aerial should be tapped on the 20th turn.

Mounting the Components

The position of the aerial tapping affects the selectivity and volume, which in turn depend on the position of the aerial with respect to the station you wish to receive.

A common H.T. battery is used for the two valves and no radio-frequency choke is included in the detector circuit. But if you should prefer to employ a transformer having a built-in by-pass condenser, a choke will have to be used. There are no filament rheostats, but an "on" and "off" switch is fitted.

The Valves Required

The photographs show the wiring very clearly and should be referred to as well as the wiring diagram. Every wire is covered in Systoflex except the two flexible ones that connect the grid-bias battery. It is recommended that a valve having an anode impedance of 20,000 to 30,000 ohms be used as a detector,

The layout of the panel components is so exceedingly simple that you cannot possibly go wrong here. Note the large tuning and reaction dials which enable fine tuning to be carried out without the use of vernier or geared tuning arrangements.

WIRING INSTRUCTIONS.

Connect aerial 2 to one side of ·0001-mfd. condenser, and the third contact on the coil holder.

Join aerial 1 to the other side of ·0001-mfd. condenser, and the third contact on the coil holder.

Connect earth to one side of tuning condenser, and also the first contact pin of the coil holder, a filament contact on each valve, — L.T., — H.T., and one side of the 2-mfd. condenser.

Join the other side of the tuning condenser to the grid condenser and leak, and the fourth contact of the coil holder.

Connect the grid of the first valve to other side of grid condenser and leak.

Join L.T. + to one side of the "on" and "off" switch.

From the other side of the "on" and "off" switch take a wire to a remaining filament terminal on each valve holder.

Connect one side of the reaction condenser to the second contact on the coil holder, and take a wire from the other side of the reaction condenser to the anode of the first valve.

From the anode of the first valve take a wire to the anode terminal of the transformer, and from the + B terminal of the transformer take a wire to the 2-mfd. by-pass condenser and H.T. + terminal.

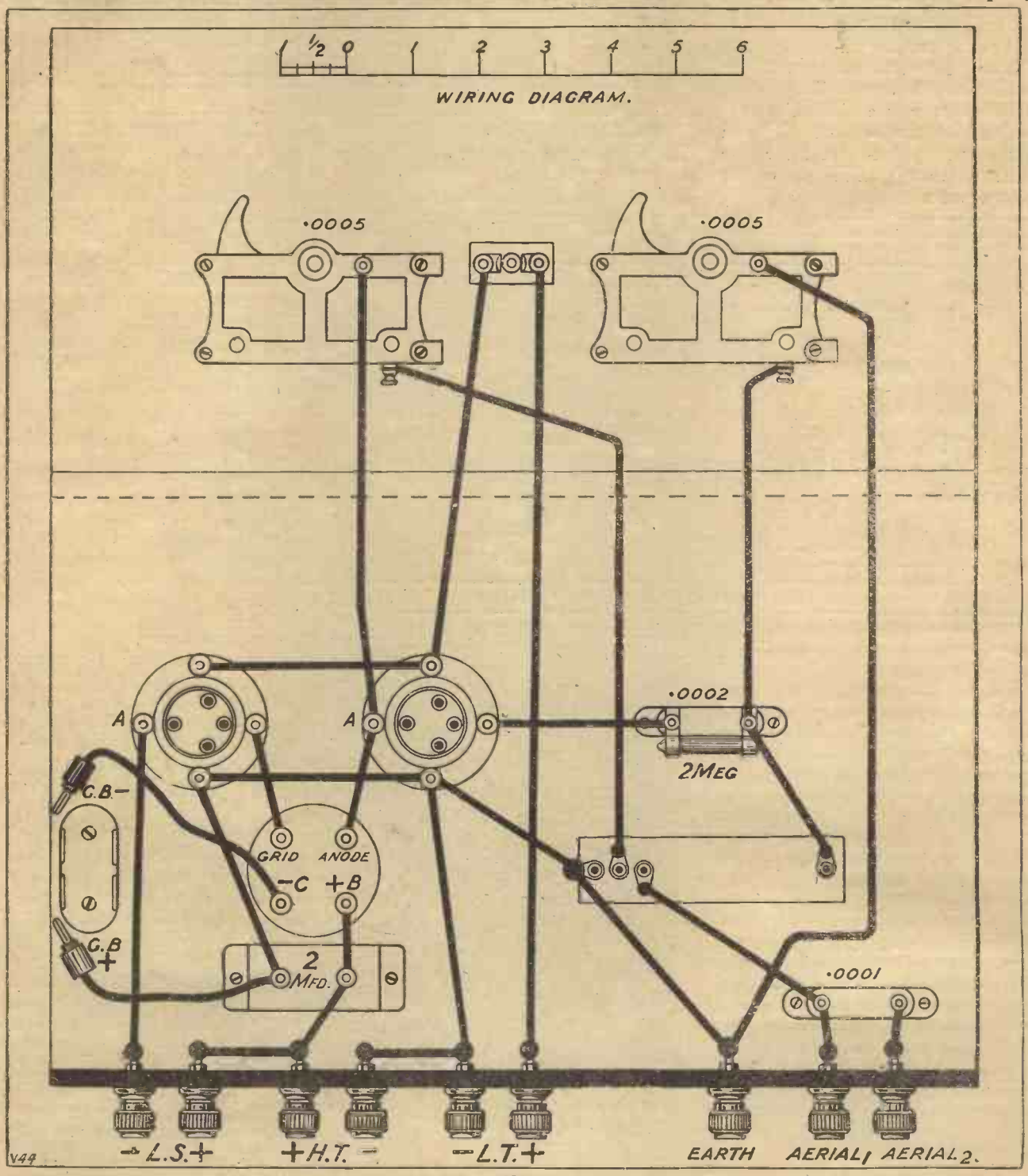
Join the grid of the second valve to the grid terminal on the transformer, and connect "—C" to G.B.—.

Connect the anode of the second valve to the loud-speaker terminal, L.S. —, and join L.S. + to H.T. +.

Connect the side of the 2-mfd. condenser that is joined to the filaments, to the positive end of the grid battery by means of a flexible wire and plug.

with a small power valve in the output stage.

It is to be expected that the best results will be obtained when 6-volt valves are fitted, for valves of this class have higher amplification factors for given anode impedances than 2-volt ones. Among the 2-volt valves that may be used for the detector I would mention the Cossor 210 L.F. and Marconi or Osram D.E.L.210; for the output stage a B.T.-H. B.23 or a Mullard 252 or similar valve are equally



satisfactory. In the 6-volt series I suggest a Marconi or Osram D.E.L. 610, or B. T.-H., Sixty-Sixty, Ediswan, Cosmos, Mullard, etc. of similar types for the detector stage; and a 6-volt power valve for the L.F. stage.

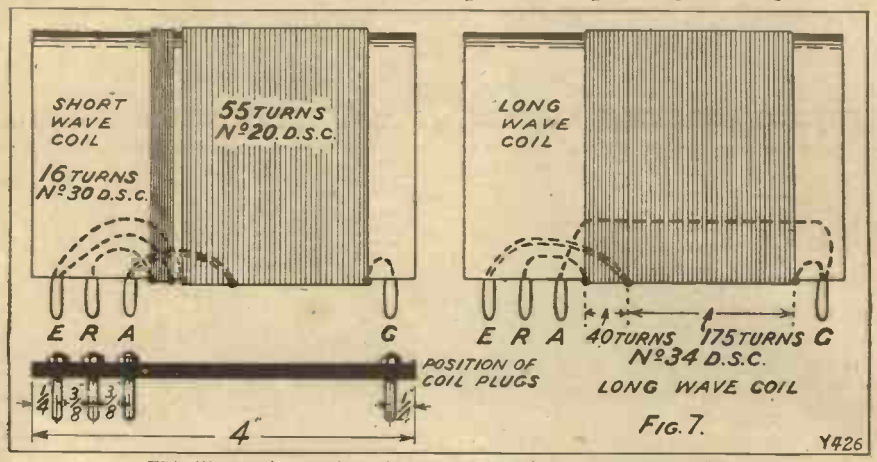
When the high-tension is of 120 volts a grid bias of negative 7½ may be used, and a 9-volt grid battery should therefore be fitted in the set instead of a 4½-volt one. The smaller grid battery is satisfactory when 2-volt valves are being used with a high-tension of 100.

The coils are easily made and contain 55 and 175 turns for the main windings of the short- and long-wave coils respectively.

The right-hand variable condenser controls the amount of reaction and must therefore be adjusted with care. You do not want to create oscillations in your aerial, therefore be careful how the reaction is used. The reaction is strongest when the right-hand condenser is all-in, that is, when the dial is set at 100 or 180 degrees, as the case may be. Too much reaction spoils quality, but a moderate amount does not harm, particularly when only a single stage of transformer coupling is used.

Excellent Reception

The receiver is very good for the reception of the long-wave stations as well as the short-wave ones, but it must be remembered that sharp tuning on the long waves is more harmful than on the shorter waves. It is therefore easier to spoil the quality of long wave-length signals by using too much reaction. The amount of reaction can easily be varied, however. Thus, if the receiver is to be used by someone who would rather that the set were not capable of oscillating, it is only necessary to remove a few turns from the reaction coil until, with the reaction condenser set at maximum, the receiver does not oscillate. The adjustment should, of course, be made with the tuner set to the stations it is desired to receive.



This illustration makes clear the method of making the coils.

RADIO REMINDERS

The Royal Society of Arts, London, W.C.2, is offering a prize of five guineas in a competition for the design of the best wireless cabinet.

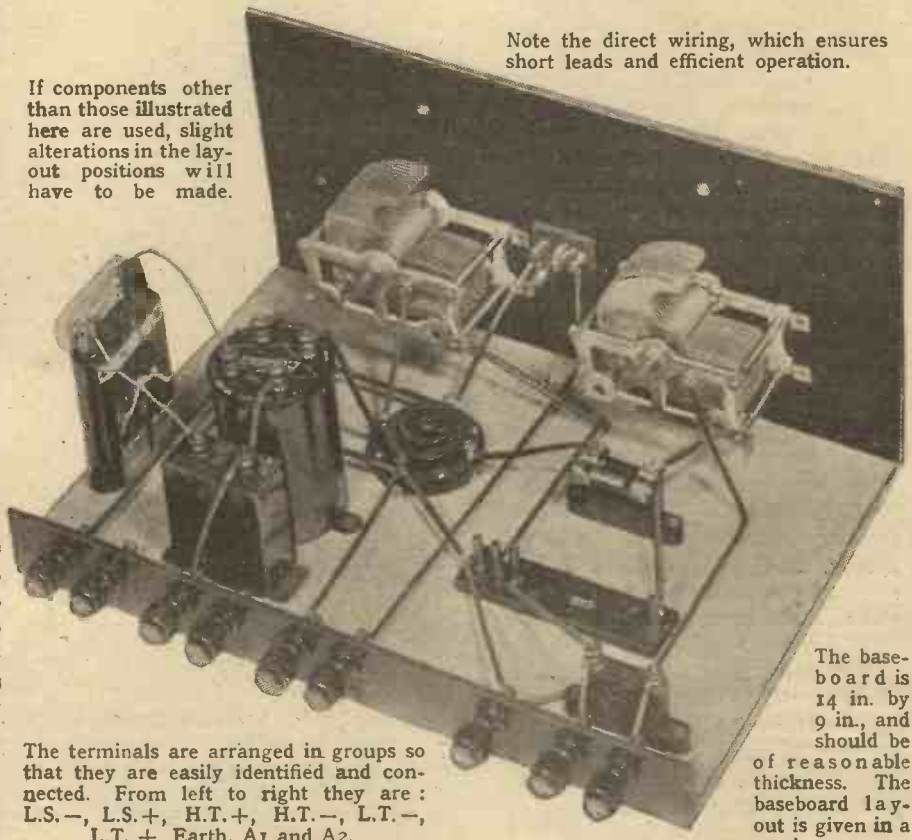
The full cost in stamp fees for obtaining a patent is five pounds. A provisional patent (protecting an idea for nine months) may be obtained for one pound.

* * *

According to the Police Journal, wireless is playing a great part in the inter-communication of police forces in this country and on the Continent.

* * *

One of the great American rubber importers keeps in touch with his plantations in Nigeria, Africa, by means of short-wave wireless.

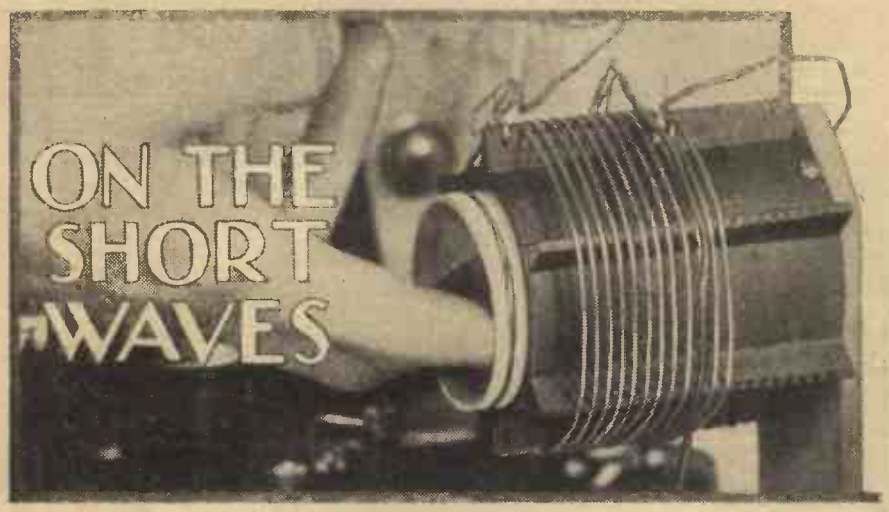


Note the direct wiring, which ensures short leads and efficient operation.

If components other than those illustrated here are used, slight alterations in the lay-out positions will have to be made.

The terminals are arranged in groups so that they are easily identified and connected. From left to right they are: L.S.—, L.S.+, H.T.+, H.T.—, L.T.—, L.T. +, Earth, A1 and A2.

The baseboard is 14 in. by 9 in., and should be of reasonable thickness. The baseboard lay-out is given in a previous page.



Notes of Interest on Short-Wave Receivers and Reception Conditions.

By W. L. S.

ALTHOUGH whenever I look back on the old days of 2MT and 2OM I feel pangs of regret at the passing of the "good old times," I cannot help wondering now and then what there really was to interest us in those days. There is no denying the fact that real thrills were experienced on hearing aged gramophones and doubtful microphones hard at work, and particularly in picking up new stations, but every station seemed to be within ten miles or so.

The old excuse, "progress," must be put forward. In these days one looks upon the regular nightly reception of American broadcast as a matter of course, and if stations like 2XAD or 2XAF are not up to scratch one looks hard at the receiver to see what has happened. The short waves are truly not lacking in variety, compared with the "good old days."

Signals from a "Sub."

Speaking of variety, I wonder how many readers have heard signals from a submarine actually under water? Tests are being carried out on a French submarine in the Bay of Biscay, and several times I have received good robust signals from it when it has been half-way to Davy Jones' locker.

It certainly seems something of an achievement to transmit short-wave signals over quite long distances under these conditions, and, although no particulars are yet available, I am looking forward to hearing further details at a later date.

I think an International broadcasting test would be an excellent way of attempting to "ginger up" the B.B.C. with regard to its present short-wave policy. We are certainly years behind our time in this country with regard to short-wave long-distance work from the broadcast point of view, although the low-power work done by some of our amateurs is second to none in the world.

A few weeks ago I heard a programme from 2XAD on 22 metres, and sat through an item or so to hear the announcement. It was, when it came, something to this effect: "This is station 2XAD, Schenectady, transmitting on 21·96 metres, and exchanging programmes with the British Broadcasting Company. Hullo, Great Britain! We hope that you are receiving this quite successfully."

Carrying a Complete Station!

This man is carrying a short-wave receiving station, complete with masts, etc. It is of the type recently supplied to the Sudanese Government by R.I. and Varley, Ltd.

5SW Remains Aloof

Now, although this was received at excellent strength and first-class quality on a standard two-valver, apparently none of the powers that be over here was taking the slightest notice of it. 5SW was relaying the 5XX programme in the usual way, and 2LO and 5GB and all the main stations had their usual programmes. Yet 2XAD was supposed to be "exchanging programmes" with us!

An international test between broadcasting stations conducted on the lines of the recent A.R.R.L. international test for amateurs is probably too much to hope for, but surely it is time that someone awoke to the fact that we are so far behind the times as to be in grave risk of becoming the laughing-stock of the more progressive countries.

Advantages of Short Waves

One of the advantages of short-wave work that has not been dwelt on to any great extent is the fact that great distances can be covered with very low powers, and this in turn renders it peculiarly suitable for very small portable transmitters and receivers.

Again, only a very short aerial is necessary, and low-power signals transmitted with a frame aerial would carry considerably farther than the same signals would on, say, 200 metres. Although short waves are not in some ways as good for truly local work as the 200–600-metre band, less power is needed to "give the signals a start," so to speak, and many possibilities open up. Portable sets using very high power are never truly portable unless they have a car or barrow to transport them, and one can see the "waistcoat-pocket short-wave transmitter" rapidly materialising, with plate supply from a 30-volt high-tension battery!

3XN AMERICA'S POWERFUL SHORT-WAVER

A few details of the latest high-power broadcaster to be erected in America.
From our Special New York Correspondent.

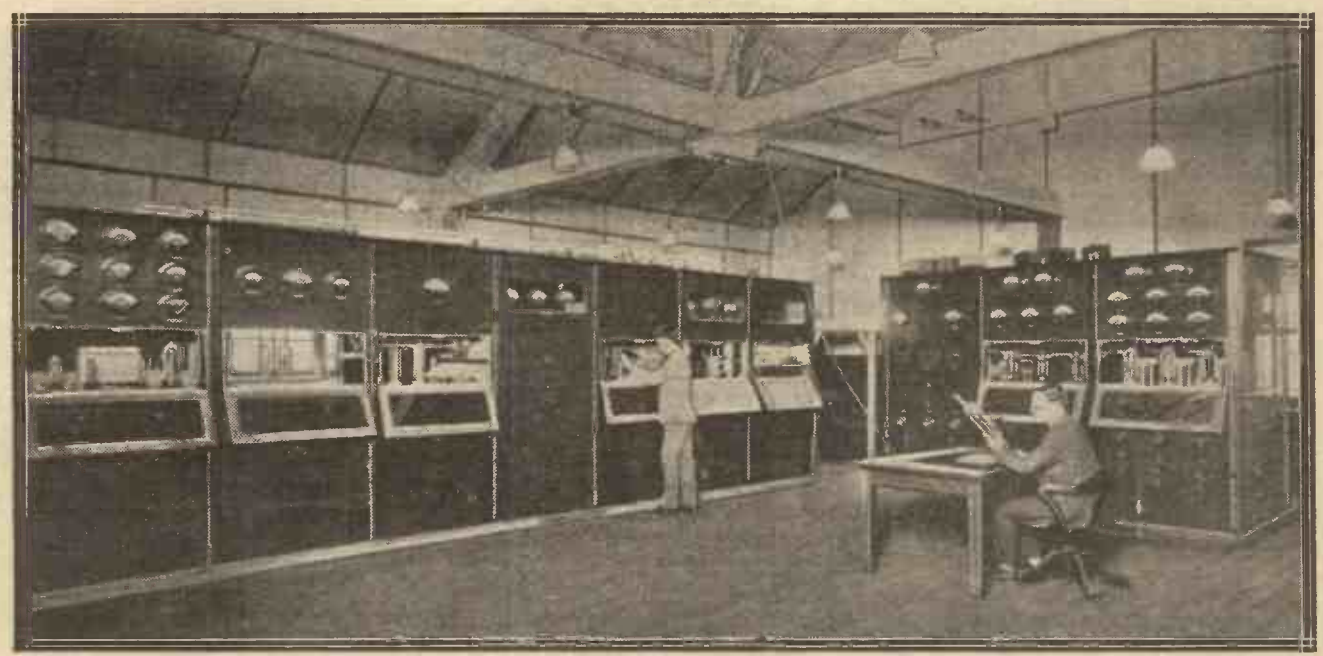
HAVE you yet picked up "3XN"? Listeners all over the world—throughout the United States, a few in England, a few in Germany, in Australia, in New Zealand, in Hawaii, in warm Bermuda, and in frozen Alaska—have all caught fragmentary messages from this amazing station, which has tucked itself away in the Orange Mountains.

Comparatively speaking, it was only the other day that we talked of "high-powered" broadcast stations of 1,000 watts and of "very high-powered" ones of 5,000 watts. Yet this new experimental station, which is situated at Wippany, twenty-two miles, as the crow flies, from New York, is equipped with power ten times greater than the biggest of which we then dreamed.

High Degree of Modulation

For it is equipped with a 50,000-watt transmitter—a striking testimony to the rapidity with which the newest of our world-industries moves.

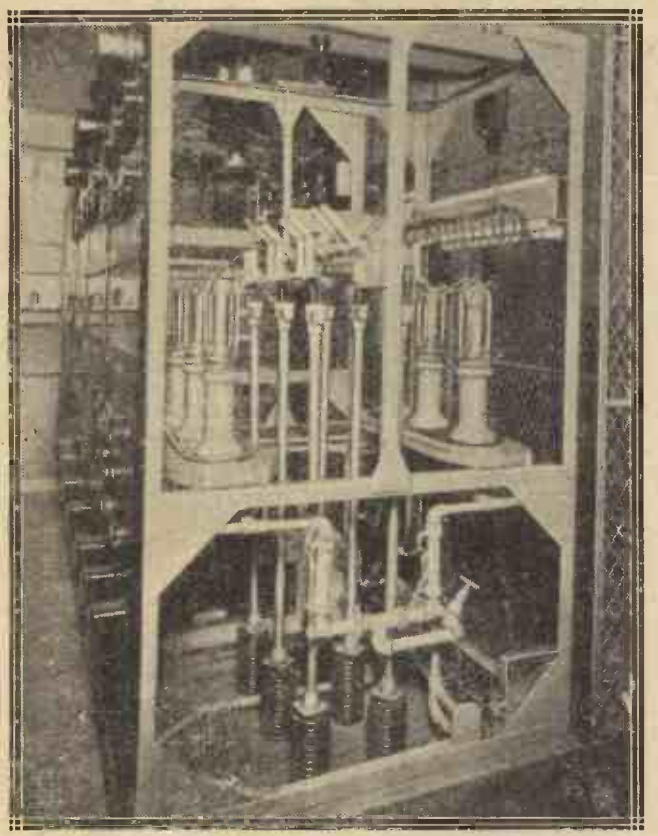
The engineers responsible for its equipment declare that among its outstanding features is the highest degree of modulation yet attained. In their own words it is



The interior of a section of the experimental station 3XN. This transmitter operates on 50 kilowatts, and is situated in the Orange Mountains, a few miles from New York.

"one hundred per cent modulation." Other points of importance are (1) crystal control of frequency stability, (2) a quite unusual elimination of harmonics, and (3) uew and elaborate safety devices for the operators.

Now, instead of trying to understand all of the technical and engineering terms lurking behind a proper explanation of these new features, suppose we have a look round for ourselves behind the scenes at Wippany and describe exactly what the layman visitor can see for himself.



A view of the special power supply valves which deal with 17,000 volts of rectified anode-current supply.

The first thing we meet with is a big power transformer situated outside the main building. This provides the power of 250 kw. at 440 volts–60 cycles, three-phase current that the twenty-five vacuum tubes of this transmitter use. Fourteen of these big tubes are water-cooled by water jackets surrounding the plates. We find that the circulating water goes through big radiators that look like the radiators on our automobiles except for the size. And even the familiar fan is there to cool the water.

Here stand ten large panels that look innocent enough from the front, but we are told that flowing into these amplifier valves there are 17,000 volts of direct current supplied by a group of rectifier tubes. To insure the safety of the operating staff against high voltages, exceptional protective measures have been developed and incorporated in the set, so that no matter what panel or door is opened the high voltage is not only shut off but all of the high-voltage parts are earthed.

Crystal Control

Over in one of the panels we are shown the small quartz crystal that, in comparison with the other pieces of equipment, looks like a midget. But it is this little device that maintains constant frequency so that in complying with the newly assigned frequency the station is always "on its wave-length."

Another really remarkable feature of the new broadcaster is the lack of noise and static. It is this feature which, perhaps, has evoked the greatest comment from those who have caught its accents on the air on the occasional Friday evenings that it has functioned.

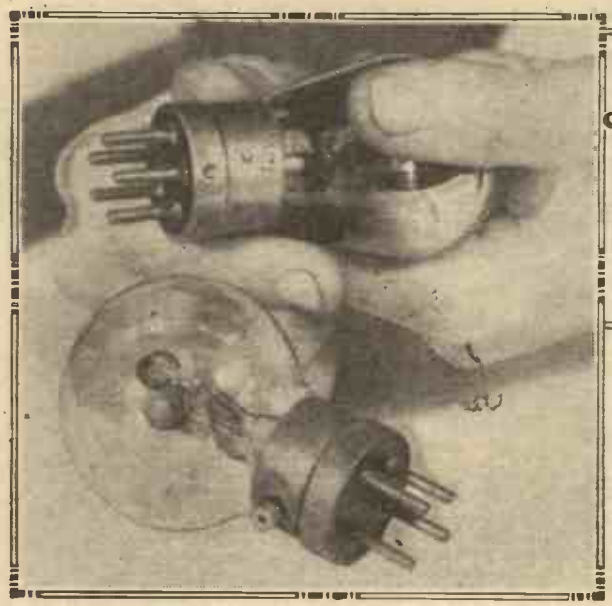
For just a fleeting moment, when we heard about it, we thought that possibly a new static eliminator had been developed. We found out, however, that there are two features involved in this apparent elimination. The step of from 5,000 watts to 50,000 watts was decided upon in order that the radio broadcast listeners might be given the proper kind of radio reception. If the signal strength received in any set is so small that considerable amplification is necessary, then we have to amplify all the other noises that are brought into the set with the carrier-wave.

Weekly Broadcasts

But the higher-power transmitter gives stronger signals; and the newly developed circuits give the "hundred per cent" modulation, which, in turn, gives greater signal strength in proportion to the carrier and the noise which it picks up. Thus the proper level of received signal strength is obtained, and over-rides most of the noise and static, leaving the listener with clear reception and wonderful quality.

In order to provide for the peaks of modulation 200,000 watts are required. The station affords us these. In other words, the normal modulated output of the aerial is actually far above the 50,000 watts about which we spoke originally!

"3 X N," which is the experimental broadcasting station of the Bell Telephone Laboratories, only operates on Fridays between the hours of midnight and 4 a.m. (American time); but when you have succeeded in getting it, I think you will agree that it is about the last word in broadcasting development.



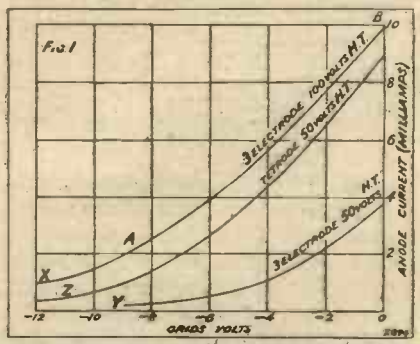
The TETRODE AS L.F. AMPLIFIER

". . . The tetrode valve provides a means of obtaining results exactly similar to those given by the three-electrode L.F. valves, but using only one-third to half the H.T. voltage."

By J. ENGLISH.

CONSIDERABLE attention has been devoted during the last year or so to developments and improvements in the design of L.F. amplifiers. We have seen the introduction of special high-amplification valves for R.C. coupling, improved power and super-power valves, and new transformers of marked efficiency.

All along the incentive of both manufacturers and designers has been the achievement of faithful and life-like loud-speaker reproduction, which



This diagram clearly shows the advantages with regard to grid voltage swing obtainable with the four-electrode as compared with the ordinary triode.

is now so much desired by all amateurs. As an example of the widespread interest taken in methods of distortionless amplification witness the recent keen controversy over the respective merits of R.C. and transformer amplification!

Simple Construction

Whether you are an upholder of R.C. or transformer amplification, I think you will agree that it is now possible and also a relatively simple matter to build an L.F. amplifier giving, with a good loud speaker, remarkably natural and pure reproduction. The design of L.F. amplifiers can, therefore, be considered to have reached a state of comparative stability; the theory of the subject is properly consolidated, and components and valves are improving rapidly. Unless something revolutionary is invented, future development can only be in the direction of improvements in design making for greater efficiency and reduced costs.

Now the best results are only obtained when your L.F. stages incorporate suitable valves for the couplings used. Whatever the latter, it is nearly always necessary to use large anode voltages to obtain full amplification free from distortion. As for power valves, you probably know to your cost how they eat up the H.T. current, and unless a reliable mains unit is installed, H.T. upkeep is somewhat of a problem even with H.T. accumulators. If your receiver is to give anything like full undistorted volume, the last valve must be supplied with at least 120 volts H.T., taking a current of, perhaps, 15 milliamps.

Lower Anode Voltages

This is where the four-electrode valve enters to show the way to lower H.T. voltages and reduced upkeep costs. The tetrode, in fact, provides a partial solution of H.T. problems without adding any complication whatever to the design or operation of the amplifier. It is remarkable that the tetrode has not already been more widely used as an L.F. amplifier considering its manifest advantages. This, as I have explained elsewhere, has been due to the lack of suitable valves. These are now available in all types and their application as L.F. amplifiers with low anode voltages should be of great interest to all amateurs.

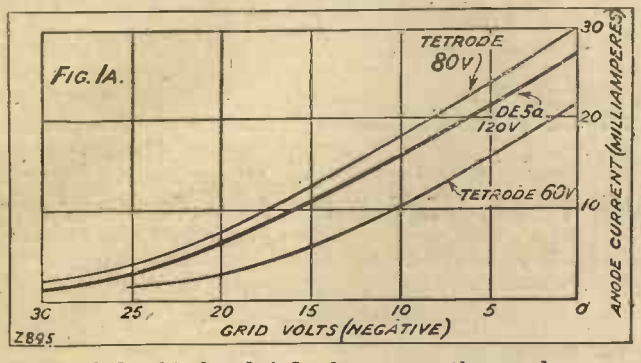
Use of Two Grids

In its simplest form the tetrode valve provides a means of obtaining results exactly similar to those given by three-electrode L.F. valves, but using from one-third to a half the normal H.T. voltage. Whether used as R.C., power, or super-power amplifiers, tetrodes work as well as, and in some cases better than, similar three-electrode types requiring much greater anode voltages. The average anode

The tetrode has assisted in solving the problem of stability in H.F. circuits as exemplified by the screened-grid valve. This photograph shows another valve having two plates and two grids whose inter-electrode capacities are so arranged as to be self-neutralising.

current required by the super-power tetrode is about the same as the ordinary super-power valve. However, it is considerably cheaper to maintain a large-capacity H.T. battery of 40 or 50 volts than one of 120.

In order to understand the reason for the great efficiency of the tetrode as an L.F. amplifier it is necessary to examine the theory of its operation.



Representative curves of super-power valves, both triodes and tetrodes, show a marked superiority in the case of the latter, which provide exceptionally good characteristics with remarkably low H.T. voltages.

We need do this but briefly, because the principles of the tetrode as an amplifier on low anode voltages are really not involved. It is the use of a second grid, placed between the control grid and the filament, that causes the valve to require less anode volts than the three-electrode.

Now in a three-electrode L.F. valve we require a nice, straight grid volts-anode current curve so that grid swings of several volts either side of the grid-bias point shall not take the working point on to the curved parts of the characteristic. In the curve X of Fig. 1, when the grid is biassed at 4·5 volts negative, a grid swing of 4 volts either side will not encroach into the bend beyond A nor make the grid positive (beyond B), so that distortion will not occur.

Effect of Varying H.T.

In order to obtain this state of affairs at least 100 volts H.T. must be used, because with less volts the straight portion between A and B is not so long, as in curve Y. In other words this type of valve requires large anode voltages in order to handle a reasonably large input without distortion. The curves of Fig. 1 apply to the smaller type of power valve, but curves representative of the super-power type are shown in Fig 1A.

When the valve is operating, the effect of the negatively biassed grid is to cause a cloud of electrons, of which the anode current is constituted, to collect round the filament. This "space charge" acts as a blanket, reducing the pulling effect of the positive anode on the electrons emitted from the filament.

The Second Grid

Hence it requires a large positive anode voltage to pull across sufficient electrons to provide the anode current necessary for a long, straight characteristic. Suppose the anode voltage is reduced to 50, giving the curve Y in Fig. 1. If the space charge were now removed, the curve for grid volts-anode current would, in all probability, be even better than X.

To improve the L.F. valve we have therefore to reduce the space-charge effect, and this is where the second grid of the tetrode becomes so useful. This grid is given a certain positive potential, and, being near the filament, it attracts a large quantity of the electrons forming the space charge. This liberates the blanketing effect on the electrons flowing from filament to anode, so that a relatively small positive potential on the latter can pull across considerably more of them.

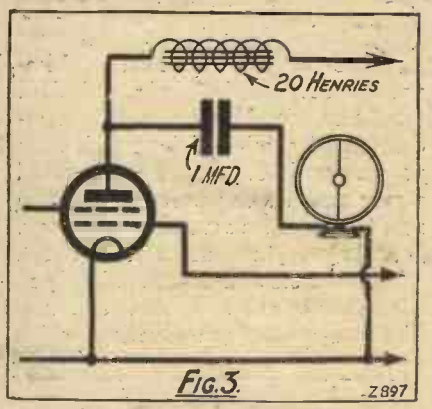
Decreasing Impedance

By assisting the electrons to reach the positive anode, the second grid causes a large anode current to flow for relatively low anode voltages. The introduction of this additional positive electrode has therefore the effect of lowering the impedance of the valve, since the smaller the impedance the greater the anode current for a given anode potential. The curve Z of Fig. 1 is representative of an efficient tetrode of the small power type with 50 volts H.T. It will be seen that this curve compares fairly favourably with X.

As with three-electrode valves, the static curves, such as X and Y, do not exactly portray operating conditions, but the relation between static and dynamic conditions is the same for both four-electrode and three-electrode valves.

Suitable Circuits

The use of the second grid of the tetrode as a space-charge reducer is, with one exception mentioned later, its sole use for purposes of L.F. amplification. There is no change whatever needed in the theory of L.F. amplification, and the same couplings can be used as with ordinary valves. In fact, an existing receiver can be adapted for low anode-voltage amplification simply by substituting

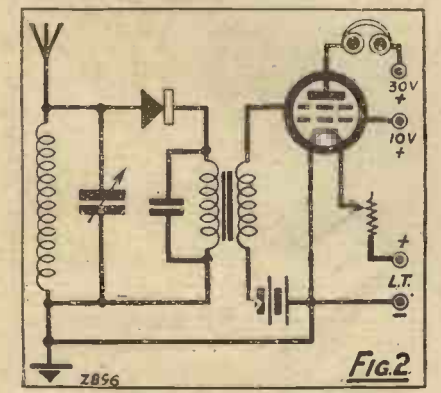


The probable advent of the super-power tetrode will greatly simplify the "last valve H.T." problem.

for the three-electrode valves tetrodes of similar type, reducing the anode voltage to 50 or so, and then providing the inner grids with a positive potential between 10 and 20 volts. The voltage of this inner grid is not critical, but its effect as a space-charge reducer naturally becomes greater as its positive potential is increased.

In order to demonstrate how simply tetrodes can be substituted for three-electrode valves, let us consider a few circuits for L.F. amplification. Notice that in every case no departure is necessary from accepted theory and practice. In transformer and choke-coupled stages the tetrode can be considered quite simply as an ordinary valve with a low internal impedance, and treated accordingly.

Most amateurs make their first acquaintance with the L.F. valve as a first-stage amplifier added to a crystal or valve detector. The



An example of a crystal set followed by a four-electrode-valve amplifier.

transformer is a popular form of coupling for this position, as construction is then so simple. Fig. 2, wherein a tetrode is used as the amplifying valve, is quite a useful circuit for the man who is about to add an L.F. stage to his crystal set or one-valve detector, as excellent results are obtained with less than 30 volts H.T. A good transformer and suitable grid bias are, of course, necessary for the best results.

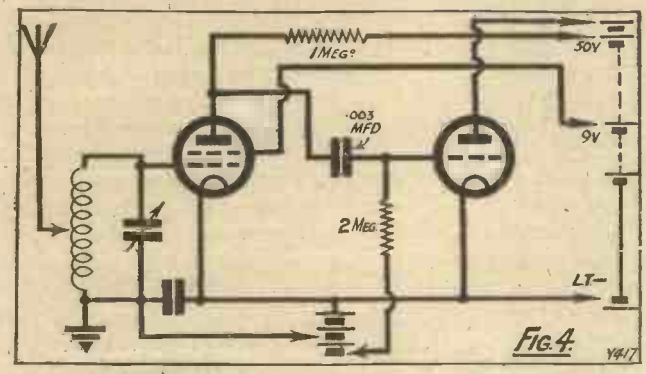
When the receiver of Fig. 2 was tested, using the voltages indicated, good loud-speaker results were obtained from 2 L O, some six or seven miles away. 5 G B was also received at fair loud-speaker strength; quality in both cases being excellent. The addition of another L.F. stage, using a second tetrode of the power type, with 60 volts H.T., transformer-coupled, resulted in very loud signals from 2 L O and full volume from 5 G B, all without any degree of distortion which could be observed on the loud speaker in use.

Choke Output

When tetrodes are used throughout the L.F. stages it becomes necessary to adopt some form of choke output coupling to the loud speaker, as in Fig. 3. The tetrode in the last stage will have quite a low impedance, so that a considerable anode current will flow. Therefore, apart from protecting the loud speaker, a choke coupling is necessary to avoid a voltage drop across the high-resistance windings of the loud speaker. Since the anode voltage is not high, we cannot afford to waste any volts in this way. The L.F. choke may have an impedance of 20 henries, with plenty of iron in its construction.

It was mentioned above that there was an exception to the use of the inner grid solely as a space-charge reducer. If the tetrode is suitably designed, changing over the grid connections so that the *outer* grid is the space-charge reducer results in a very considerable increase in magnification. In this form the tetrode is very useful as an R.C. amplifier. In common with the three-electrode valve, a large increase in the magnification factor is attended by a high internal impedance.

This, however, is not such a great disadvantage as it would appear, because the degree of amplification obtainable is only equalled by the ordinary R.C. valve when supplied with at least double the H.T. voltage. Also the amplification yielded by tetrodes specially designed for R.C. amplification is considerably higher than anything obtainable with three-electrode valves.



Here we see the four-electrode valve being used as an anode-bend detector, the inner grid being employed as the control grid and the outer as the space-charge reducer. Full loud-speaker strength with this circuit is obtained in London on 2 L O and 5 G B.

How It Works

A good idea of what goes on inside the tetrode, as used in this way, is to consider it as an ordinary R.C. valve with an extra grid. The inner control grid, near the filament, has a close mesh for the purpose of obtaining a high magnification factor, as in the three-electrode R.C. valve. But this would make the valve's impedance extremely high were it not for the outer grid, which having a positive potential pulls the electrons through the meshes of the inner grid and so reduces the anode-filament impedance.

R.C. Coupling

In order to test the capabilities of these valves as high-magnification amplifiers the circuit of Fig. 4 was set up. Here the tetrode was used as an anode-bend rectifier, resistance-capacity coupled to a three-electrode power valve; the voltages for anode and outer grid and values of the chief components being indicated in the diagram. With the receiver so constituted, full loud-speaker volume was obtained from 2 L O.

In fact, at full tune the London station set up an input to the power valve which was beyond its ability to handle without distortion. A larger valve was then necessary to deal with this volume without distortion. Even with 30 volts on the first valve the amplification was of a high order.

It was noticed that when tuning in the London station, grid bias for the first valve had to be increased to as much as 7·5 volts negative in order to obtain maximum signal

Radio receivers are becoming more and more simple to construct and operate. Self-neutralising valves, fieldless coils, examples of which are seen above, screened-grid valves, and other examples of the four-electrode variety, are tending to make for an economy and efficiency of working never before experienced.

strength, smaller potentials resulting in very weak and distorted signals. The large H.F. input to the detector apparently set up a positive bias which had to be counteracted by an increase in the negative bias applied to the grid. Similarly for 5 G B a bias up to 3 volts negative was required.

Many Advantages

The results of these experiments demonstrate very well, I think, the advantages accruing from the use of tetrode valves as R.C. amplifiers. In comparison with the three-electrode R.C. valve the tetrode gives increased amplification on much lower H.T. voltages.

Where the reduction in the size of the H.T. battery is of paramount importance, as in portable receivers, the tetrode L.F. valve becomes extremely useful. Having already ascertained that quite good results are possible with a maximum anode voltage of 30, we can proceed to draw up a circuit suitable for a small portable receiver. A representative circuit which I have developed for this purpose is shown in Fig. 5, the detector being suitably arranged to provide reaction. This valve is R.C. coupled to the L.F. amplifier, both being supplied with not more than 30 volts H.T.

Notice that in the detector the outer grid is used as the "anode," from which the reaction feedback is obtained in the usual way, by means of the small variable condenser C_2 and reaction winding L_2 closely coupled to L_1

Important advantages are gained by the use of the outer grid in this way. Normally, reaction is difficult to obtain when feeding back from the anode itself, while the shunt capacity of the reaction condenser across the coupling resistance is rather detrimental to quality. A potentiometer is very useful for obtaining the correct grid bias for the first valve, the adjustment of potential being somewhat critical. Anode and outer grid voltages are indicated in Fig. 5.

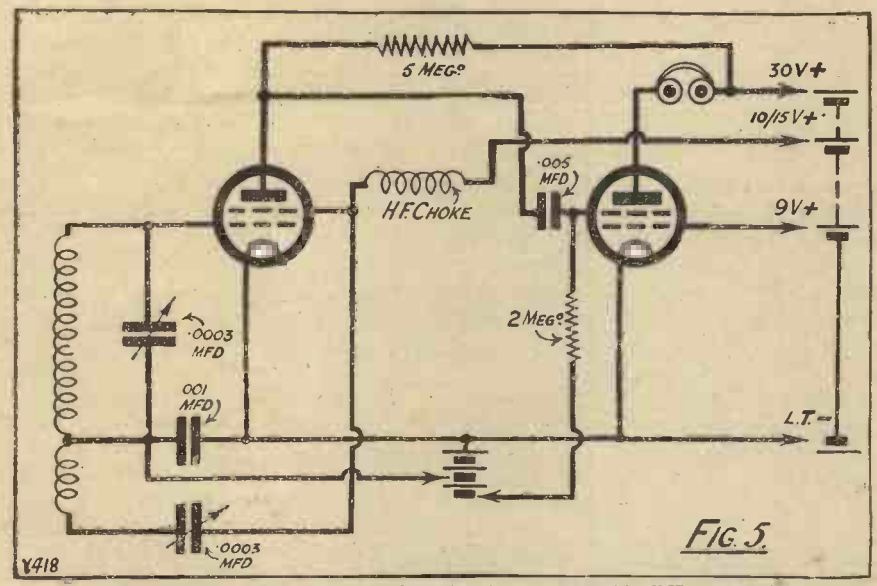
An experimental receiver was roughly put together on these lines and, using a 4-in. diameter coil as the frame aerial, quite good 'phone strength signals were obtained from both 2 L O and 5 G B. This circuit is so interesting that it is hoped to give a fuller description of it at some later date.

Large Capacity Batteries

In conclusion there is one aspect of the use of tetrodes as L.F. amplifiers, more especially the power and super-power types, and that is the additional H.T. current drawn by the inner grid in its capacity of space-charge reducer. This current increases as the anode current decreases, and vice versa, so that the sum of the two currents is sensibly constant.

Although there is no appreciable increase in the amount of current drawn from the H.T. battery when tetrodes are substituted for ordinary valves, it is highly desirable to use either H.T. accumulators or large-capacity dry-cell batteries. If small batteries are used, the internal resistance is sure to increase considerably after a period of use. This causes a voltage drop across the battery when the set is working, and since the anode volts are already low the actual voltage on the anode may be very small indeed. Therefore, in the interests of economy and quality of reproduction it certainly pays in the long run to install large-capacity H.T. batteries.

For the benefit of readers who wish to use tetrode valves as L.F. amplifiers I may mention that they are readily obtainable, suitable types being marketed by a British manufacturer. This firm produces reliable and efficient tetrodes for all purposes—H.F., R.C., L.F., and detector stages.



A good local loud-speaker circuit which also has remarkable DX properties. Two tetrodes are employed respectively as anode-bend detector and R.C. coupled L.F. amplifier. Note the connections to the various grids and the low H.T. voltages required.

SOLDERING LITZ WIRE

LITZ wire is very difficult to handle and soldering it, in the hands of the average amateur, becomes an impossible task unless considerable patience and a fair amount of skill is applied. This is the way this, or any other stranded wire, should be dealt with.

For a half an inch or so from its end it should be carefully unravelled and each strand cleaned separately. Gently scrape with a sharp knife each tiny wire until it is clean. Do not use force or endeavour to hasten the operation, for if you do the wire will break. If the wires are enamelled the operation may be a long one, but if the job is to be satisfactory it will have to be carried through.

Care Needed

Next cover each strand very carefully with flux. Having done this, gently twist the whole lot together again, taking care not to rub the flux off with the fingers. Twist them up very carefully but tightly together with a pair of pliers, the jaws of which have previously been cleaned. Next get the bit of the soldering iron well cleaned and tinned. On one face of the soldering-iron bit get a large bead of molten solder, and in this place the end of the Litz wire. Hold it there for two or three moments and then withdraw it, and you will find that it is successfully welded together by means of a mass of permeating solder. You can now proceed to join it to a soldering tag or other such point in the usual way, confident that a strong connection will result.

ALL ABOUT The "MASTER THREE" The "MELODY MAKER" AND THE "R.C. THREESOME"

1. THE "MELODY MAKER."
2. THE "MASTER THREE."
3. THE "R.C. THREESOME."

THE COSSOR "MELODY MAKER"

THE indisputable popularity of the Cossor "Melody Maker" is not undeserved. Judged purely from technical angles, it is an excellent set. And, curiously enough, I believe that this will be the first time that the theoretical circuit of this very well-known receiver has been published.

It is a first-class design, and it shows many points of interest. Get together the pictorial blue print, the theoretical diagram and your actual "Melody Maker," if you happen to have one built up, and let me see if, first of all, I can get you interested in the theory of operation of the set. If you can derive a fair inkling as to how Stuttgart, Berlin, or some other station manages to thread its transmissions through your Cossor "Melody Maker" from the aerial to the loud speaker it will at least give you some idea of the purposes and ingenuity of the designers

In your aerial, which is represented at the extreme top left of the theoretical diagram, high-frequency electrical currents are generated by the broadcasting station. The aerial lead can be connected to either one of two terminals, shown as "A_1" and "A_2" in the diagram. This gives you the choice of two degrees of selectivity.

Ingenious "Wave-Change"

When the aerial lead is taken to terminal A_2, a ·0001-mfd. fixed condenser is brought in series and the highest degree of selectivity available is provided The two fixed condensers also have the effect of making the receiver adaptable to varying aerial-earth conditions. From the small fixed condenser a lead is taken to a tapping on the tuning coil and this still further increases the receiver's selectivity. There is really only one tuning coil in the Cossor "Melody Maker," although this is divided into two sections and the reaction coil centred between them.

The three-valve receivers designed by Messrs. Cossor Ediswan, and Mullard have achieved considerable popularity, and there must be very many thousands of radio enthusiasts, new and experienced, who have built or are going to build them.

For the benefit of these, and indeed for the interest of all our readers, Mr. G. V. Dowding, the Technical Editor, discusses the three "valve-maker" sets in the accompanying article. The constructions of the receivers are dealt with, the circuits are impartially criticised, operating notes are given, and much information likely to prove of value and afford guidance to builders of the sets is included.

It should be noted that Mr. Dowding has spent a considerable amount of time with the actual sets, thus gaining his data in an eminently first-hand, practical manner. And, further, he handled them under home and not laboratory conditions

One of these aerial coil sections—the one marked "long"—can be shorted out of circuit by the switch S_2. When this S_2 switch is closed, the "long" section is rendered inoperative and the set is suitable for the reception of broadcasting stations working on the medium band of wave-lengths.

When the switch is opened, the "long" section is brought into circuit, and stations such as 5XX and others using long wave-lengths can be tuned in. The wave-length tuning is carried out by the ·0005-mfd. condenser VC_1.

The received energy is fed into the first valve via the grid leak and condenser marked R_1 and C_3 respectively. A "feed-back" or reaction is effected from the plate of the first valve to its grid via the reaction coil, which is positioned between the two sections of the aerial tuning coil.

Reaction Skilfully Applied

In the usual way a larger winding or much closer coupling between the reaction and aerial coil is required when one is working on the long waves. This is effected in the Cossor "Melody Maker" in a very cunning manner. A fairly large reaction winding—electrically speaking—is arranged some distance away from the short section of the tuning coil and near to the "long" section.

Thus when one is working on the low wave-lengths a larger reaction coil than is generally necessary is in use, but this is coupled fairly weakly by having it spaced some distance away. When one is working on the long waves the tight coupling of the reaction coil, which is then automatically obtained by bringing the "long" section of the tuning coil into service, makes the "feed-back" successful on the high wave-lengths.

A "Safeguard" Condenser

The reaction is controlled by the variable condenser marked VC_2. In series with this variable condenser is a fixed condenser marked C_5. The purpose of this latter is to prevent the high-tension current shorting through and possibly causing damage should the VC_2 variable condenser develop a fault. Without this safeguard it would only be necessary for the vanes of the VC_2 variable condenser to touch to bring the whole

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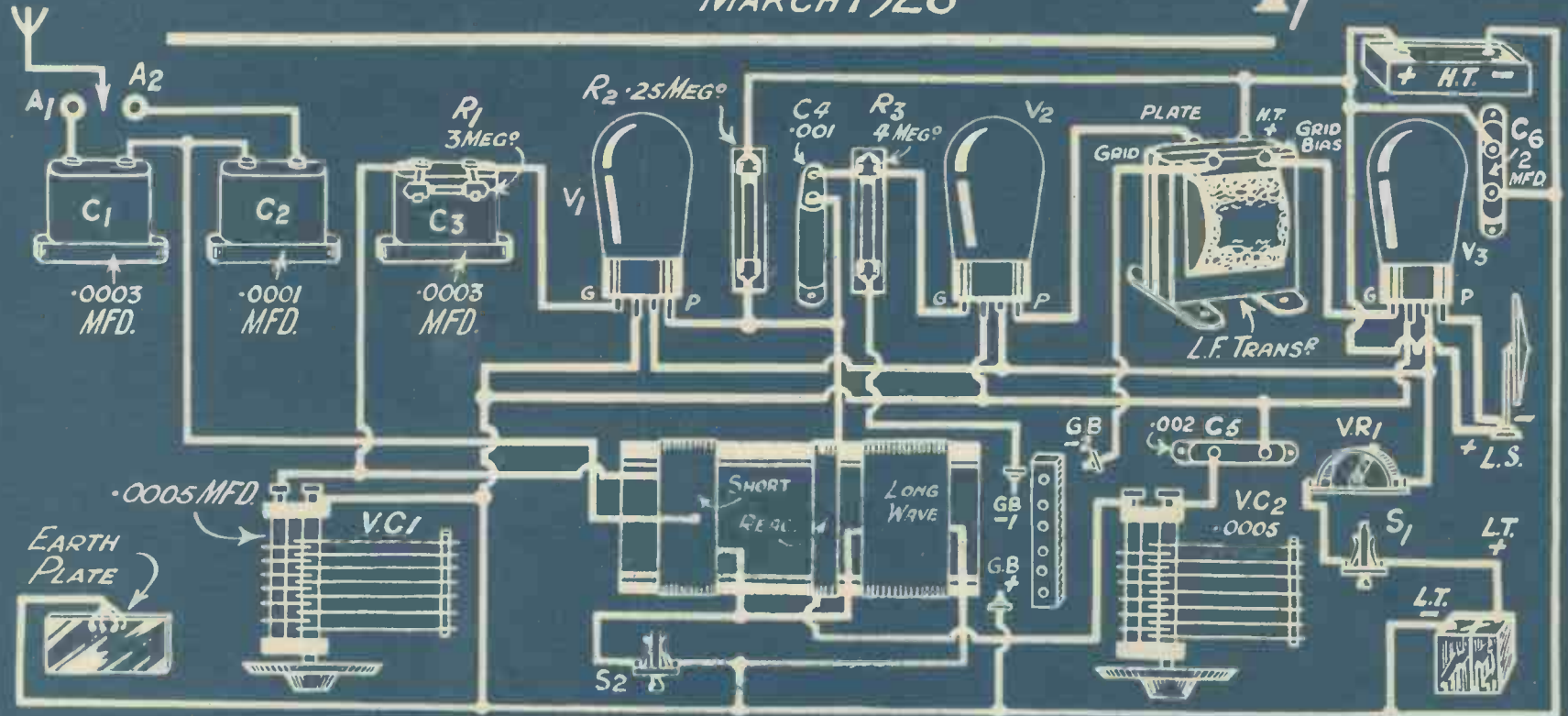
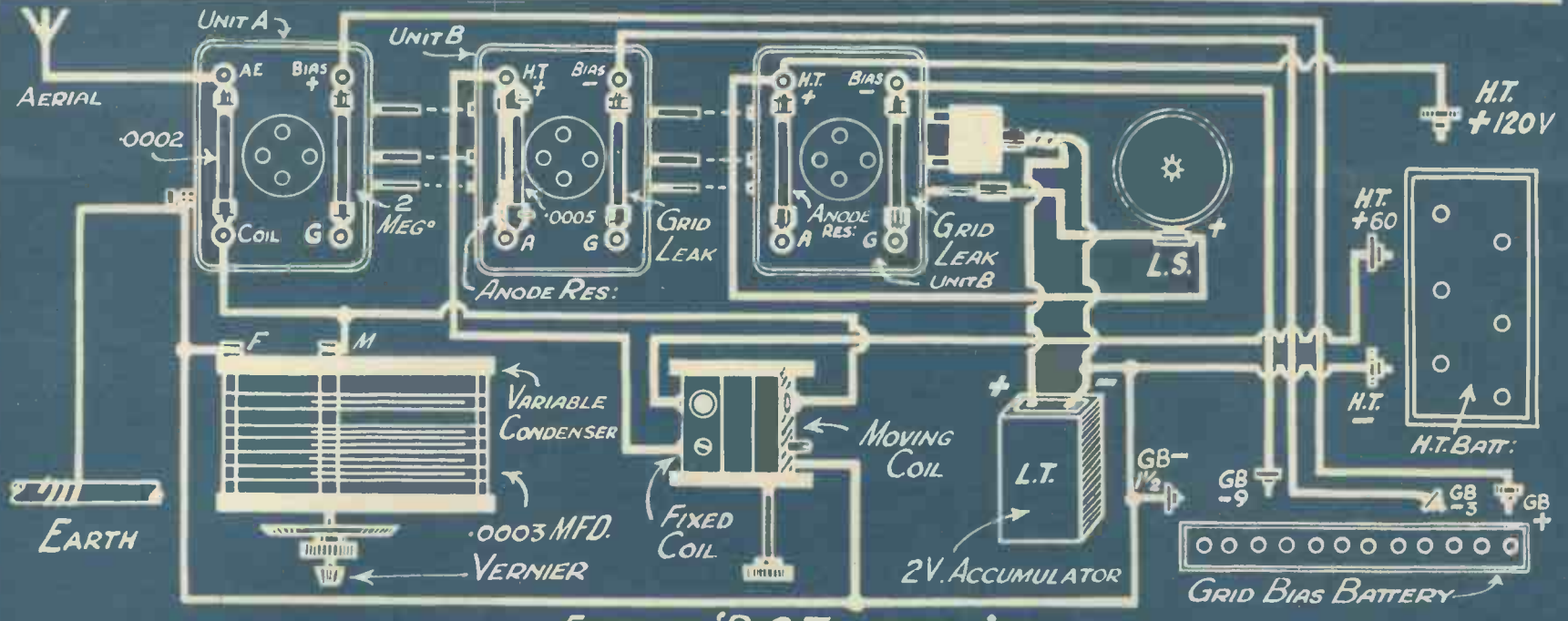
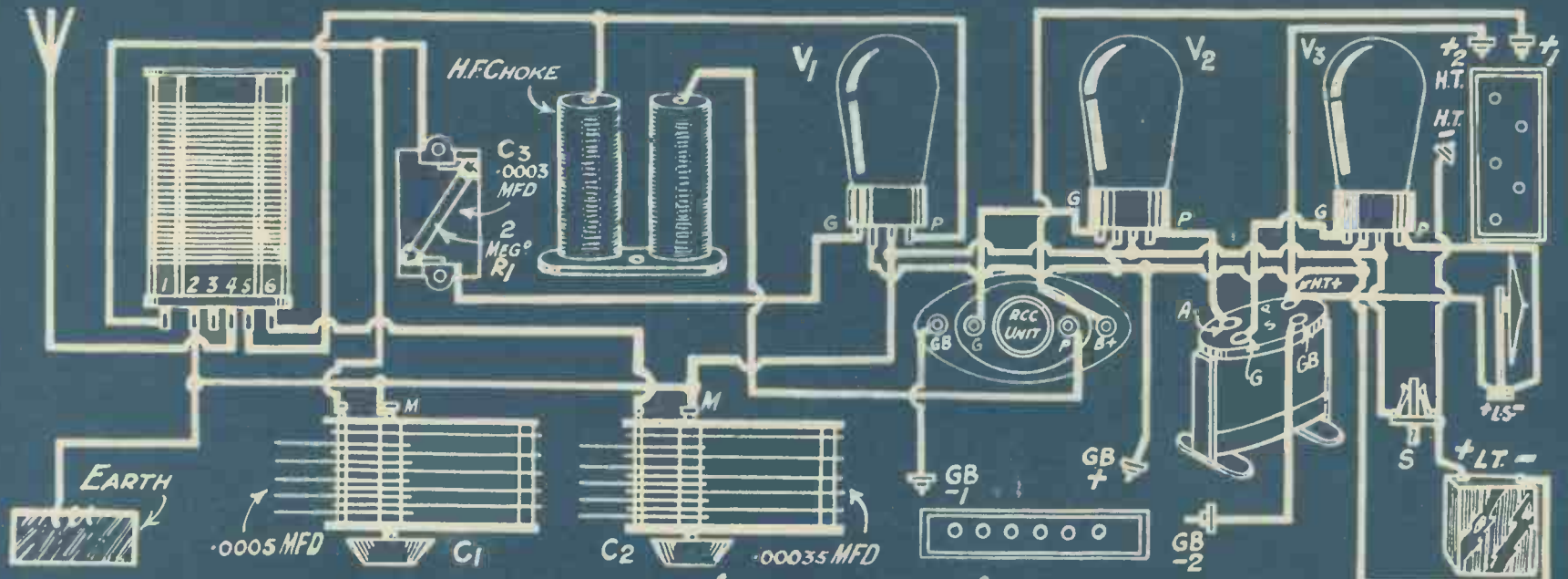


COSSOR 'MELODY MAKER'



EDISWAN 'R.C. THREESOME'



MULLARD 'MASTER THREE'

of the high-tension voltage across the anode resistance R_2. S_1 switch would not switch off the H.T.!

The leaky-grid detector valve is coupled to the first L.F. amplifying valve by the resistance-capacity method. The anode resistance R_2 is of such a value that effective magnification results without purity sacrifice. And the value of the grid condenser C_4 and the grid leak R_3 are proportioned with the same object in view.

The Intervalve Couplings

The energy fed to the grid of the first valve is magnified by that valve and passed on to the second valve through the grid condenser C_4. The third valve, or the second L.F. amplifying valve, is transformer-coupled. The plate of the second valve is taken to the primary of an L.F. transformer, the secondary of which is connected to the grid of the third valve. The plate of the last is taken direct to the loud speaker.

There is only one high-tension positive terminal, but this is all that is necessary. Across the H.T. terminals is a 2-mfd. fixed condenser which is shown as C_6 in the diagram. The purpose of this component is to "by-pass" the H.T. battery. Switch S_1 breaks the L.T. circuit and in doing so automatically places all the other batteries out of operation.

The rheostat VR_1 enables the L.T. current to be adjusted to the correct value. By means of the G.B. (grid bias) leads, which are very plainly marked in the theoretical diagram, the grids of the L.F. amplifying valves can be given an initial potential of just the value they require to give the best results.

Well, that is the circuit of the Cossor "Melody Maker." A "Det.-2 L.F. resistance-transformer," as it is known technically, which illustrates an almost ideal arrangement of three valves.

In the construction a very important item is, as Messrs. Cossor indicate, the specially designed coil. If you vary in any way from the specification of this, your results may be considerable impaired. You are advised to use certain gauges of wire having certain coverings. Other kinds of wire will not suit. Cotton-covered wire is cheaper and more easily obtainable, generally speaking, but you must use the double-silk-covered wire specified.

The "wave-change" switch figures on the front of the panel of the "Melody Maker," the "on-off" switch being at the back of the set.

Special Transformer Connections

I notice that quite a few manufacturers are now supplying special coils for the Cossor "Melody Maker." The prices appear to be very reasonable, and if you have not made your "Melody Maker" yet, I would advise you to buy one of the ready-made coils.

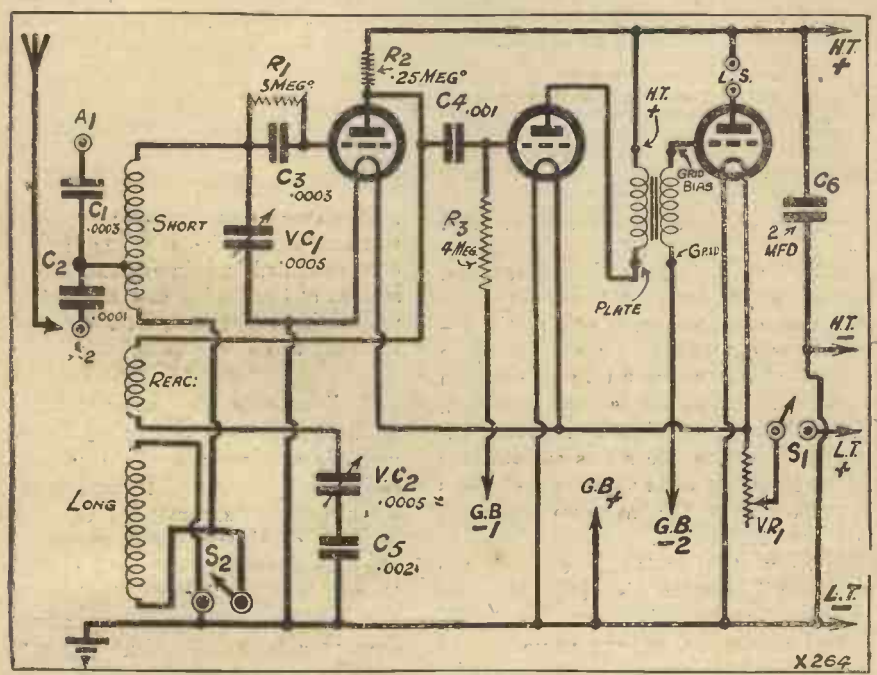
You will notice that the L.F. transformer has its "grid bias" terminal connected to the grid of the third valve, the "grid" terminal being taken to the grid-bias battery. This is not an accident or a mistake, and you should see that your transformer is wired in exactly the same way. To be fair to the designers, and in order to ensure success, as I have said elsewhere, you should employ exactly those components specified. But I can sympathise with you if you have a transformer on hand which you wish to use, perhaps one that was used in a set dismantled in favour of the "Melody Maker." And if it is a transformer of good make there is no reason why you should not endeavour to use it. It will be your risk as to whether or not it will give good results! That is, in this particular set.

The plus H.T. and plate terminals on the transformer shown in the "Melody Maker" wiring diagram correspond with the I.P. and O.P. terminals on some other makes of transformers.

Lead Reversals

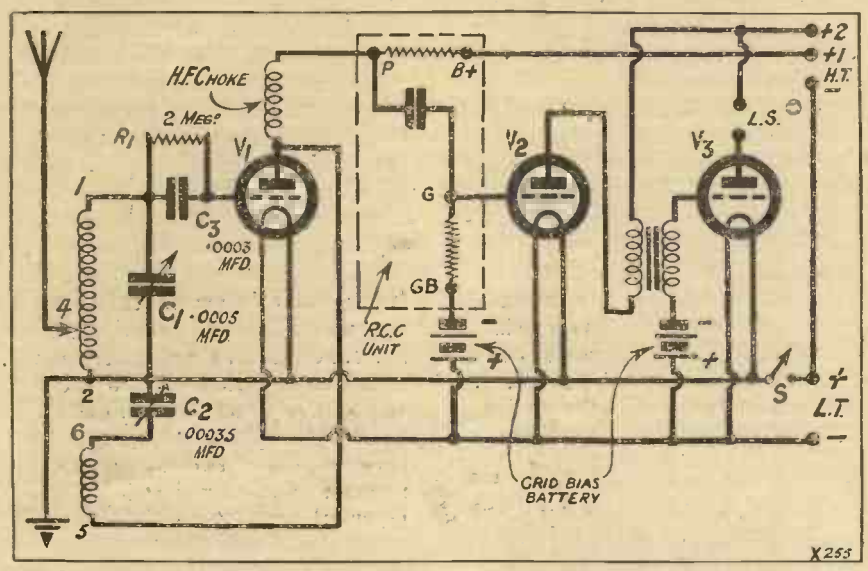
Instead of grid bias and grid, you might find O.S. and I.S. In using another make of transformer—and mind I do not advise you to do this—it will be necessary for you experimentally to reverse the leads corresponding with "grid bias" and "grid" in order to discover the best arrangement. You should also try changing over the primary leads, but on no account mix up the primary and secondary leads. These are never interchangeable.

The terminals of the various components should be comparatively tightly screwed up, thumb pressure is not quite sufficient. A pair of pliers should be used for the purpose, but the terminals should not be screwed up too hard, otherwise you will strip their threads.



In the Cossor "Melody Maker" a special coil unit is used, which enables both "long" and "short" wave-length bands to be covered by the operation of a simple switch. This latter, "S_2," "shorts out" a portion of the tuning coil.

If any of the valve-holder terminals work loose in their settings they can be tightened again from the underneath by means of a screwdriver. But it will be necessary to remove the component from the baseboard for this purpose. Even if you have a Cossor "Melody Maker" working well, I would advise you to run all over the terminals and see that they are tightly screwed up.



The theoretical circuit diagram of the Mullard "Master Three."

You are not likely to meet with much trouble with this popular set provided you have closely followed the specification. You will, of course, use the recommended valves—that is very important, and the 120 volts H.T. is essential—75 or 100 will not be enough. As you will be using a power valve you should obtain one of the higher-capacity types of dry batteries; the usual small, standard type will not last you very long. A treble-capacity H.T. battery of good make should last at least six months with this set. The smaller type might last only two or three.

Useful Maintenance Hints

And, remember, that the keynote to successful radio reception is good contacts. As I have already said, you must make sure that every lead is firmly and cleanly held by its terminals. The grid bias and H.T. battery wander plugs must fit snugly into their sockets. Also the pins of the valves must be making good contact with the sockets in the valve holders. In cases you may find it necessary to open the valve pins and wander plugs a little with a penknife in order to make them fit more firmly.

And keep all the external leads well separated and not bunched together. If terminal H.T. positive or L.S. positive is allowed to make contact through its lead with a lead running from the L.T. negative terminal or the earth terminal, you will burn out the whole three of your valves.

Beware of Dangling Leads!

And when disconnecting either the L.T. or H.T. battery, or both, from the set, always disconnect the leads at the battery end first, and then remove them entirely from the receiver. A dangling lead is always dangerous, more especially when it is attached to a battery. Having once adjusted your grid bias and filament rheostat and connected the aerial lead to the aerial terminal most suited to your individual conditions, you can proceed to forget the inside of your Cossor "Melody Maker" until, in nine months' time or longer, the grid-bias battery commences to run down and needs to be replaced. The set can be switched on and off by S_1 at the back of the set. The batteries do not need to be disconnected.

When you are searching for a station do not haphazardly twiddle the two dials on the panel. You might be lucky and hit your six or seven stations, but it is more likely that the only result will be that you will cause considerable interference in your neighbourhood.

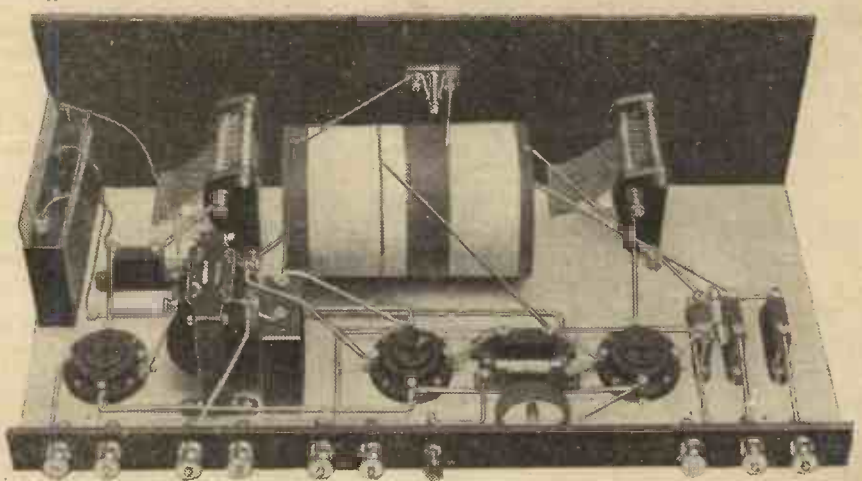
Notes on Tuning

The right-hand dial, that which controls the variable condenser VC_2, needs to be used gently and with discrimination. You can whizz about on VC_1 searching for stations, but deal tenderly with the other dial. The nearer you are to zero with the VC_2 dial the farther away you will be from the oscillating point of the set; that point where squeals and howls are met is the "danger" point.

You work up on the VC_2 dial until you get a sensitive condition, keeping back from that point where silvery little whistles are heard. As soon as you find a station on the VC_1 dial make a note of its reading, then you will be able to pick it up again at any other time with a minimum of delay.

THE MULLARD "MASTER THREE"

It seems that the first requirement for a very popular wireless set is that it should use three valves; one for rectifying the high-frequency radio energy received on the aerial, and the other two for building up the result into moderately powerful loud-speaker sounds. Therefore, one is not surprised to find that the Mullard "Master Three" employs a three-



The Cossor "Melody Maker" has its "on-off" switch at the back on the terminal strip. On the right can be seen the two fixed condensers which provide alternative degrees of selectivity. Note the short direct leads from the coil unit.

valve circuit of this type. But it is not quite so "standard" that it might be *any* three-valve set. Naturally, most of its distinctiveness is in its special method of assembly, but there are also one or two points of interest in its circuit.

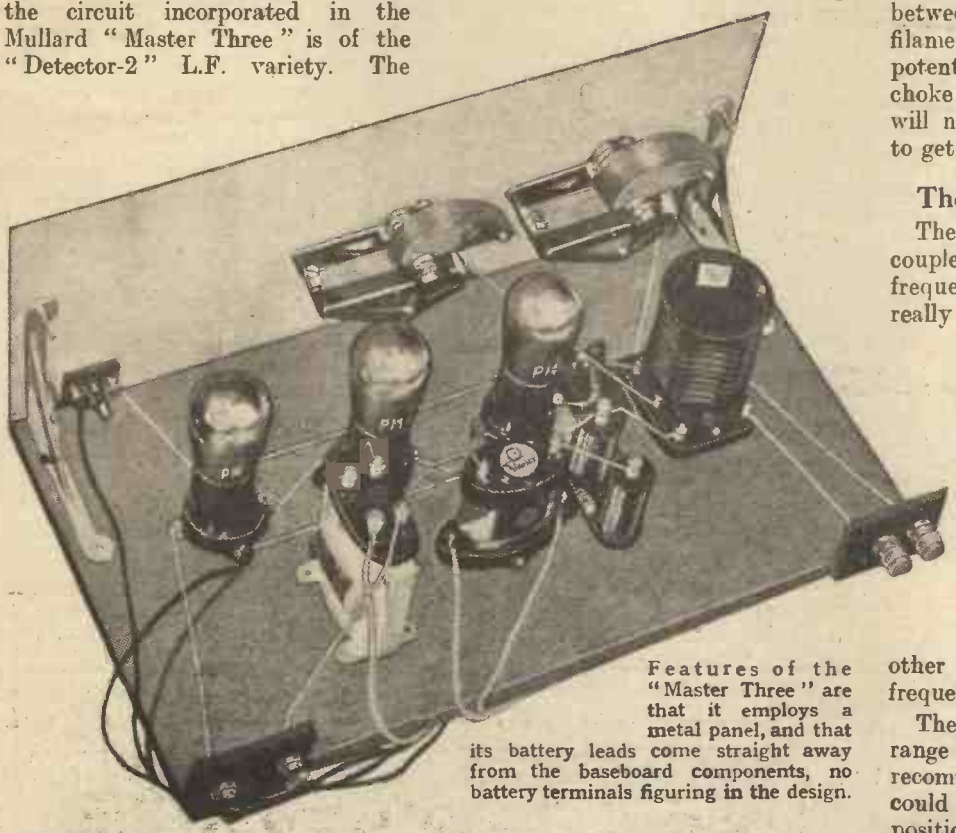
Circuit Details

The high-frequency choke placed in the anode circuit of the detector valve could be eliminated and the set would still work quite well. But besides enabling smoother reaction control to be obtained this choke has the very excellent effect of tending to prevent high-frequency impulses being passed through to the low-frequency valves and causing distortion.

As I have already indicated, the circuit incorporated in the Mullard "Master Three" is of the "Detector-2" L.F. variety. The first low-frequency valve is resistance-capacity-coupled, and the second is transformer-coupled. This is accepted as being the best practical arrangement of two low-frequency amplifying valves, when both purity and volume are required.

The detector portion of the circuit is quite straightforward. There is a single tuning circuit controlled by the .0005-mfd. variable condenser shown as C_1, and in order to attain some degree of selectivity the aerial is taken to a tapping on the aerial tuning coil. The reaction coil is wound on the same former as the aerial coil, the two windings constituting one complete and neat unit which can be quickly changed for another unit of a similar type when a different range of wave-lengths is required to be covered. Two units, one for such stations as 2 L O, 5 G B, Langenberg, etc., and another for those stations operating on the higher wave-band, such as Hilversum, 5 X X, and so on, are all that the average listener will need.

The variable condenser with which reaction adjustments are carried out (it is shown as C_2 in the diagram) is placed between these two coils so that its one set of vanes can be connected to earth. This is a very important feature in the design of the set and one well worth noting.



Features of the "Master Three" are that it employs a metal panel, and that its battery leads come straight away from the baseboard components, no battery terminals figuring in the design.

It not only allows the use of a metal panel with its consequential reduction of connecting leads, but it also contributes to that stability and freedom from hand-capacity effects which contributes in no small measure to the good results given by the "Master Three."

The R.C.C. Unit

The first low-frequency valve is coupled by means of an R.C.C. unit which embodies those elements shown in the theoretical diagram which are enclosed within dotted lines. There is the anode resistance, the grid condenser, and the grid leak. A few R.C.C. units incorporate further components—the Mullard does, for instance—which, taking the form of a small condenser, and/or a high-resistance, are present for the purpose of enabling reaction to be obtained more easily in certain circumstances, and to prevent high-frequency currents passing through to the grid of the low-frequency valve.

In the "Master Three" neither of these is essential, and the set will be perfectly efficient without them. You can draw a line down through that theoretical diagram in extension of the left-hand dotted line, right to the bottom of the drawing, and regard the circuit as high-frequency to the left, and low-frequency to the right. You will note that the only two connections between these two areas are the filament circuit, which is at earth potential, and the high-frequency choke which, if it deserves the name, will not allow much high-frequency to get through.

The Recommended Valves

The second low-frequency valve is coupled to the first by means of a low-frequency transformer. There is really only one grid-bias battery common to the two low-frequency valves; two are shown in the theoretical diagram for purposes of simplification. That may sound paradoxical, but I have saved cross-overs and kept the R.C.C. unit and its connections straighter by adopting this scheme.

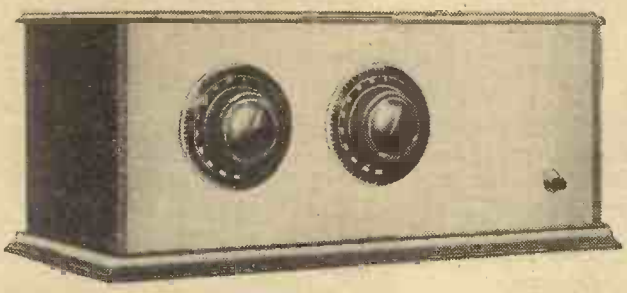
There are two H.T. + terminals, one of which serves the detector valve while the other is common to both the low-frequency amplifiers.

The Mullard people have a fine range of valves, and the combinations recommended are as good as one could hit on. For the detector position they specify a special type of valve for resistance-capacity coupling. You should note that with R.C.C. the special valve precedes the coupling, for the anode resistance is included in the anode circuit of that valve. The features of a special R.C.C. valve such as the P.M.1a, or P.M.3a, are that it has a very high amplification factor and a high anode impedance. The latter is more incidental than desirable, but need not worry us much when the valve is used in the detector position.

For the V_2 position is stipulated a valve having a fairly low impedance and one capable of handling a

moderately intense input. A power or super-power valve for V_3 completes the team, and a team that will deal well with the local station, as well as the more distant broadcasters, from a quality point of view.

A very particular point in the construction of the "Master Three" is the use of a metal panel which forms a vital link in the scheme of connections. The metal panel replaces at least three important leads, and thus contributes in no small measure to the simplification of the design. The three leads in question are one from each of the two variable condensers and one from the "on-off" switch. The three indicated points are connected to earth via the metal panel and the short lead which has to be joined between the metal panel bracket and the coil unit base.



The Mullard "Master Three." An important feature in its design is the metal panel which also gives it a distinctive appearance.

Note this Point

The variable-condenser contacts are made through their spindles and securing nuts. The on-off switch connects with the panel through its frame. If this switch were not contacted with the panel in this manner, the filament circuits would be "left in the air."

Therefore, the constructor of a "Master Three" should make sure that he has a definite metallic contact between one or other of the two terminals on this switch and the metal panel, and this contact must be a good, hard one. No insulating bushes of any kind should figure on the metal panel, or any of the components mounted on it.

Tracking Trouble

If a "Master Three" should develop great distortion or howling noises occur the following experiment should be tried. A short piece of wire should be obtained, and this joined to the plus terminal of the L.T. accumulator battery. The other end should be secured to the earth terminal. If the result is beneficial one can be certain that there is a fault in the metal panel circuit, and the above-mentioned points should be checked up.

Another very necessary thing is that the pins of the coil unit should make good contacts with the sockets in the coil base. It may be necessary to open one or other of these pins in order to ensure this.

If you have not adhered to the makes of components specified, you may have trouble. The most likely causes are the H.F. choke, the R.C.C. unit, and the L.F. transformer or the "on-off" switch, for reasons already detailed.

You—and I am now addressing myself to the owner of a completed "Master Three"—should not be disappointed if you fail to tune in dozens of stations the very first week or so that you have the set in operation. In a very short time you will have a round half-dozen or so at your finger-tips without changing the coil unit, but a little experience and skill will be needed to drag in others. You will soon acquire this skill, even if you have had no previous experience, providing you go fairly methodically to work.

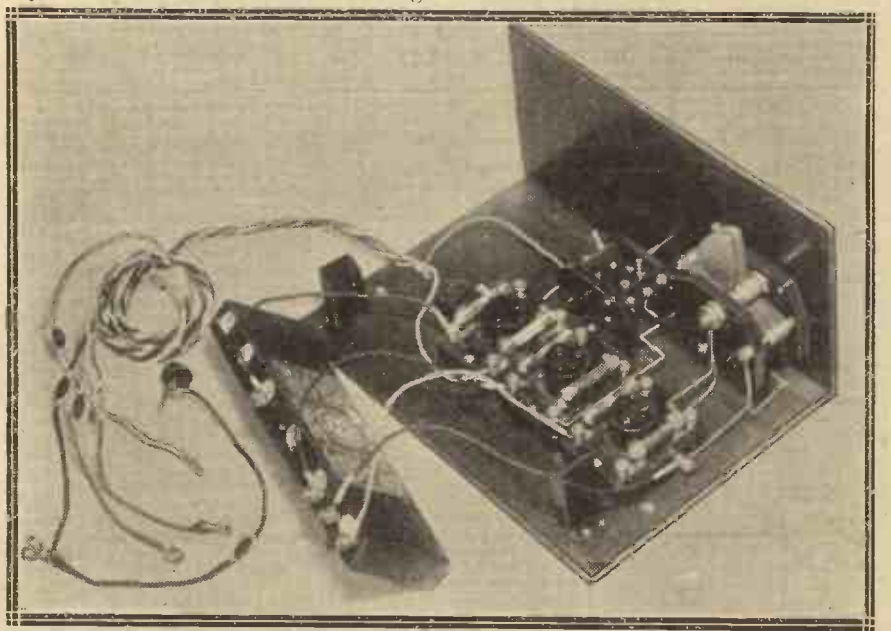
Operating the Set

The Mullard people have provided you with a list of dial readings covering some fifty stations, and have told you that these must be regarded as only approximate, as they are liable to a more or less uniform variation with different aerial and earth systems. You won't find this variation absolutely uniform, but the list forms a most useful guide.

The left-hand dial gives you the wave-length tuning, and the other a control of reaction or sensitivity. As you rotate the right-hand dial from zero, so the set gets more and more sensitive, until it bursts into oscillation. Whatever you do, keep back from that point; regard this as a sort of danger point and keep away from it. Do not indiscriminately run through the oscillating point searching for stations by making them produce squealing noises. In doing this you will be making squeals in the sets of your neighbours as well.

Simple Tuning

Find your local station with the right-hand dial set at zero, and then note how far you can increase the reading of the right-hand dial until you get to a point where there is a slight rushing background and the music becomes somewhat distorted. Then fall back from that point a degree or two until the music is absolutely clean. For left-hand dial readings below that of your local station it will be necessary to reduce the right-hand dial readings somewhat, increasing them again as you go up the scale with the other condenser.



The Ediswan "R.C. Threesome" set is a very compact assembly, mainly of ingeniously designed R.C.C. units. It employs a two-way coil holder. Note the multiple lead. You can gain a good idea of the size of the receiver from the grid-bias battery.

In due course you will be able to run up the scale with the left-hand dial, bringing in simultaneously with the other hand just enough reaction to keep the set in its most sensitive condition. Having found a station, you can balance the two dials nicely until the loud speaker is giving you good undistorted reproduction. Turn the dials very slowly, otherwise you will miss stations. In due course you will be able to tune in numbers of stations very quickly without making the set oscillate at all.

But until you have acquired a modicum of tuning skill, keep to the more powerful broadcasters, such as Langenberg, Frankfurt, and so on.

THE EDISWAN "R.C. THREESOME"

By using resistance-capacity coupling throughout, and by introducing a special plug-together unit system of assembly, the Ediswan people have made their "R.C. Threesome" an extremely cheap and simple set. But the compacting of the various elements of the set makes it difficult for the amateur to follow through the circuit. It is not essential that he should do this, though, and perhaps there are many people who have built an "R.C. Threesome" and, having got it to work satisfactorily, are now at all interested in the circuit of their set.

However, for the benefit of others, I am going to deal with the circuit before touching on the assembly and operation of the receiver.

The "R.C. Threesome" has a detector circuit which is not quite ordinary. There is, first of all, a simple coil and condenser tuning circuit having in series with it a ·0002-mfd. fixed condenser. The purpose of this latter is to increase the selectivity of the receiver. The aerial coil is carried in a two-way coil holder and is, contrary to normal practice, the moving coil. The reaction coil is the fixed coil. It really does not make any difference to the working of the set, and presumably this departure from general practice was made in order to simplify the wiring.

Distinctive Features

The detector valve operates on the leaky-grid principle, but has 1½ volts grid bias positive. Owing to the high amplification given by the special valves and coupling, it was probably found that this was necessary in order to preserve complete stability. The two L.F. valves are coupled according to the normal R.C.C. method. Across the first anode resistance (marked 100,000 ohms in the theoretical diagram) there is a ·0005-mfd. fixed condenser. This acts as an H.F. "by-pass" and without it it is possible that reaction effects would be unobtainable.

No filament rheostats figure in the circuit, and, providing the valves recommended are used, there is no need to have them. There is no "on-off" switch, but the set can very easily be switched off either by withdrawing the L.T. plug from the third unit or by disconnecting one of the leads joined to the L.T. battery.

Apart from the two-way coil holder and the variable condenser, all the components are carried in three units. These are known as "Universal" Coupling Units, and they are all plugged together before screwing them down on the base-board. In effect, therefore, there are only three components in this three-valve set.

The Unit A is that one to which are attached the aerial and earth leads. It embodies a valve holder, two fixed condensers, and a grid leak. The aerial series-condenser is of the tubular type, and is held in between two clips joined to the terminals marked "Ae" and "Coil." The circuit is as follows: The aerial is attached to the terminal

The Ediswan "R.C. Threesome" is a very small and compact receiver.

Ae and the energy passes through the tubular fixed condenser and thence to the grid socket of the valve holder, and so on to the grid of the valve. The tuning coil is joined across the grid condenser (which is in the interior of the unit) and the filament of the valve.

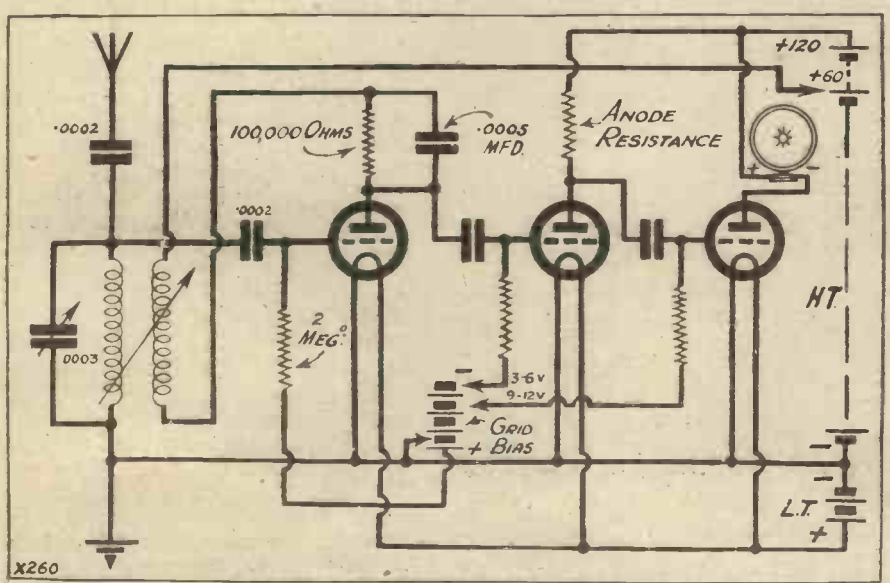
The Coupling Units

The grid leak is that tubular affair on the other side of the unit. One end of this grid leak is joined to the grid of the valve through the terminal marked "G," and the other end goes to the grid-bias battery via the lead joined to the "Bias X" terminal. Two of the pins and sockets on each of these units carry the L.T. connections through.

The second unit is of the "B" type and embodies an anode resistance (100,000 ohms); this is at the right looking at the back of the set. Fixed above the clips holding this anode resistance is a tubular fixed condenser (·0005 mfd.). The purpose of this condenser has already been indicated. The grid condenser which passes the energy along to the grid of the next valve is built into the body of the unit. The grid leak or resistance is contained in clips on the top of the device.

The third unit, which is also of the "B." type, has in and on it the valve holder, the anode resistance for the second valve, and the grid condenser and grid resistance for the third valve. As the anode resistance belongs

(*Continued on page* 320.)



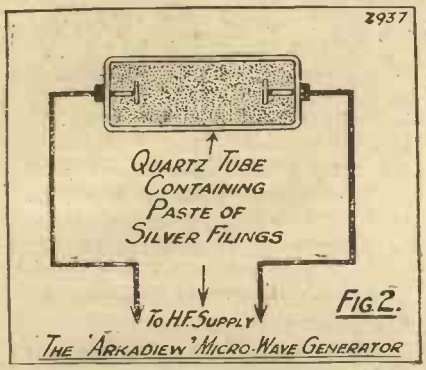
Here you have the simple circuit of the Ediswan "R.C. Threesome" set.

IS RADIO REALLY HEAT?

An interesting speculation! It is far more than that, if you really know the answer. The author thinks that "a new line of research in the field of television might be opened up."

By F. JACQUET.

PRACTICALLY every radio enthusiast is very familiar with the fact that the difference between wireless waves and light waves, "X" rays, or waves of radiant heat, is one of degree and not of kind. In other words, all these different forms of energy consist of waves



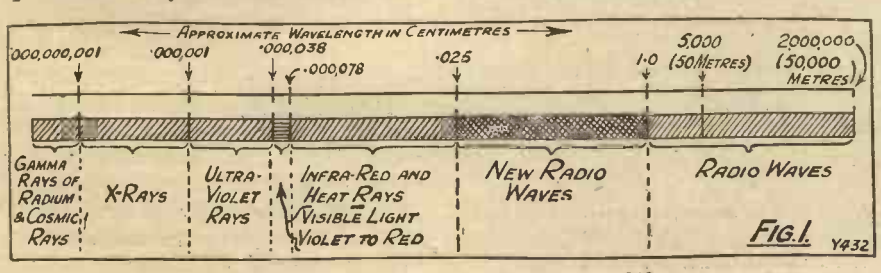
which are set up in the ether, and whose fundamental difference consists in their varying wave-lengths. Thus the rays of visible light vary in length from ·000,078 cm. at the red end of the spectrum, or colour band of visible light, to approximately ·000,038 cm. at the violet end of the spectrum. Beyond this region the ultra-violet and X-rays have a still shorter wave-length, whilst some of the shortest waves of which we are aware—the "Gamma" rays of radium—possess a wave-length of merely ·0,000,000,002 cm.

Wireless waves, on the other hand, possess wave-lengths of anything from 1 metre to 50,000 metres. But, nevertheless, the main difference between a long wireless wave in the ether and an almost infinitesimally short "Gamma" wave of radium is concerned merely with their respective sizes. Otherwise, in the majority of respects, they are identical in nature.

The Spectrum Completed

Thus, ranging from the shortest "Gamma" rays emitted by the metal radium, to the gigantic 50,000-metre radio waves which can be sent out into space by wireless transmitters, we have a very long spectrum, or wave-length band. Such a wave-length band is illustrated in diagram of Fig. 1. An examination of this wave-length band will serve to indicate the fact that the range of ether waves which makes an appeal to our eyes as visible light is very small indeed. Below the visible light portion of the wave-length band we have the infra-red and radiant heat waves, and finally, of course, we arrive at the wireless wave portion of the wave-length band.

Of recent years, wireless experimenters, and amateur transmitters generally, have been creeping down the radio wave-length band, and have been utilising more and more frequently wave-lengths which were known practically only in theory in former times. There are many reasons for this more frequent use of very short radio waves. Such waves, for instance, in many respects travel better than the longer radio waves. They are less liable to fading, and they have better directional qualities than the longer waves.



This is a Bolometer; a device used for detecting radiant heat energy. It operates on the Wheatstone Bridge principle. The heat warms a thermo-couple and this generates a current which destroys the bridge balance. The instrument is extremely sensitive.

Nowadays, therefore, it is a practical matter to transmit on a 20-metre wave-length, or on even smaller wave-lengths, whilst within the last year or so tests conducted in New York have shown that the practical utilisation of a 1-metre wave-length is a feasible proposition.

> "... for the first time scientists have been able to generate artificially radio waves which are practically identical with the waves of radiant heat. ..."

More recently still, however, radio waves of a length very much less than 1 metre have been discovered, and, although their utilisation is by no means a practical matter, they possess an enormous degree of interest to the wireless man. Such waves have been produced almost simultaneously by several experimenters, notably by Professors Nichols and Tear, at Cleveland, in America, and by a Russian electrical scientist—a woman, by the way—Madame Arkadiew, of Leningrad.

Extremely Directional

The Arkadiew waves have a two-fold interest. Firstly, from a purely theoretical standpoint, they have been shown to bridge the gap which formerly existed between the longest infra-red and heat waves and the shortest radio waves. Secondly, on account of the fact that they are extremely directional in nature. They can be concentrated into beams almost as accurately as light and heat rays can be. Thus, in view of this fact, it seems very possible that they will ultimately be utilised in a practical manner in the development of systems of secret radio communication over short distances.

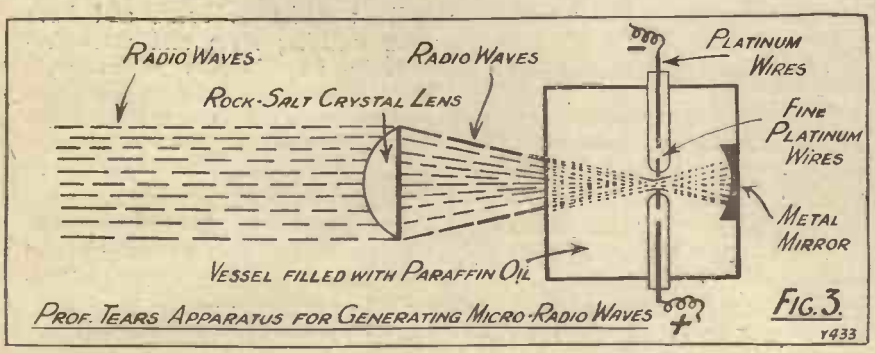
Madame Arkadiew's method of generating the extremely short radio waves is simple. A quartz tube is packed with a semi-conducting paste, apparently of secret composition, containing within its mass a number of fine silver filings. A high-frequency electric discharge is passed through the tube (shown diagrammatically at Fig. 2). Under these conditions it is found that each individual metal particle acts as an oscillation generator.

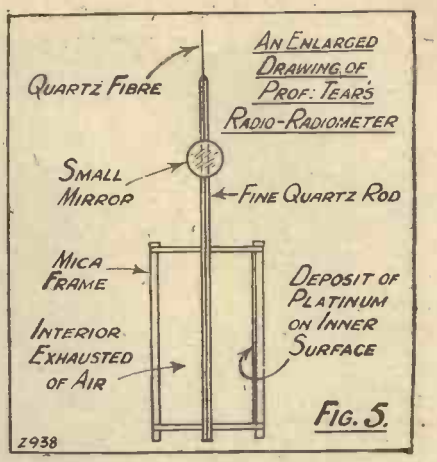
Prof. Tear's Method

Now, since the inductance and capacity of the metal particle is very small, it is able to set up waves of extremely high frequency, or, in other words, of low wave-length. Wave-lengths generated in this manner have been found to measure from 1 millimetre to ·022 millimetre in length.

Another recent method of generating these extremely small waves is due to Professor Tear, and is illustrated at Fig. 3. The waves generated by this method have the advantage of being more easily concentrated into a beam. Essentially, Tear's method consists in having two glass tubes immersed in a bath of paraffin oil. Into the ends of the tubes are sealed pieces of extremely fine platinum wire each only two-tenths of a millimetre in length. External platinum electrodes are also sealed into the tubes. These electrodes do not make contact with the short platinum wires in the ends of the tube, but reach to a distance of about 2 millimetres above them.

Fig. 4. This is the Radiometer which forms the basis of Prof. Nichols' method of detecting micro-radio waves. The finished radio detector is, however, very much smaller, being only about the size of the nail on one's little finger.





The apparatus is then adjusted so that the ends of the fine platinum wires are separated by a space of only a few thousandths of a millimetre. A high-frequency current is then led into the tubes, with the result that a minute spark occurs between the ends of the fine platinum wires. This spark generates radio waves of very minute wave-length, and these are reflected by means of a metal mirror placed behind the tubes, and concentrated into a beam by means of a rock-salt crystal lens, the latter being employed on account of its transparency to all forms of very minute wave-length energy.

The Detecting Apparatus

The reader will now be inclined to ask how these extremely short radio waves are detected, since it is obvious that the ordinary methods of detection will be inadequate for the purpose. As we have seen, the newly produced radio waves are very much akin to heat waves, and therefore one would naturally imagine that the methods of detecting waves of radiant heat would also be applicable to the detection of closely related radio waves.

Such has actually been the case, and the radio-wave detector devised by Professor Nichols is in reality a refined modification of the well-known radiometer, or the little "light-mill" which is so often to be seen in opticians' shop windows. The radiometer, a photograph of which will be seen at Fig. 4, consists of an evacuated glass bulb in which is pivoted an arrangement of four mica vanes.

Each vane is polished on one side, and blackened on the other. Now, when light or radiant heat rays fall on the blackened surfaces of the vanes, energy is absorbed more

readily than it is by the polished surfaces of the vanes. Consequently the blackened surfaces become warmer. And on account of this fact, a particle of rarified air within the bulb will leave the blackened surfaces of the vanes with greater velocity than it will do from the polished sides. The result is that a series of molecular "kicks" are given to the blackened surfaces of the vanes, and it is in consequence of this fact that the continual rotary movement is obtained.

A Minute Instrument

Now, the radio detector is devised on this principle also. An enlarged diagram of the device is illustrated at Fig. 5. Actually, however, the whole instrument is no bigger than the nail of one's little finger. The framework of the Nichols radiometer consists of

Fig. 6. A photograph taken by means of heat rays only slightly shorter in wave-length than the newly discovered radio waves.

fine mica. A fine quartz rod runs through it. To the top of the rod a small mirror is attached, and the whole apparatus is suspended freely by means of a quartz fibre. One wall of the apparatus is coated on the inner side with a black deposit of metallic platinum, and the device is evacuated of air.

When a train of minute radio waves comes into contact with the Nichols radiometer it causes a slight warming of the inner blackened surface. A molecular "kick" or repulsive effect is then given to the blackened wall of the apparatus by the particles of rarified air remaining within it, and thus the whole suspended apparatus tends to twist on its own axis. The degree of its twisting or rotation is shown by means of a spot of light which is focussed upon the mirror and which is reflected on to a scale.

Delicate Apparatus

Thus it is that even the shortest radio waves which can be produced by means of the Arkadiew or Tear methods can be detected fairly readily by means of this apparatus. Naturally, the Nichols radiometer is not suited for ordinary use. It is merely a very delicate laboratory instrument, but nevertheless there is no doubt of the fact that if ever these extremely short radio waves become of practical importance the Nichols device will be modified into something more serviceable for ordinary use.

As a detector of radiant heat, of course, the Nichols radiometer is an extraordinarily sensitive apparatus. Professor Nichols himself stating that it is well capable of detecting a variation in temperature of one ten-millionth of a degree Centigrade.

For the first time, therefore, scientists have been able to generate artificially radio waves which are practically identical with the waves of radiant heat emitted from hot bodies, and to detect such waves by means of the same device.

An interesting question now arises, and that concerns itself with the possibility of actually photographing the newly discovered radio waves. It is well known, of course, that radium rays, X-rays, and ultra-violet rays have the property of affecting the photographic plate besides the rays of visible light. Within recent years, also, it has been possible to devise certain photographic emulsions which are sensitive also to rays whose wave-lengths lie far below the lowest wave-length of "visible" light. For the interest of the reader a photograph taken entirely without "visible" light, and by means of infra-red or heat rays is shown at Fig. 6, whilst the identical subject photographed in the ordinary manner is shown at Fig. 7.

"Heat" Photographs

The black sky in the heat or infra-red ray photograph, Fig. 6, is due to the fact that at the time of photographing a blue sky prevailed, and that this absorbed all the heat rays. Consequently none of the rays was reflected on to the photographic plate. On the other hand, the green trees and vegetation strongly reflected the heat rays. Thus they were able to affect the plate, giving a white appearance in the finished "heat ray picture."

Now, the wave-lengths of the rays with which the "heat photograph," Fig. 6, was taken are only very little shorter than the wave-lengths of the newly produced radio waves. Consequently there is good reason to suppose that these latter wave-lengths, also, will be found to affect the photographic plate, and thus permanently to record their presence.

> "... Within recent years it has been possible to devise certain photographic emulsions which are sensitive also to rays whose wave-lengths lie far below the lowest wave-length of "visible" light. ..."

It is a fascinating speculation, and a very feasible one, too. For if we can record radio waves photographically then quite a new line of research in the field of television might be opened up.

One discovery brings about another, and there is no doubt of the fact that, although at the present time the production of these extremely short radio waves constitutes nothing more than a series of interesting laboratory experiments, they will in the future be found to possess many important

Fig. 7. Exactly the same scene shown in Fig. 6, but this time photographed under ordinary conditions.

uses, not only in the fields of accurately directional and secret radio communication, and of television, but also in the sphere of radio-generated and transmitted heat.

RADIO ABROAD

H.F. on Short Waves

EXPERIMENTS in short waves are interesting quite a considerable number of French amateurs, and one of the latest to produce a new short-wave circuit is Monsieur Braleret. This well-known French experimenter has produced a new circuit which he claims facilitates very greatly high-frequency amplification on short waves. He has been giving demonstrations twice a week for some time past, and has satisfied a number of well-known authorities of the efficiency of his new circuit.

A French Valve

A rather interesting design of valve, for heating directly from the A.C. mains, is due to another French inventor, Monsieur Havardier. In this valve two filaments are used, connected together in parallel, but the leads to the one are the opposite way from those to the other, so that the current passes through the two filaments (which are placed close together, side by side) in opposite directions. In consequence of this, the general distorting effects of the current in the two filaments balance each other. The filaments are designed to emit at a very low temperature, and the valve has given very good results in actual practice.

Train Broadcast

The new Paris-Bordeaux express, which accomplishes the journey between these two cities in seven hours and a quarter instead of the usual time of over nine hours, has now a special coach which is equipped with a receiver and picks up broadcast programmes for the entertainment of passengers. About sixty pairs of headphones are provided at present, and it is proposed that the system should be extended to all first-class compartments.

An interesting technical point is that, once the train has moved outside the electrified area of the traction system, the reception is very much improved.

American S.W. Stations

Talking of broadcast reception, station 2 X A F, the 32-metre (9,150 k.c.) Schenectady transmitter of the General Electric Company, is supplying the world with radio programmes, and its signals are frequently heard in this country as well as in South Africa, South America, New Zealand, and Australia.

An increasing number of American broadcasting stations, including W G Y, K D K A, W R N Y, W L W, W A A M, W R A H, and W H K are, or soon will be, broadcasting their programmes on short wave-lengths. Short-wave programmes are readily heard at great distances during the summer, when the range of most receiving sets designed for broadcast wave-lengths is limited.

The question may well arise before long whether short-wave broadcast will not entirely replace the present type of broadcast.

Wide Ranges

A short-wave transmitter is ideal for long-distance transmission, but owing to fading and the "skip distance effect" it is of little value for local service. Within 200 to 600 miles of short-wave stations signals are often inaudible, but quite moderate, or even small, power delivers strong signals (on short waves) over

(*Continued on page 325.*)

BROADCASTING FROM BERLIN.

This flashlight photograph shows the orchestra at Berlin's famous "Voxhaus" station, which transmits concerts on 483.9 metres, with a power of 4 kw. (The power employed by the B.B.C. at the London station, 2 L O, is only 3 kw.)

The ART OF LISTENING

" From time to time a headline pops up in one or other of the newspapers which asks in good big letters, ' What is wrong with the programmes ? ' Why has no newspaper ever asked, ' What is wrong with listening ? ' "

A fascinating article by the Editor of the " Radio Times."

LET me first ask you to lay aside any prejudice which the title of this article may already have aroused in you ? " Art " is a stiffish sort of word—and " the Art of Listening " sounds alarming ! But by this art of listening I only mean the way of getting the most enjoyment out of the B.B.C.'s programmes. Though what I am going to say may appear a trifle—well, obvious to some of my readers—I happen to know from personal experience that it will present a new point of view to a great many others.

They Just " Listen Blindly " !

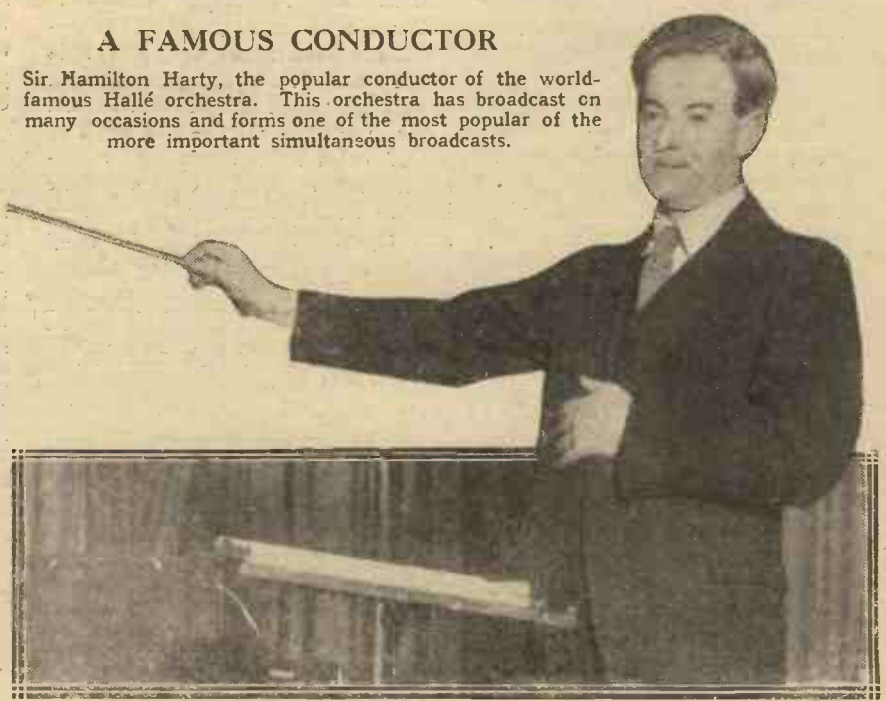
From time to time a headline pops up in one or other of the newspapers which asks in good big letters, " What is wrong with the programmes ? " There *may*, of course, be something wrong with them, but why has no newspaper ever asked " What is wrong with listening ? " I am convinced that half the answer, at least, to the question " What is wrong with the programmes ? " is " Why, listening, of course ! " If only people knew how to listen to the best advantage, they would find a great deal less fault with the programme builders at Savoy Hill.

First of all, I know that there is *too much listening*—and by that I mean indiscriminate, unselective listening. *Not only sets, but listeners also should be " selective."* In the course of my work I receive a great many letters from listeners. I can see from those letters that the majority of licence holders have not got the ghost of what one might call " a philosophy of listening." They listen blindly to anything and everything in the programmes—one thing after another—talks, military bands, symphony orchestras, Girl Guide bulletins, cookery classes, Grand Guignol plays—and when they come across something they definitely dislike, they complain. " Why do you have dance music every night ? Horrible cacophonous stuff ! " . . . " Why is there so much of this classical music when everyone knows that variety is the most popular part of the programmes ? "

You do not read any and every book you can lay your hands on—a love romance, a discourse on Buddhism. Mrs. Beeton's immortal classic, Swinburne's poems, a history of

A FAMOUS CONDUCTOR

Sir Hamilton Harty, the popular conductor of the world-famous Hallé orchestra. This orchestra has broadcast on many occasions and forms one of the most popular of the more important simultaneous broadcasts.



Medicine, and so on, one after the other. You do not go to see every play that is advertised. Why? Because these pleasures are comparatively expensive and troublesome to procure. A book will cost from a shilling to a guinea, a seat at a show from two shillings to fifteen.

Therefore, when you indulge in these small luxuries, the choice of which book or which play demands some thought. You don't spend money on a book, you don't fag all the way to the bookshop or library, without first being pretty sure that you're going to enjoy it when you get it. Nor do you bother to book seats for an Ibsen play when your object is to find light musical entertainment.

Artistically Criminal Attitude

But broadcasting costs the listener comparatively little, and it is "easy"—one touch of the switch and there you are! It is simple enough to "come in" in the middle of a programme without looking first to see what is on. That sort of attitude to broadcasting is artistically criminal. If the programme you have hit on turns out to be your pet abortion, a Symphony Concert, you have only yourself to blame if you go on listening to it. And if you do like Symphony Concerts, by coming in blindly in the middle of a movement you have impaired the enjoyment which it should have given you.

Now, look at your programme for the evening. "Ah, a classical concert!" you exclaim, in disgust. "Don't care for that sort of thing." Don't switch on, then. There are nearly a hundred hours of broadcasting during the week and plenty of things which you *will* find amusing. After all, a licence costs very little—and the other chap is enjoying his Symphony.

On the other hand, if you *do* like classical music, make a note of the time at which the concert begins and come to it as you would to a concert hall (when you have paid for the tickets and had the fuss of getting there in the bus), punctually and with the anticipation of rather special enjoyment. You won't enjoy it, though, if you have been listening "blindly" for weeks past.

A "Saturation" Point

You couldn't go to a different theatre every night for a month and really enjoy the twenty-eighth performance. The merit of the Symphony Concert (or variety show or play) you are listening to will be that it is one which you have specially marked down for hearing—though you may not have listened to anything else for weeks, because you "didn't feel that you wanted to." *Incessant, indiscriminate listening makes blasé listeners.*

Suppose it were a difficult and expensive thing to listen to one broadcast programme. Suppose that, in addition to a licence to possess a set, you had to go every time you wanted to hear a programme to a central office and pay a half-crown for the loan of a key without which your set wouldn't work. You would read in your "Radio Times" that Sir Henry Wood was to conduct a concert from the Queen's Hall, that Cecil Lewis's new play in two thousand scenes was to be given from the Studio, that Sir Harry Lauder was to broadcast an hour of his old favourites.

"Earning" An Entertainment

Great excitement in the family—as much excitement as when Pola Negri comes to the local cinema or a new book by Ethel Dell appears. "We mustn't miss this, at any price! Send Willie down with a half-crown for a key! Get everyone here in time! Arrange the chairs—and cigarettes handy!" And, by Jove, how you would enjoy it! You wouldn't pay a half-crown for a talk on electrical engineering, a Bartok recital, a commentary on a boxing match, if you didn't like them. But you would be strung up to enjoy the

Sir Henry J. Wood, the famous conductor, who has been responsible for many greatly enjoyed symphony broadcasts.

things you *did* like, because it was such a "business" sending for the key and being sure to be in time for the broadcast.

Well, as it happens, things *don't* work that way. All you have to do is to buy your licence and switch on at any time to hear what you like. The impetus to excitement, to a proper sense of anticipation of enjoyment, in the shape of special preparation and effort is lacking. So it remains with your own keenness and interest to create this impetus.

"If You Are Lazy——"

If you're a lazy listener you'll switch on at any old time to any old thing, bang into the middle of it. You'll sit hour after hour listening to everything that comes through your loud speaker until you are so soaked and satiated with broadcasting that your critical sense has vanished, and with it your enjoyment. If, however, you are *not* a lazy listener, if you realise still the miracle of this broadcasting and visualise its great and infinite future, you will bring to your enjoyment of the programmes enough common sense to prevent your making these mistakes I have mentioned.

Listen less—and listen well. Instead of "Eat more fruit," it should be "Eat less programmes!"

If a dance band is "on," clear the floor for dancing, and take full advantage of it. Do everything you can to make your programmes enjoyable.

A "SUPER" SHORT WAVER

When the Armstrong super-regenerative receiver was evolved, short-wave work was almost unknown. But now there are great possibilities for super-reception with one valve. This practical article gives full constructional details for interesting experiments in this field.

By A. V. D. HORT, B.A.

THE reception of short-wave telephony calls for a higher degree of operating skill than that demanded by C.W. signals. Using the ordinary "Reinartz" detector circuit, followed by L.F. amplification, there will be only one point on the tuning condenser at which a weak telephony station will be intelligible, and this will be a quite definite "point."

The Armstrong System

To bring up speech from a faint murmur to audibility needs a critical adjustment of reaction. Too much reaction, on the other hand, defeats its own object by rendering the speech unintelligible. C.W. reception is a simpler proposition, because one does not have to tune to such an exact point. However weak the signal, there is room for a certain amount of variation on either side of the silent point, without complete loss of the beat note.

Anyone who has handled a short-wave receiver will know that such telephony transmissions as those from 2 X A F and from K D K A, on 14 metres, are often amply strong when they are tuned exactly, but that the least movement of the tuning controls will lose them altogether.

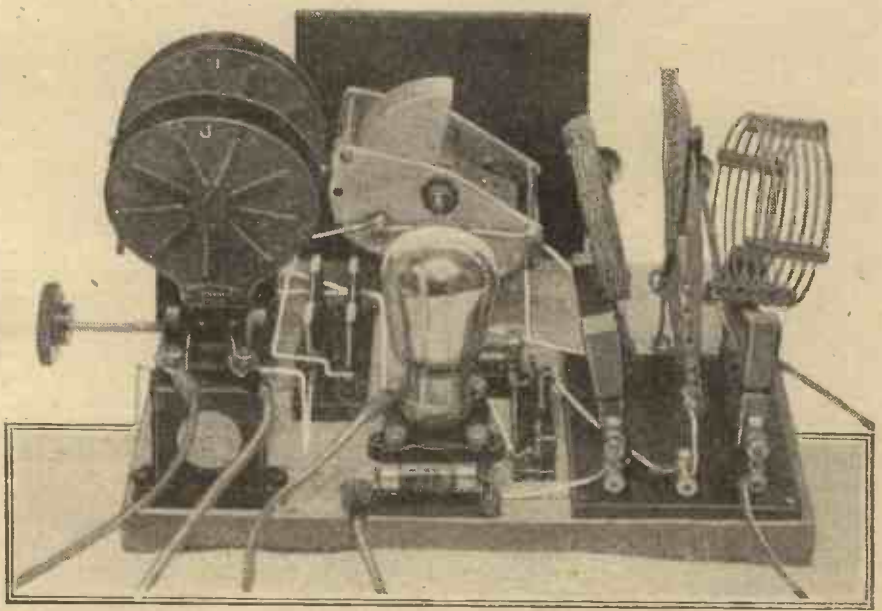
When the type of circuit which is commonly known as the "Armstrong super-regenerative" was first evolved there was not much activity on the short waves, and possibly for that reason the circuits never took the popular fancy to any great extent. Now that there are a number of stations working regularly below 100 metres, there is plenty of material for experiment with the circuits.

Unbeatable Circuit

With the exception of circuits with H.F. amplification and the super-heterodyne, there is no circuit, in the writer's opinion, to beat the "quench" (a name for the circuit which is more expressive and less cumbersome than its full title) for the reception of telephony on short waves.

COMPONENTS REQUIRED.

- 1 ·0003 variable condenser with slow-motion dial (Peto-Scott "Keystone" logarithmic in original).
- 1 Ebonite panel, 6 in. × 6 in. × ¼ in.
- 1 Baseboard, 9 in. × 12 in.
- 1 2-coil holder (Lotus).
- 1 Special short-wave 3-coil holder (Burne-Jones).
- 1 Valve holder (Igranic). (Ashley, Benjamin, Bowyer-Lowe, Burne-Jones, Lotus, W.B., etc.)
- 1 ·0002 fixed condenser and mount for baseboard (Igranic). (Clarke, Dubilier, Lissen, Mullard, T.C.C., etc.)
- 1 Grid leak and mount, 4 megohms (Dubilier). (Igranic, Lissen, Mullard, etc.)
- 1 Base for two clip-in fixed condensers (McMichael).
- Set of clip-in fixed condensers, ·001, ·002, ·003, ·004, ·005 (McMichael).
- 1 1-mfd. fixed condenser (Lissen). (Dubilier, Ferranti, Hydra, Mullard, T.C.C., etc.)
- 1 ·004-mfd. fixed condenser (Lissen). (Clarke, Dubilier, Igranic, Mullard, T.C.C., etc.)
- 1 1,000 and one 1,500 plug-in coils (Any standard make).
- 1 Filament control ("Amperite" in original set. Ordinary fixed or variable filament resistance can be used if desired.)
- 2 Telephone terminals mounted on ebonite, Glazite or Junit, a few inches of flex, screws, etc.



This is a general view of the rear of the receiver, showing the coils, valve, etc., in position.

Referring to the circuit of Fig. 1, let us consider the essential points of the system. L_1, L_2, and L_3 are the short-wave coils, aerial, secondary and reaction, so proportioned that oscillations can be maintained over the tuning range of the variable condenser C_1. In the grid and anode circuits respectively we have two coils L_4 and L_5, tuned by fixed condensers C_4 and C_5.

When L_4 and L_5 are coupled together, oscillations will be set up in the circuit at a frequency determined by the values of the coils and condensers. If we make these values large relative to the values of L_2, C_1, these oscillations will occur at a frequency which is low with respect to the H.F. oscillations already existent in the circuit. This is known as the "quenching frequency" in this particular circuit. The Q.F. oscillations are superimposed on the H.F. oscillations, and act so as alternately to hinder and assist the latter.

Adjusting the Q.F.

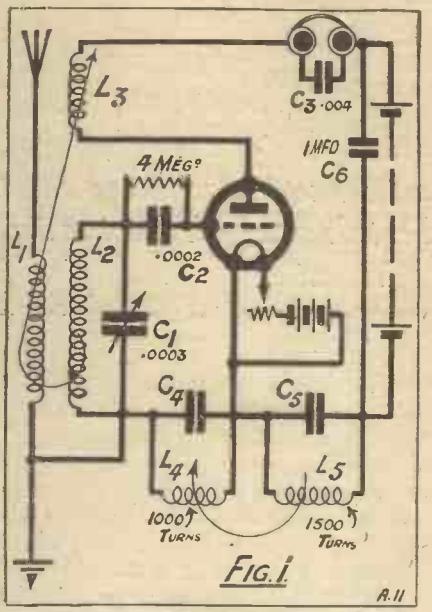
When L_3 is brought close to L_2 the Q.F. oscillations will maintain the valve in an extremely sensitive state. It will not actually be oscillating continuously at H.F., although the reaction has been pushed to a point far beyond that ordinarily required for oscillation.

If we lower the Q.F. too far, the alternations will become too slow, and the H.F. oscillation periods of the valve will become noticeable. Provided that the Q.F. is kept high enough, the periods of H.F. oscillation will be so brief that telephony will be practically undistorted.

Remarkable Amplification

It is necessary to have a wide frequency difference between the H.F. and the Q.F. for the circuit to function efficiently. By lowering the Q.F. we can increase amplification, but at the same time we shall introduce distortion if we go too far. The same effect will be obtained by increasing the frequency on the H.F. side. For a given Q.F., amplification will be increased with an increase in the H.F. This is why the "quench" is most efficient on short waves. On 300 metres, for example, to get any amplification the Q.F. has to be so low that serious distortion of signals is caused, while the Q.F. note is uncomfortably audible in the telephones. An inaudible Q.F. will give little useful amplification. On 30 metres, however, a Q.F. high enough not to give an audible note in the telephones will provide really useful amplification.

This brief survey of the function of the Q.F. in the circuit brings us to practical details of the set shown in the photographs. With the single-valve circuit shown it is not possible to use the parallel-feed arrangement on the anode, since it is essential to provide a free path for the Q.F. currents.



It will be seen that the circuit employed for the Super Short-Waver is based directly upon an ordinary one-valve circuit.

This involves the employment of the conventional straight circuit with variably coupled coils. Movements of the coil L_3 vary the tuning of L_2, C_1, but as the selectivity of the circuit as a whole is somewhat below that of a circuit without the Q.F. coils and condensers, this is not a serious matter.

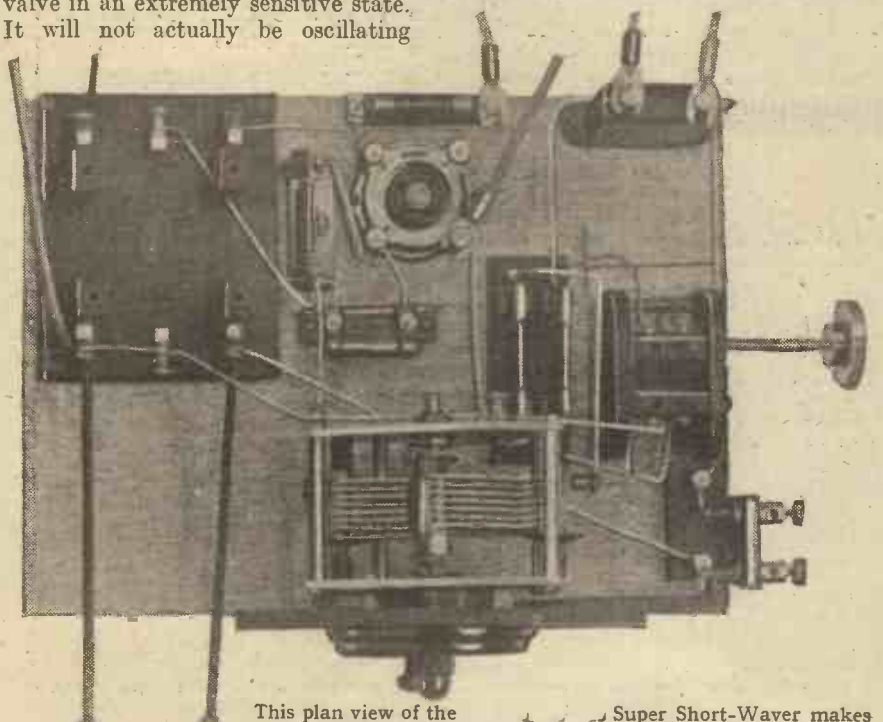
The S.W. Coils

The short-wave coils may take any convenient form. Here they are mounted in a special low-capacity holder, obtainable from Messrs. Burne-Jones. The number of turns in the reaction coil should be about 25 per cent more than is normally needed.

The Q.F. coils are mounted in a two-coil holder, preferably with a slow-motion coupling control. Clip-in condensers are convenient for C_4 and C_5, so that various values may be tried. The telephone shunting condenser C_3 is of rather higher value than normal. When an audible Q.F. is used this by-pass helps to render the Q.F. whistle less prominent.

Arrange the Q.F. coils on the baseboard at right angles to the H.F. coils. Slow-motion drive to the variable condenser C_1 is recommended, the pattern shown being one of the suitable types.

The filament setting of the valve is not critical, so that a fixed resistor



This plan view of the [illegible] Super Short-Waver makes a wiring diagram unnecessary. The flexible leads to the receiver are as follow (reading from left to right): Earth, Aerial, L.T. minus, L.T. plus, H.T. minus, and H.T. plus.

is included in the layout shown. Fig. 2 gives the correct method of connecting the Q.F. coils and condensers. Be careful to follow this diagram accurately. It is possible to get results of a sort with the coils differently connected, but the method of connection shown provides the best control of the circuit. No other constructional diagrams are given, as the remainder of the set should present no difficulty, and the photographs will assist you if you wish to copy the original.

ON THE SHORT WAVES

The famous Dutch short-wave station, P C J J, which was recently dismantled, is now on the air again, on 30·2 metres.

* * *

Short-wave programmes from the Sydney station, 2 F C, Australia, have been picked up at Bromley, Kent, on a two-valve receiver, using an underground aerial, 30 ft. long, and buried 2 ft. down.

The pioneer American station K D K A has been experimentally sending out transmissions on 2·5 metres, but has now abandoned this wave-length as being too low for practical purposes.

* * *

The Radio Corporation of America has applied for two exclusive short wave-lengths, for use in exchanging programmes with Britain.

Operation

When first trying out the set, use a valve of the D.E.5b type. A lower impedance valve will give somewhat louder signals, but the reaction controls are not so easy to handle. Apply not less than 60 volts to the anode; start with about this value. When you are more familiar with the working of the circuit you can use up to the maximum rating of the valve with advantage. For C_4 and C_5 put in condensers of ·005 and ·004 capacity. These with 1,000 and 1,500 coils for L_4 and L_5 will give an audible note in the telephones, making it easier to ascertain whether the circuit is functioning correctly.

First of all, put shorting plugs in the two-coil holder, and test the circuit for H.F. oscillation in the ordinary way. Then put in L_4 and L_5, tightly coupled, bring L_2 and L_3 close together, and swing L_1 right away. Set C_1 about midway. You will probably hear nothing but faint long-wave C.W. signals, brought in on the Q.F. coils. Slowly loosen the coupling of these coils until a rushing sound is heard, increasing in intensity as the coupling is further loosened.

The Correct Setting

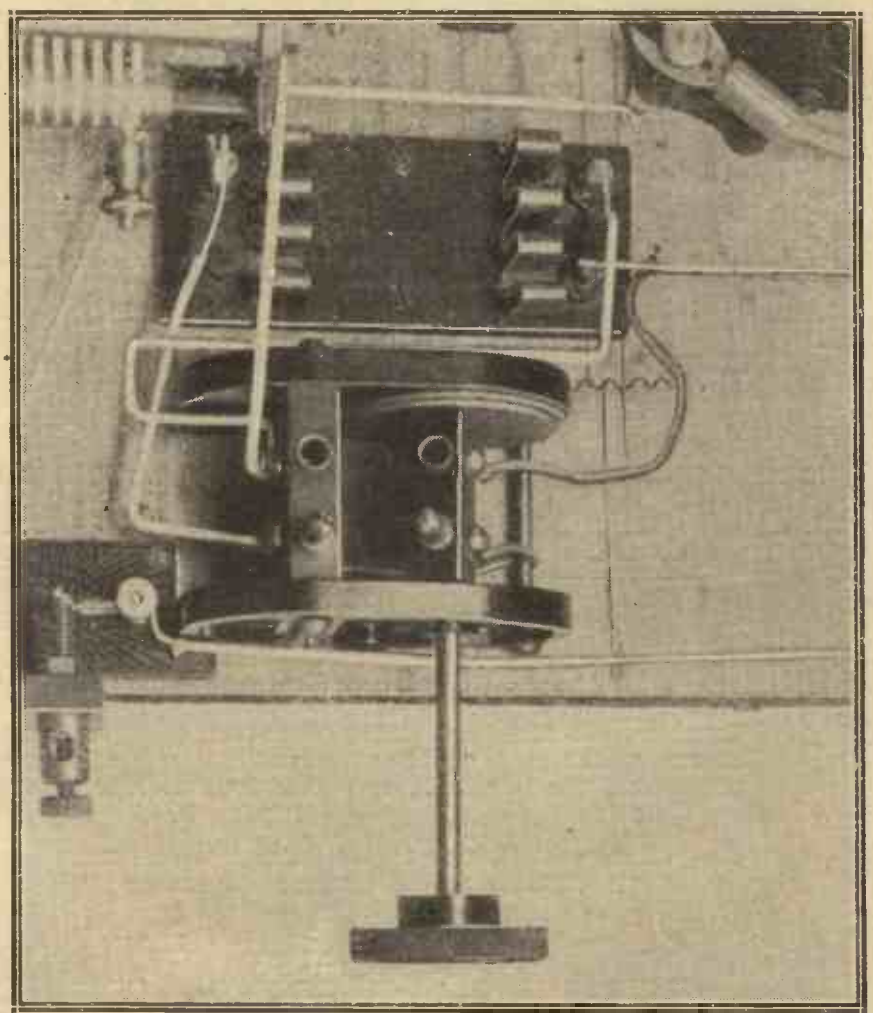
With the rushing noise not too pronounced, search for a signal with C_1. Notice that as you decrease wave-length with C_1 the rushing noise becomes louder, and that as you increase wave-length it becomes fainter. Having found your signal, loosen the coupling of L_4 and L_5 until the signal is at maximum strength. Mush and parasitic noises will increase with the signal, but you will find a setting at which you can get a reasonable "balance," the signal being loud and the mush not too loud for comfort. You will also hear all the time the high-pitched whistle of the Q.F. oscillations.

If you separate the Q.F. coils too far, there will be a sudden squeal and click, sometimes preceded by a loud howl, followed by silence as the coupling is further loosened. At the point where you hear the squeal, the circuit starts to oscillate at H.F. as well as Q.F. It is sometimes possible to amplify C.W. signals by adjusting the circuit to oscillate in this way, but the setting is very critical.

Locating Telephony

It is not easy to locate telephony stations with the Q.F. coils in action, so that the best method of procedure is to search for the carrier-wave in the ordinary way with the Q.F. coils shorted, and then to plug them in and amplify as described. To find the carrier-wave in the ordinary way the reaction coil L_3 will have to be swung away from L_2, as it is of larger size than the normal and tight coupling will cause howling.

On plugging in the Q.F. coils, L_3 must be brought closer, so that the setting of C_1 must be decreased to keep the set in tune with the station



A "close-up" of the two-coil holder for carrying the quenching frequency (Q.F.) coils, and its shunting condensers. Note the flexible lead joining plug to plug, which passes under the coils when they are in position.

pound. Once you have found that station with the Q.F. coils in action, use L_1 as far as possible to control reaction, if this is necessary. This will not affect wave-length so much as movements of L_3.

At first the behaviour of the set on telephony may be puzzling. When a station has been located with the Q.F. coils in action, as described, you will notice that the station, especially if the signal is strong, is audible over two or three degrees of the tuning condenser. You will find that there is a point where the signals are strongest.

Normally, when you tune out a signal on a "straight" set, the signal dies away to nothing as the tuning condenser is rotated. With this circuit the signal dies away, but reappears again at less strength. This occurs two or three times before the signal is finally inaudible, each "tuning point" giving a weaker signal than the last. Be careful, therefore, to select the point which gives the best signal strength. Alteration of the coupling of the Q.F. coils will affect the setting of C_1 slightly.

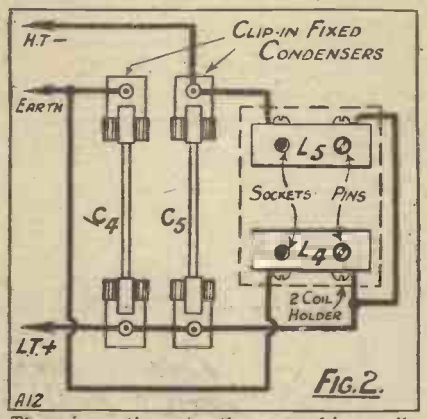
Adjusting Quenching Condensers

When you have the circuit functioning correctly with the capacity values already quoted for C_4 and C_5, you can experiment with other sizes of condensers. The sizes given, ·005 and ·004, serve very well when big amplification is required. If you make the condensers larger than this, the whistle in the 'phones will be much more troublesome to the ears, while quality will begin to suffer.

Smaller values, down to ·002 and .001, may be tried with success. It is best to carry out experiments with the condensers when you have tuned in a telephony station with a good strong signal. Otherwise much time may be spent in hunting for signals.

The H.F. Coils

A point to note is that for the best control of the circuit you should always make the value of C_4 larger than that of C_5. This is not quite so important with the smaller values, but it is advisable when higher amplification is sought. Selectivity is improved by decreasing the sizes of C_4 and C_5.



The connections to the quenching coils and their condensers.

There is no need to describe in detail the coils used on the H.F. side of the set. Those shown in the photographs represent three different methods of constructing suitable coils. The centre coil, the tuned secondary, is a helix of bare wire, threaded through an ebonite cross. Extensions of the ends of the winding are formed into loops which fit over the terminals of the coil holder.

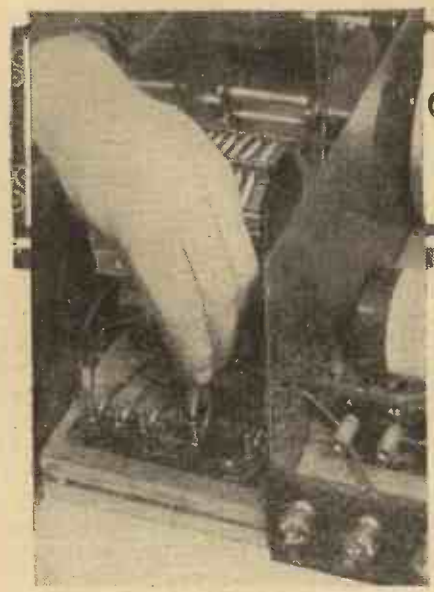
The aerial coil is also wound with bare wire. The form here is that of of an air-spaced solenoid, ebonite spacers being employed. The coil is mounted on a split plug to plug it into the split socket of the coil holder.

The reaction coil, mounted on a similar split plug, consists of a basket-weave winding, supported by a vertical strip of ebonite. With the exception of the reaction coil, the turn numbers for the coil will be those used in an ordinary straight set, the reaction winding being, as already stated, slightly larger than normal.

Excellent Results

When first testing the set, attach either the aerial or the earth lead, or both. You can use your ordinary aerial and earth for reception, but do not be misled into supposing that there is something wrong with the set if it will only howl when aerial and earth are disconnected. If the reaction coil is large enough to enable the set to function well, a certain amount of damping will be needed in the aerial circuit to stabilise it at some settings.

In conclusion, do not be disheartened if at first your efforts to operate the set are greeted with a chorus of howls and squeaks, with no sign of signals. Once you are familiar with the characteristic noises of the set and the adjustments which produce them, you will find that the circuit is perfectly stable, and that really excellent results can be achieved with it.



The "SOLODYNE" ON LONG WAVES

In order to maintain the wonderful efficiency of the 1928 "Solodyne" when used on the long wave-lengths special coils had to be designed and numerous experiments carried out. In this article these coils are described in detail.

By G. P. KENDALL, B.Sc.

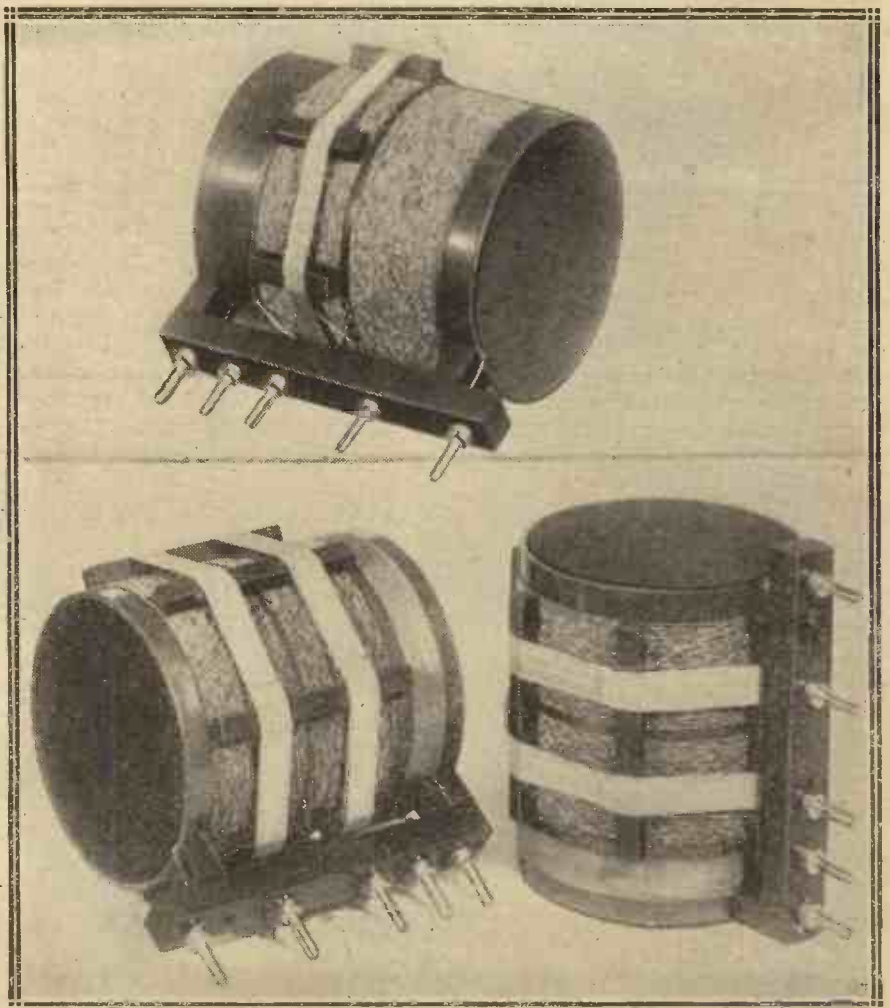
I SHOULD imagine that if ten designers of wireless receivers were asked what change in radio conditions would do most to make their lives easier, certainly nine of them would reply in chorus, "Abolish the long-wave stations!" (The only reason why I do not assume complete unanimity is that probably one of them would still be smarting from his recent struggles with a design for a set to work from the electric mains, and he would be likely to breathe a heartfelt petition for uniformity in the electricity supplies.

Seriously, the average home constructor can have little conception of the difficulties which arise from the fact that it is necessary to provide for reception on two widely different wave ranges.

Re-neutralising Troubles

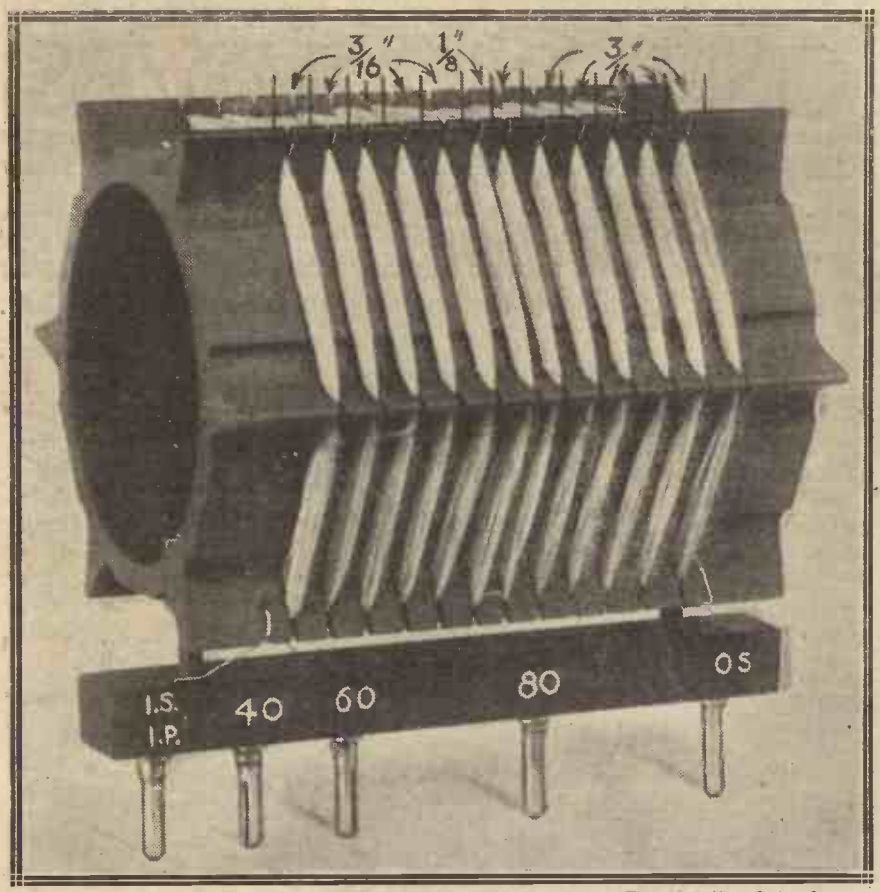
We have all heard of the annoyance of having to re-neutralise a neutrodyne type receiver when the 5 X X coils are put in; although this ought not to be necessary in a well-designed and carefully-wired set, there is no doubt it does happen not infrequently. When a gang-tuned set is involved, of course, re-neutralising generally means readjusting the gang condenser as well, and this may be further complicated by slight differences in the matching of the long-wave coils.

Difficulties such as these can be overcome if sufficient trouble is taken, but the nuisance of coil changing remains, and grows more objectionable the larger the set, and so, too, does the difficulty of arranging a really satisfactory interchangeable fitting, ensuring perfect contact and low losses at a reasonable cost. If only one set of coils were needed, of course, it is a simple matter to make permanent well-spaced connections to the various points on the windings.



A number of well-known makers are now producing sets of the special coils for the 1928 "Solodyne." These are the "Lewcos" version for the ordinary B.B.C. wave-band.

Arising from the annoyance of coil changing comes the very natural demand on the part of set construc-



This is the aerial unit for the 5 X X range of wave-lengths. The details of the former are given, and hold good in the main for the transformer units also. The saw-cuts are all $\frac{3}{16}$th in. apart except the middle pair, which are only $\frac{1}{8}$th.

tors for designs providing for switching schemes to cover all waves without the use of interchangeable coils, but, of course, this is a very difficult demand to meet in any except the simplest sets; in large receivers it is very nearly impossible to meet in a fashion suitable for home construction.

If the reader has not by now grown weary of this "set designer's lament" and turned the page hastily, he will begin to realise that when a receiver is being planned which involves novel, or, at any rate, unfamiliar, arrangements the designer is never surprised to find trouble on the long waves after overcoming any difficulties on the shorter ones. It was, therefore, with no very pleasant expectations that the upper wave-range problem was attacked when the appointed time arrived in the development of the 1928 "Solodyne."

Special "Snags"

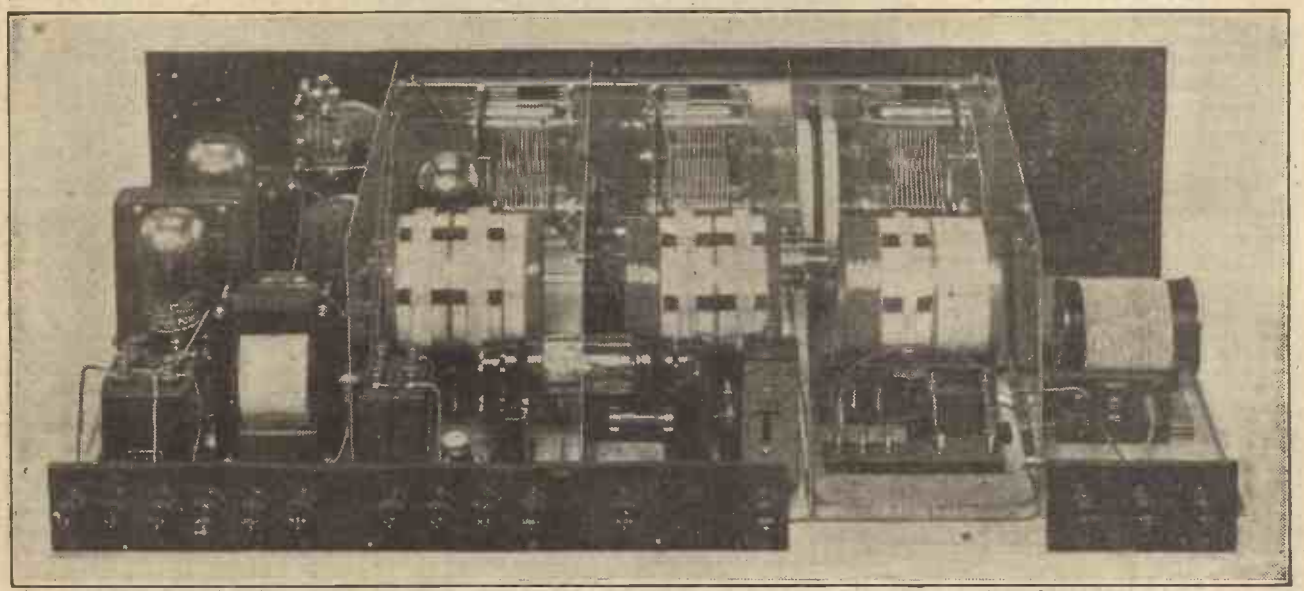
The modern "Solodyne," of course, is not a neutrodyne set, and so one of the main difficulties is automatically removed, but those which remain proved quite troublesome to eliminate. For example, the screened-grid type of valve tends to give greater amplification on the longer waves, and since long-wave coils are apt to have more widely spreading fields the result may easily be that a set which is perfectly stable on the lower waves will oscillate uncontrollably on the long.

This difficulty has been met in two ways. First, special pains have been taken in the design of the coils to reduce the stray fields to reasonable limits. This involves rather more difficult constructional work than would otherwise have been necessary, but it is well worth while to spend a little more effort to maintain one of the most valuable features of the set, namely, its great factor of safety.

An Important Point

Secondly, the amplification is kept down to practical limits by a careful adjustment of the size of the H.F. transformer primaries. This is an important point, for it must be realised that it would have been quite easy to

(*Continued on page* 323.)



A 1928 "Solodyne" built by Messrs. Sydney S. Bird & Co., who report very good results. The special "Cyldon" condenser which they have produced for the set is incorporated.

The Voxhaus (Berlin) Broadcasting Station

Some Interesting Details. *By Our Special Correspondent.*

NOT more than a few minutes' walk from the much-renowned Berlin *Unter den Linden* is situated the well-known German broadcasting station, *Voxhaus*, or, as we might literally translate it, the "Voice-House." There must be, one imagines, a considerable number of English amateurs who have repeatedly tuned in this famous station, and who, although they may not have been able to follow its spoken items, have at least admired the excellent orchestral and chamber music which is regularly sent out.

Heard Well Over Here

The Berlin *Voxhaus* transmits generally on a wave-length of 483·9 metres, corresponding to a frequency of 620 kilocycles. Its normal power is of the order of four kilowatts, the station generally transmitting a morning, afternoon, and evening programme, the latter ending approximately about 12.30 a.m. Amateurs, therefore, who, having rung the changes on the English stations are, like Alexander of old, seeking fresh worlds to conquer, should certainly endeavour to pick out the famous Berlin station, *Voxhaus*, for although its power is not over-great, the station possesses good transmitting characteristics, and it can generally be picked up all over England, using, under suitable conditions, a three-valver of normal efficient design and construction.

As I have mentioned above, the Berlin *Voxhaus* specialises in orchestral music. It has made a special study in this direction, and whilst its regular orchestra has a normal membership of nearly fifty performers, this number is very frequently augmented for special concerts. The

Several series of dancing lessons have been broadcast from the Voxhaus station—practical instructions being given to a few pupils before the microphone. In this way the proper "atmosphere" necessary for a successful broadcast is obtained.

station possesses quite a collection of studios—large, small, experimental—and studios for the special purpose of sending out radio plays accompanied by the necessary "effects."

Take, for instance, the largest studio, or *Senderaum*, of the station. Besides being equipped with two organs, this out-size in radio broadcasting apartments is able to accommodate an orchestra of over a hundred members, a small choir, together with an audience of quite considerable proportions. The studio, owing to its largeness, is used very frequently for the transmission of chamber concerts and small instrumental combinations, it being found that an additional echo-quality is imparted to the music under these conditions.

No play can ever be broadcast successfully without "effects" of some sort or another. The Voxhaus "noises off" department is a large one and, as will be seen, employs some weird and wonderful devices.

Specially Developed Plays

The *Sendespiel*, or radio play, has received much study and attention from the authorities of the Berlin Broadcasting Station, and it is not improbable that the specialised technique of broadcasting radio plays has reached greater heights at this station than it has done anywhere else. Every broadcast play produced by the station is sent out with a very effective accompaniment of realistic effects. The studio director, Herr Alfred Braun, has his own ideas on the "effects" part of the broadcast programme, and besides installing special machines for imitating the sounds of rain, running water, and wind effects of all degrees from the roaring of a tornado to a gentle spring breeze, he has developed very ingenious devices for aptly imitating the running of a motor-car engine, the gliding of a steamship through rough or calm water, and countless other noises of which we all are, at one time or another, consciously or unconsciously aware.

German children listeners have their own Uncles and Aunties, and here we see a group of these radio "relations" busy in one of their broadcasts. The microphone is situated just out of the picture on the extreme right.

The Berlin station, as will be evident from the above paragraph, runs its own special "effects" department, and a very important department this is, too.

Dancing Lessons

Quite a novelty in the broadcasting line are the series of dancing lessons which have recently been transmitted by the station. The idea is a simple one, a small number of expert dancing-instructors delivering the lessons in graduated stages before the microphone.

Generally one of the instructors delivers the spoken lesson whilst the remainder carry out the actual movements and steps with exaggerated foot movements, the latter of which have been found to be distinctly audible to listeners.

In this way, the young folk of Berlin—and many of the older folk as well—have been made something like experts, not only in the modern ballroom steps, and in the German variant of the Charleston, but in a number of the more stately and classical dances, too. Thus the "dancing-hour" at the *Voxhaus* station has attained a large amount of popularity, as has the development of a similar feature on the part of the B.B.C.

The Children's Hour

The *Voxhaus* has, of course, its own "Children's Hour." And a very entertaining "hour" it is, too, for

the kiddies. The station possesses five "uncles" and four "aunties," who are on the regular staff, besides its coterie of cousins and other visiting members of the family circle who come at frequent intervals to talk to the children. From this happy circle go out little talks, fairy stories, bed-time tales, miniature sketches and plays, music, birthday greetings, all of which are conducted in the most effective and attractive manner in order to make a real appeal to the hearts and intellects of the diminutive listeners.

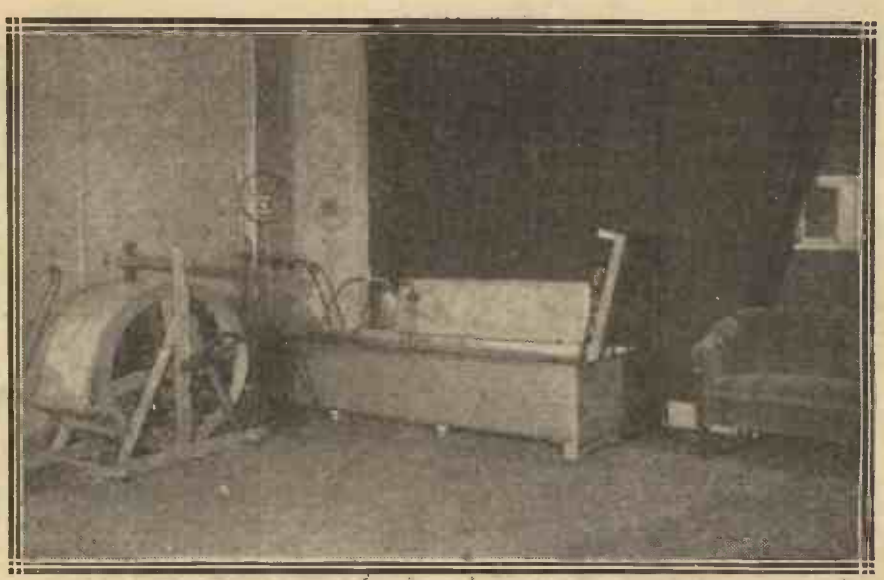
Broadcasting Going Ahead

The above scraps of non-technical information from a foreign land will thus serve to convey to the British listener the fact that in Germany, at least, broadcasting as an ideal form of entertainment for old and young alike is not only in a very thriving condition, but that it is continually being developed and extended in every possible way.

An episode from one of Voxhaus' nightly studio sketches.

Secret of Success

And the secret of the success of the *Voxhaus* station? It is, probably more than anything else, due to the fact that the station is run by a committee of directors, who, far from being educational theorists filled to overflowing with their own pet cranks and fads, and ever ready to disgorge them on to a long-suffering community, are practical men not only in their own particular spheres, but in the art and technique of broadcasting as well. The committee of *Voxhaus* meets every week to consider new proposals relating to the programmes which the station sends out. It believes in sound, clean, and healthy entertainment first, and in the running of a broadcasting station along the lines on which such services were originally intended to be carried on.



A corner of one of the studios, showing the machines used for imitating the sounds of water and wind.

FROM FAR AND NEAR

The old British battleship "Centurion" has been fitted with a wireless transmitter that can steer, start and stop the ship, so that she can be manœuvred from a distance by radio.

* * *

So great is the carrying power of the short waves that an efficient two-valve short-wave set is capable of picking up signals from most countries of the world in, say, a twelve-hour constant watch.

* * *

As far back as 1889 the War Office adopted Marconi wireless apparatus for use in the field in South Africa.

* * *

The Metropolitan Fire Brigade adopted Marconi wireless signalling in 1900, and apparatus was fitted at Mitcham Lane and Streatham Fire Stations, London, S.W.

* * *

The first wireless-equipped British merchant ship was the s.s. "Champlain" of the Beaver Line.

* * *

Powerful broadcasting stations are being erected at Genoa and Turin, to replace the existing stations.

The station director, second from left, together with his committee of management, which directs the policy and operation of the Voxhaus broadcasting service.

WHAT READERS THINK

A Selective Circuit—
The "Filadyne"

A Selective Circuit

SIR,—The article by Mr. A. Johnson-Randall on the construction of astatic coils, and the fact that constructional details of multi-valve sets employing tuned anode H.F. circuits are never given now, is the reason for my writing.

Up to eighteen months ago, in Reval, one had not to worry so much about selectivity; so long as a set was capable of reaching out it was all that was required, but when the local broadcasting station started functioning the question of selectivity had to be considered.

Excellent Results

The simplest way to achieve this, I thought, was to construct a set of coils almost identical in detail to those described by Mr. Johnson-Randall, with the exception that they were wound in one direction and on a "X" former which I cut from ebonite (suitable tubing is not procurable locally). The circuit adopted was taken from an article which appeared in an early issue of MODERN WIRELESS, and resulted in a decided improvement in selectivity.

With the approaching of summer in this country the reception of distant stations falls off very considerably, and it was therefore necessary to employ some form of reaction. For this purpose I altered the second H.F. circuit from tuned anode to transformer coupling (screened), so commonly used now, which resulted in the circuit shown below.

By this alteration not only was the signal strength improved, but selectivity was still better; in fact, my own personal opinion is that the results altogether obtained from my present receiving set, using this circuit, are better than most other five-valve sets I have heard, using complete sets of expensive screened transformers.

The selectivity is all that can be desired, and as the aerial and first H.F. coils are not screened there is not the damping and consequent loss in signal strength. There is no capacity between the coils and transformer provided they are well spaced. In my own set they are 8½ in. apart, centre to centre.

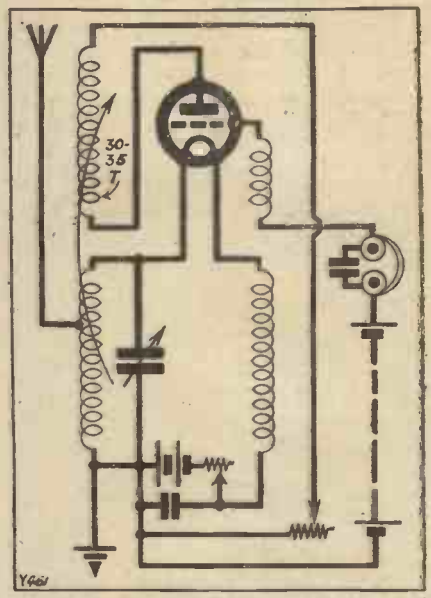
Yours truly,
A. HALSEY.

c/o British Consulate,
Reval, Estonia.

The "Filadyne"

SIR,—I have just completed the "Filadyne One-Valver," as described in MODERN WIRELESS, No. 7, for July of last year. I find it exceedingly sensitive and selective. Glasgow, my nearest main station (30 miles), occupies only three spaces on the dial, and a German can be faintly heard only four spaces from 5 S G without any background.

When first completed and connected up I had great difficulty in getting the set to oscillate, even with the potentiometer at zero, so I connected a coil of 30–35 turns in series with the potentiometer and coupled it to the aerial coil. The coupling is variable, and I can obtain a coarse adjustment by varying the coupling, and a fine adjustment by varying the value of the potentiometer. The set oscillates freely all round from 180°–65° on the dial, carriers coming in every few spaces now. I get no stations below 65°.



"I find it exceedingly sensitive and selective," writes "C.D.," of this amazing-looking circuit, which he evolved from the "Filadyne One-Valver." He finds that 24 volts H.T. is ample, and gets six to eight stations any night on one valve!

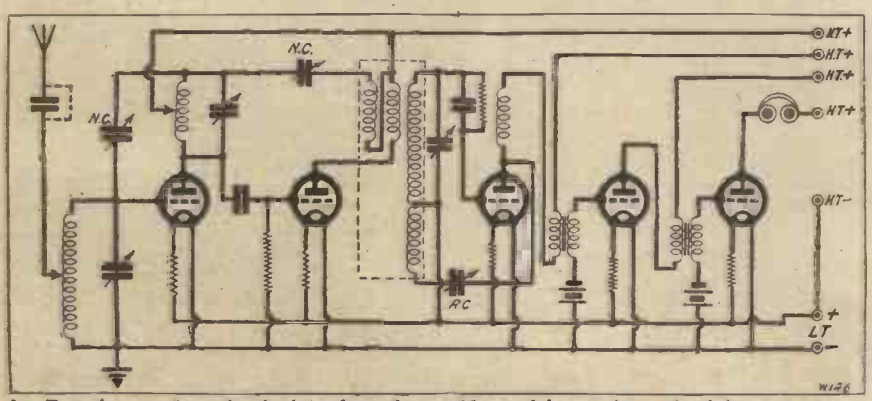
I work the set on a cheap Dutch valve. Glasgow comes in at tremendous strength on three pairs of 'phones. With 1 L.F. it could easily work a loud speaker. My aerial and earth systems are moderately good. The set works best on only 24 volts H.T.; at 60 no signals are heard.

On the whole, I am very pleased with the Filadyne and can get at least from six to eight different stations any night, Germany coming at pretty good strength.

Wishing you success in all future sets.

I remain,
Yours sincerely,
Linlithgow, N.B. C. D.

P.S.—This is easily the best one-valver I have heard.



An Estonian reader who had to face the problem of improving selectivity on a long-distance set found the above simple circuit better than most other five-valve sets using complete sets of expensive screened transformers.

THE BAIRD TELEVISION SYSTEM

THE POSITION TODAY

By The Editor

" There is no reason why, even at this moment, receiving machines (for television) should not be produced," Mr. Baird said in a recent interview. In our opinion such optimism is by no means justified, as the following article shows.

THE article " Television—Some Facts and Fancies," which appeared in the January issue of MODERN WIRELESS, has had some good effect, for during the last few weeks it has been noticeable that lay writers in the Press, when dealing with television, have curbed their imagination a little, with the gratifying result that there has been considerably less nonsense written about television and, in particular, about Mr. J. L. Baird.

A few weeks ago Mr. Baird gave a television lecture in Glasgow—to be precise, at the Royal Technical College. A report of his lecture appeared in some detail in that well-known newspaper, " The Scotsman," and although we are inclined to a friendly argument with Mr. Baird over some of the statements he made at the lecture, we should also like to congratulate " The Scotsman " in reporting his lecture free from any exaggeration and fantastic forecasts with regard to television.

Mr. Baird should make a point in future of seeing that distorted and exaggerated versions of his lectures, when reported in the lay Press, are repudiated at once; they do him more harm than good. Television is such a tricky business and so easily used to tickle the imagination of the public, that it is all the more important that Mr. Baird and the Baird Television Development Company see to it that only facts, and not fancies, are allowed to appear before the public in connection with their television work.

Many Misstatements

And if a highfalutin, exaggerated article appears in print to the effect that Mr. Baird has " perfected television " (and we have seen that statement in print many, many times), he would be well-advised to write at once to the editor of the paper concerned correcting such misstatements and exaggerations appearing in connection with his name and his work. That is only fair to himself and to those who are interested financially or scientifically in television.

But to revert once more to Mr. Baird's recent Glasgow lecture. We reproduce extracts here with due acknowledgment to our contemporary, " The Scotsman."

" Restricted Images "

" The present position in television (said Mr. Baird at his lecture) was that they could transmit restricted images—such as the head and shoulders of persons—with great success. The transmitting apparatus was at present very complex and bulky, but the receiving set was compact and easily manipulated, and could be contained in a box of the size of a large suit-case. About a year ago, when he was in Glasgow, the pictures reproduced were extremely small, but the images they were transmitting now were very much larger and clearer. They were not yet in a position to show a boat-race, a stage, or anything like that, but they could show speakers and restricted views."

Dr. E. F. Alexanderson has for a long time been struggling with the problem of successful television. So far he has not achieved such results as would enable world-wide television broadcasts to be practicable propositions, though remarkable tests have been carried out.

These statements should be borne in mind by readers who imagine that considerable detail can be shown on a televisor screen. Mr. Baird says that restricted images such as the head and shoulders of persons, can be televised with great success, but has he ever yet succeeded in televising a head and shoulders by wireless in such a way as fully to justify the adjectival qualification of "great success"?

Television Gramophone Records?

In the course of his lecture, Mr. Baird discussed noctovision, which he considers to be a further development of television, and about which he admitted there was considerable confusion. When working with television images, and in trying to get light down to a reasonable amount, he had to experiment with the ultra-violet and infra-red rays, which were outside the visible spectrum. He found he had not much success with the violet rays, so he proceeded with ordinary light. His experiments led to research work on the infra-red ray, and by this he managed to transmit without visible light at all. To televise there was no advantage to be gained by transmitting in the dark, but the instrument that could see in the dark had considerable possibilities in other directions. He claimed that the infra-red ray penetrated fog from ten to sixteen times more effectively than did light.

Mr. Baird makes it clear that "to televise there was no advantage to be gained by transmitting in the dark." Many people are under the impression that noctovision is the "key" to the final secret of practical television.

Shall we before long be able to see as well as to hear by means of radio? It would appear that it will be some time before reception in the realm of television will reach anything like the perfection attained in ordinary broadcasting.

This is not the case, as Mr. Baird himself admits. The true possible value of noctovision lies in the direction of its application to navigation, and at present the Baird Company are considering this sideline, which has been developed, up to a point, and arising out of Mr. Baird's television experiments.

While discussing photovision, Mr. Baird described it as scientific curiosity. In transmitting by television, he said, the "electric metals," of course, made audible sounds, and these could be recorded on a gramophone record. Out of curiosity he had placed the sounds on a gramophone record and reproduced the original image by playing the record into the television apparatus. At present his investigations were purely embryonic and the results crude, but there were considerable commercial possibilities. The cinematograph did the same thing, but with much better results, and they were now endeavouring to put sound on a gramophone record on one spiral, and television on an outside spiral, so that one could have some visual impressions of the singer or speaker.

> ***"The television problem still exists, and although it has been nibbled at . . . the fact is still apparent . . . that the heart of the problem remains intact."***

At the conclusion of his lecture, Mr. Baird had a few words to say about the future of television—and he expressed himself in a way which we hope will always in the future serve him as a model for scientific caution. To quote in full from "The Scotsman":

"Regarding the future, he (Mr. Baird) considered it dangerous and difficult to prophesy. Certainly he had the greatest hope for television. He thought it wise to quote a very unbiased authority, Signor Marconi, who recently said that the most fruitful avenues in which the young engineer could direct his energy were directional wireless and television."

No one can quarrel with that. But what one does quarrel with is the reports which from time to time state that Mr. Baird has really solved the problem of practical television—reports which we feel sure are garbled, and which do not represent Mr. Baird's real convictions.

"Faithful" Representation.

That is why we have expressed the hope that in future Mr. Baird will deal effectively and promptly with such reports by repudiating exaggeration and distortion of his actual statements. Such reports are really designed to excite public imagination concerning a scientific novelty about which, as Mr. Baird admits, it is "dangerous and difficult to prophesy."

Our readers have no doubt seen in the newspapers some three or four weeks ago an announcement that Mr. L. G. Hutchinson, Managing Director of the Baird Television Development Co., is in America with a view to carrying out official experiments in Transatlantic television, and also with a view to exploring the prospects of the commercial side of television. In a recent interview, Mr. Hutchinson said:

"We have been experimenting for a long time and, as

was proved to Press representatives, we have already achieved a remarkable degree of success within the limits of our own country. We have worked from such places as Leeds, Glasgow, Hull, and several others, and have been able faithfully to represent images in London."

We do not agree with his remark that they "have been able *faithfully* to represent images in London." *Faithfully* is far too strong a word to apply to these television experiments, and that is where the public gets the wrong impression. The images are still most crude and flickering.

Crux of the Problem

In the same interview, Mr. Hutchinson said in connection with the Transatlantic television experiments:

"On several occasions it has been possible for us to see the faces and hands of human beings, and although the features have admittedly been indistinct, that is a detail which, no doubt, will be effectively overcome in the not distant future."

The last paragraph in the recent quotation from the interview calls for explanation. Mr. Hutchinson states (*inter alia*):

"The features have been admittedly indistinct . . . that is a detail which no doubt will be effectively overcome in the not distant future."

Indistinct—in other words, lack of detail—the crux of the whole television problem—the problem which so far has baffled solution and which necessitates the minimum use of a million synchronised impulses per second: in short, radio-frequency.

If Mr. Hutchinson can dismiss this problem so lightly—as a detail—his optimism should be substantiated by the inventor, Mr. Baird himself. Has Mr. Baird any grounds for supporting Mr. Hutchinson's belief that the indistinct nature of televised images, etc., due to lack of detail, is in itself a detail which will be effectively overcome in the not distant future? If so, does "not distant future" mean within the next two or three years or within the next fifty?

Atlantic Experiments

The recent experiments in connection with Transatlantic television are undoubtedly interesting, but here again the true value of the experiments is likely to be over-estimated. The Baird Company succeeded in televising a crude image of a head, if evidence is to be accepted from the daily newspapers, across the Atlantic—the reproduction being made on a screen 3 in. by 2 in.

The Baird Company, no doubt, could have done this some time ago, and could, if necessary, repeat the experiment again and again, and even over greater distances. But that is not the point. The Transatlantic experiment is merely an example of the repetition of a known experiment over greater distance, and it is not revolutionary. Distance is not the great problem in television. Mr. Baird, if he can transmit a crude image from Leeds to London, can undoubtedly transmit it from London to New York.

An Analogy

That is merely a question of power and the necessary facilities. But if, as well as distance, Mr. Baird could *transmit detail*, then that would be a different story. But he cannot because by the known facts his system is not capable of sending televised images in greater detail.

That, as we have quoted above, is admitted by Mr. Hutchinson, and although Mr. Hutchinson thinks that the question of detail is in itself a detail, we beg to differ and we think that anyone with scientific knowledge will admit that the question of increasing the detail still constitutes the almost insuperable problem in television. We say "almost" because nothing is impossible, but it would be gross exaggeration to say that on the evidence already shown by Mr. Baird his system is capable of expansion and development as regards detail in his televised images.

From the evidence already shown by Mr. Baird, another system must be devised. Let us take an analogy. The one

BEHIND THE SCENES

The three great lamps are used by Mr. Baird in some of his television experiments in order to provide sufficient illumination to operate the photo-electric cell. So far only crude images have been obtained.

we choose is that of a man riding a horse at full tilt and with great courage right up to the edge of a deep and wide chasm. The horse, being limited by nature as to physical capabilities, cannot possibly progress farther. In other words, the rider has to realise that his medium has definite limitations. The only way to jump the chasm and so progress farther is *by means of a new medium*—say, for example, in this analogy, an aeroplane.

The Dilemma

That is Mr. Baird's dilemma. He has several times mounted his horse, and, with great determination, ridden full tilt at this chasm. He has cleared minor obstacles and great credit to him for doing so, but always he has come to the edge of the chasm and the horse has refused to jump. The horse cannot be blamed because it cannot achieve the impossible. Perhaps some blame may be attached to the rider, for by now he should have realised the limitations of his medium. Again, we repeat, this is Mr Baird's dilemma, and the dilemma of all television workers of to-day. Their systems, which have been studied, have definite and very serious limitations. Up to a point they certainly can be impressively spectacular, but inevitably, like the horseman, they come to the chasm which bars further progress—unless a new medium is discovered for crossing it.

The Transatlantic television experiments are exciting, but they are but repetitions on a more spectacular scale of what Mr. Baird has already shown us and what several other television workers have shown us in effect. A crude image on a screen, 3 in. by 2 in., is not enough to justify a television service for the public, and certainly not enough to justify some of the statements made in a brochure we have before us, entitled "The Baird Televisor."

Questions To Answer

For example: "This little booklet tells how, after many years of pioneer work, the baffling problem (television) was solved at last."

That statement has never yet been fully substantiated by Mr. Baird. The television problem still exists and although it has been nibbled at, and the flakes, metaphorically speaking, which have been chipped from the solid substance of the problem, have been magnified as evidence that the problem, as a whole, has been smashed, the fact is still apparent to all who take the trouble to look that the heart of the problem remains intact and that science, for all its prowess, cannot in the light of present-day knowledge and the evidence provided by known television systems definitely make it otherwise.

In conclusion, we wish to make it perfectly clear that this article—and the one which preceded it in the January issue of MODERN WIRELESS—is not intended to be inimical to Mr. Baird. Nor do we wish to give the impression that we deprecate Mr. Baird's television system, nor the excellent work he has done in connection with it, and is still doing. But we do wish this: to make it clear, and as clear as possible, that when writing or talking about television, flights into the realms of the future should be studiously avoided. Leave the romantic possibilities of television to the novelists and Mr. A. M. Low. What the public wants to-day are the undiluted facts about the present stage in the development of television. It wants to know how much progress has been made, and it wants to know the answers not only to the questions we put to Mr. Baird in our January issue, but whether such forecasts as made by Mr. Hutchinson recently are justified in view of the present rate of television progress and development.

A Further Query

Judged by known facts, we say that in our opinion such forecasts are not justified; and although Mr. Baird has not replied direct to the questions put to him in our January issue, he recently dealt with one of the questions we raised when granting an interview to a representative of the "Observer." He said:

"The question of placing these machines (televisors) on the market is naturally of the greatest interest to the general public, and there is no reason why, even at this moment, receiving machines should not be marketed. It is, however, a question of policy whether it would be advisable to place in the hands of the public an article on which further experiments are still being made, and therefore possibly of an unfinished type."

Very well; we ask Mr. Baird this further question: Is it not a fact that the chief reason why television sets should not be marketed is that, beyond a very crude and flickering image reproduced, in fact quite inadequately, a television service at the time of writing, and in all probability for some time to come, would only be an experimental novelty and definitely not capable of fulfilling the expectations which have been aroused in the public mind; and, further, that the obstacles in the way of possible further development which would justify a commercial Television Service are such that in view of the present-day knowledge of science, may justifiably be termed insuperable?

TELEVISION

Two Scientific Opinions

"IT should be emphatically pointed out to the public that Television is still very much in its infancy and still requires time and careful scientific investigation.

"The idea of transmitting the boat-race with any degree of success by wireless, according to any known system, is absurd.

"And as for the idea of placing Television receiving sets on the market at the present time, with Television in its present undeveloped stage, this is too optimistic." (Sir Oliver Lodge, in an interview.)

* * *

"But if by 'television' we mean the transmission and reproduction of something equal to, or even comparable with, an early cinematograph show, then it seems to me that the technical difficulties are so enormous as to constitute, as near as may be, an insuperable obstacle to any progress very much beyond the present achievement, unless some totally new principle or system be discovered."

(Dr. J. H. T. Roberts, F.Inst.P., in an interview.)

The CONCERTS of EUROPE

So many stations are now "on the air" that a complete list of them is cumbersome. But below the various European "stars" are listed, together with details and "identification marks."

STATIONS WORKING ON WAVE-LENGTHS BETWEEN 150 AND 250 METRES.

Wave-length in Metres.	Name of Station.	Remarks.	Wave-length in Metres.	Name of Station.	Remarks.
158	Beziers, France	Power recently raised to ·5 kilowatts.	229	Umea and Hülsingborg (Sweden)	Wave-length shared by low-power relay stations.
187·5	Örnskoldsvik, Sweden	Relays Sundsvall.	230·2	Boras, Sweden	Relay of Goteborg, power of 1 kw
196	Karlskrona, Sweden	Low-power relay of Stockholm.	235	Stettin, Germany	Relays Berlin, power of ·75 kw.
200	Biarritz, France	Low power.	236·2	Örebro, Sweden	Relay of Stockholm; power of ·25 kw.
201·3	Jönköping, Sweden	Relay of Stockholm.	237	Bordeaux, France..	Power of 1·5 kw.
204·1	Gäyle, Sweden	Relay of Stockholm	238·1	Kiruna, Sweden	Low-power relay of Boden.
214·3	Viborg, Finland	Power of ·7 kw.	241·9	**MUENSTER, GERMANY** ..	(See note below.)
215·8	Halmstad, Sweden	Low-power relay of Malmö	243·9	Trondhjem, Norway	—
217	Luxembourg	Power of ·25 kw.	250	Gleiwitz, Germany	Relaying Breslau.
220·6	Karlstad, Sweden..	Power of ·25 kw.; relays Stockholm.	250	Uleaborg, Finland	Relays Helsingfors.
222·2	Strasbourg	Concert, Tues. and Thurs., 10 p.m.	250	Eskilstuna, Sweden	Relays Stockholm.
225	Belgrade, Serbia	Power of 2 kw.			

NOTES.—Muenster (241·9 metres) is received consistently well in the South of England. It generally relays the Langenberg programmes, commencing with a chime of bells. Can also be identified by the letters M S, sent in morse (— — · · ·).

There are several "common" wave-lengths in this group, no less than three stations working on 250 metres. Of these three, Gleiwitz, relaying Breslau, is often received well in Britain.

STATIONS WORKING ON WAVE-LENGTHS BETWEEN 250 AND 325 METRES.

Wave-length in Metres.	Name of Station.	Remarks.	Wave-length in Metres.	Name of Station.	Remarks.
252·1	**BRADFORD (2 L S)**	Relay with Leeds.	272·7	Cassel, Germany	Relays Frankfurt.
252·1	**BREMEN, GERMANY**.. ..	Relays Hamburg on ·75 kw. Occasionally has a "silent night," but generally late dance music.	272·7	Klagenfurt, Austria	Relays Vienna
			272·7	Hudiksvall, Sweden	Relays Stockholm.
			272·7	Danzig, Germany	Relays Koenigsburg(·75kw.) Concert daily 10.30 a.m.
252·1	Säffle, Sweden	Relays Stockholm.	275	Bordeaux (P T T), France ..	Power of 1 kw.
252·1	Montpelier, France	Concert, 9 p.m., most week-days.	275·2	**NOTTINGHAM (5 N G)** ..	Shares this wave-length with Dresden, Jacobstad, and Norrköping.
256	Kiel, Germany	Relays Hamburg on ·7 kw.			
257	Juan les Pins, France ..	Power of ·25 kw.	277·8	**LEEDS (2 L S)**	Power of ·2 kw.; shares wave-length with Trollhattan, Sweden, power 1 kw.
259	**TOULOUSE (P T T)**, France	Power of ·5 kw.; regular evening concerts, operas, etc.			
260·9	Malmo, Sweden	Power of 1 kw., and often picked up at good strength in this country.	278	Grenoble, France	Wed. and Sat. only.
			283	**COLOGNE, GERMANY** ..	Power of ·4 kw.
272·7	**SHEFFIELD (6 F L)**	First British relay station.	287·9	Lille, France	½-kw. station.
			288·5	**EDINBURGH (2 E H)** ..	·2-kw station

THE CONCERTS OF EUROPE—*continued.*

STATIONS WORKING ON WAVE-LENGTHS BETWEEN 250 AND 325 METRES—*continued.*

Wave-length in Metres.	Name of Station.	Remarks.
291·3	Lyons, France	Concert weekdays, (except Mon.) at 7.45 p.m.
294·1	**DUNDEE (2 D E)**	British relays (·2 kw.), sharing wave-length with Uddevalla (Sweden) and Innsbruck (Austria).
	HULL (6 K H)	
	STOKE (6 S T)	
	SWANSEA (5 S X)	
296·4	Hanover, Germany	Relays Hamburg on ·7 kw
297	**LIVERPOOL (6 L V)**	Shares this wave-length with Agen (France), Varberg, and Jyvaskyla.
300	Bratislava, Czecho-Slovakia	·5 kw.
302	Radio Vitus, Paris	Wed., Fri. and Sun., concert at 9 p.m.
303	Nurnberg, Germany	Relays Munich, 4 kw.
306·1	**BELFAST (2 B E)**	Main B.B.C. station, 1·5 kw.
309	Marseilles, France	Concert, 9 p.m., weekdays.
312·5	**NEWCASTLE (5 N O)**	Main B.B.C. station, 1·5 kw.
316	Milan, Italy	1·5 kw.
319·1	Dublin (2 R N)	1·5 kw.
322·6	**Breslau, Germany**	4-kw. station; transmits at intervals from 10 a m.

NOTES.—Three foreign stations share Bradford's wave-length (252·1 metres), and of these Bremen is often received well. Malmö is another good transmission, on 260·9 metres. The six transmissions shown on 294·1 metres come through on a sensitive set outside the range of any of them as a hum, caused by the mutual heterodyning. Of the foreign stations, Cologne, Hanover, Radio Vitus, Milan and Breslau are all received well, at times on simple sets, whilst Dublin's daily programme can be heard clearly in the west and south of Great Britain. It is reported that the power of the Milan station will soon be increased considerably, and that the French stations will be replaced by others of much greater range. The Radio Vitus station, Paris, sends out its programmes on short waves, as well as on 302 metres.

STATIONS WORKING ON WAVE-LENGTHS BETWEEN 325 AND 500 METRES.

Wave-length in Metres.	Name of Station.	Remarks.
326·1	**BOURNEMOUTH (6 B M)**	Main station; generally relays London.
330·3	Koenigsburg, Germany	Concert at 7.10 p.m. daily, on power of 1 kw.
333·3	Reykjavik, Iceland	Power of 1 kw.
333·3	Naples, Italy	Call sign, I N A; power, 1·5 kw.
335	Cartagena, Spain	Call sign, E A J 16; programmes until long after midnight.
335	San Sebastian, Spain	Call sign, E A J 8; programmes until long after midnight.
337	Copenhagen, Denmark	Power, 1 kw.
340	Petit Parisienne, Paris	Power, ½ kw.
344·8	Barcelona, Spain	E A J 1; power, 1·5 kw.
348·9	Prague, Czecho-Slovakia	Concert daily, 7 p.m., on 5 kw.
353	**CARDIFF (5 W A)**	Main B.B.C. station; power 1·5 kw.
355	Falun, Sweden	Power, 2 kw.
361·4	**LONDON (2 L O)**	Power, 3 kw.
366·3	Leipzig, Germany	Power, 4 kw.
370	Radio (L L), Paris	Concert, Mon., Wed. and Fri., at 10 p.m.
370·4	Bergen, Norway	1·5 kw.
375	Madrid, Spain	E A J 7, 1·5 kw.
375·9	Helsingfors, Finland	Daily concert, 7 p.m.
380·7	Stuttgart, Germany	Transmits at intervals from 11.30 a.m., on power 4 kw
384·6	**MANCHESTER (2 Z Y)**	Main B.B.C station; 1·5 kw.
391	Toulouse, France	Daily concert, 8.50 p.m., on 3 kw.; received well in Midlands.
396	**HAMBURG, GERMANY**	Call sign, H A in Morse (· · · · — —); power, 4 kw.
400	**PLYMOUTH (5 P Y)**	·2-kw. relay station.
400	Cork, Irish Free State	Relays Dublin.
400	Cadiz, Spain	(In all there are eight European stations sharing this wave-length)
405·4	**GLASGOW (5 S C)**	Main B.B.C. station; 1·5 kw.
411	Berne, Switzerland	1·5 kw.
416·7	Gotcborg, Sweden	1 kw.
422	**KATTOWITZ, POLAND**	10 kw.
428·6	**FRANKFURT-ON-MAIN, GERMANY**	4 kw.
434·8	Seville, Spain	2 kw.; call sign, E A J 5.
443	**BRUENN, CZECHO-SLOVAKIA**	3 kw.; concert daily, 6 p.m.
450	Moscow (Trades Union)	4 kw.; call sign, R A 2. Talks at 3 a.m. and 8 p.m.
451	Rome, Italy	1 R O call sign; power, 3 kw.
454·5	Stockholm, Sweden	1·5 kw.
458	Ecole Superieure, Paris	·5 kw.; call sign, F P T T.
461	Oslo, Norway	1·5 kw.
470	**LANGENBERG, GERMANY**	25 kw.
477·5	Lyons, France	Concert, 9.45 p.m. Sun., Tues., Thurs. and Sat.; (relays Ecole Superieure.)
483	Berlin, Germany	"Witzleben" station; power, 4 kw.
491·8	**DAVENTRY EXPERIMENTAL (5 G B)**	25 kw. in aerial. Maximum power of
500	**Aberdeen (2 B D)**	Main B.B.C. station; shares this wave-length with Upsala and Linköping (Sweden).

NOTES.—The outstanding stations in the above group are Daventry Experimental and Langenberg. It will be noted that the Polish station at Kattowitz has a comparatively high power, too, of 10 kilowatts, and there are many stations with a power in excess of that of the ordinary main B.B.C. station. All the Paris stations are easily received in this country, and many of the German stations are received at greater strength than British main stations situated at shorter distances. Some of the German stations are active almost continuously during the hours of daylight, and some can be picked up even on single- and two-valve sets, when conditions are good.

The ROMANCE of the COIL

What happens inside your coils?—Every owner of a radio set should read this interesting article, dealing with the unseen "life" of a coil in action.

By P. R BIRD.

"THERE is a great coil to-night." Now that is what William Shakespeare said in "Much Ado About Nothing" (Act III, Scene III), and since that time a truer word has not been spoken by mortal man nor George Bernard Shaw. For there *is* a great coil to-night! *In your set!*

The Wizardry of Wireless

If you would care to test the truth of the Shakespearean assertion, take the trouble to look at your tuning coil. Look at it fixedly, interestedly and intelligently. Try to get a sympathetic inside view of that coil, and then ask yourself if you oughtn't to feel proud of it; proud of it not merely because it is a piece of wireless, but because it is a piece of wizardry.

Just consider for a moment what your coil is doing, helped by its pal, the tuning condenser. Between them this clever pair handles the whole input from your aerial circuit. One end of the aerial coil is joined to a wire that links up to the very depths of the earth; the other end is led out to an aerial which hangs high in the heavens. And through that coil there ebbs and flows a fraction of all the vibrant radio life that surges and swings across the tingling skin of the world.

Ceaseless Activity

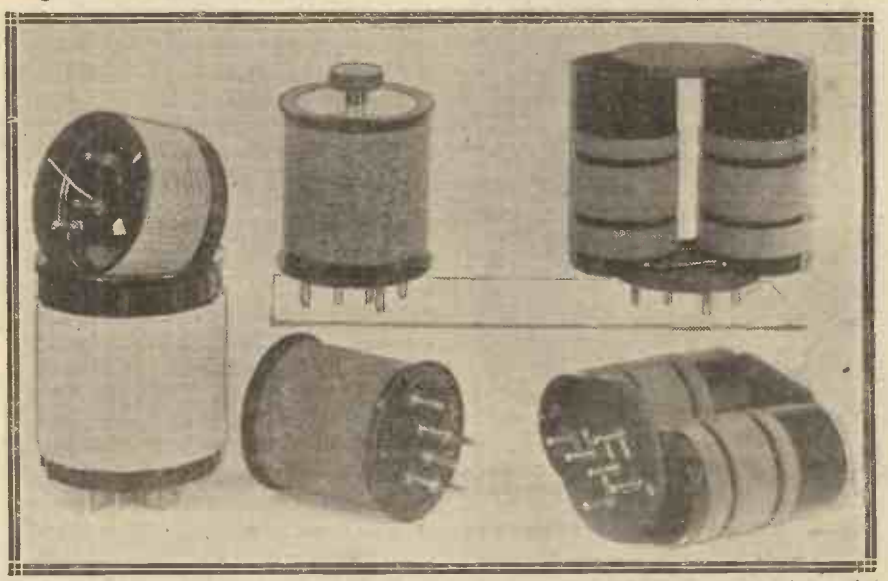
At first glance, a coil is a very ordinary-looking affair. Just a few turns of wire separated from one another and fixed upon a former; but we must not judge a coil by its external appearance, any more than we must judge a man's mind by his freckles! Just as the ugliest man may have the most beautiful ideas—witness Socrates—so the most ordinary-looking coil may do the most extraordinary electrical miracles.

For all its innocent appearance, and for all its apparent solidity, your coil is active sixty minutes out of every hour, and twenty-four hours out of every day. There is literally no pause, no period, no single second's rest in that electro-magnetic miracle which you fondly term your "old Ignanic," or your "No. 50."

When I took up my pen to write this article on coils I intended to make it quite a practical affair about inductance, about taking tappings, types of coils, the choice of wire, how coils could be coupled, and so forth. But no sooner does one settle down to try and think seriously of coils for a moment than one is struck by the staggering immensity of the coil's achievement. The facts about coils, as related in the text books, are fairly easy to read and understand. But the Truth about coils will never come out at an inquest.

Life Inside the Coil

It is no good sitting over a coil as though it were a dead body, measuring it and accounting for it by phrase and precedents, by the law of averages and by probabilities. The really relevant facts about a coil are not the number of turns, the kind of wire, insulation or the spacing—but the



Modern tuning coils vary a great deal in design. In binocular coils, for instance (right), the windings are in opposite directions, in order to limit the coil's magnetic field

internal, unseen, almost unimaginable activity of the thing. The uncanny, leaping life of it. Call it magnetism, call it electron-flow, or what you will, but do not make the mistake of looking upon a coil as a corpse. Instead, let us look for a moment at the *life* of a coil.

Faraday's Find

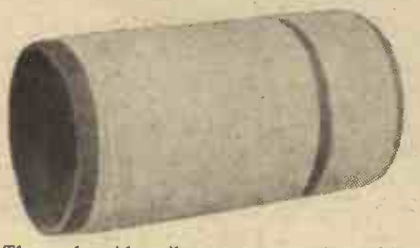
Let us imagine a coil in action. It was Michael Faraday who first laid bare the beauty of a coil, way back in 1831. He discovered, first of all, that if you move a magnet near a loop of wire, or a coil, a current flows in that coil.

The first wireless thrill that ever tingled up and down the spine of mortal man tingled along the spine of Michael Faraday, nearly one hundred years ago, when he found that a coil placed near a moving magnet was "alive." And wizard that he was, Faraday went on to find that not only did a current flow in a coil when a magnet was moved near it, but, conversely, if a current was made to flow in a coil, a magnetic field appeared around the coil. In fact, any coil with current flowing in it becomes a magnet!

Your Coil is a Magnet

So the first thing to realise about that coil of yours is that it is a magnet, with all the mysterious properties of magnetism. Given suitable apparatus, you could find the North Pole with that coil of yours. If you connect a dry cell across its ends, or in any other way send a current of electricity through it, there instantly springs into being a north and a south magnetic pole, at the opposite ends of the coil. If delicately suspended in space, your coil would act exactly like a compass, and would swing itself round and adjust itself until it came into line with that greatest of all magnets, Mother Earth!

As like repels like, and *un*like poles attract, it would lie with one of its



The solenoid coil—easy to make, old-fashioned, and marvellously efficient.

magnetic poles turned towards the south pole of the earth—the scene of Scott's great endeavour—and its other magnetic pole would swing itself Iceland and Spitzbergen way. So that if your coil were wound upon a tube like one of those illustrated in this article, and it were delicately suspended in space and allowed to lie as its magnetic inclination directed, anyone walking along the tiny tunnel formed by the tube and keeping straight on would come in one direction to the earth's North Pole, or, in the other direction, to the South Pole.

A coil of the popular plug-in type, wound on the "honeycomb" (or duolateral) system. For years these coils were in almost universal use, two of their great advantages being compactness and interchangeability.

This, then, is one of the interesting facts about a tuning coil. As soon as a current flows in it it becomes a magnet. But unlike the ordinary horseshoe magnet its magnetic properties are transient—they depend upon the current flowing through it. Immediately the current ceases, they cease also.

There are two other facts about your coil's magnetism which are worth noticing at the moment, and they are (*a*) the stronger the current which is made to flow through the coil the stronger will be its magnetic poles; and (*b*) although the magnetic field will spring into being the moment the coil carries a current, yet there is a definite though almost infinitesimal pause whilst some of the energy of the current is reappearing as the energy of the magnetic field.

Life that Reappears

Now it might be thought that as we are not in the habit of connecting a small battery across our tuning coils, much of the foregoing is hardly relevant. But there are other sources of electric current besides the battery. As a matter of fact, if the coil is a brand new one and is still in its cardboard container, it will already have been carrying current.

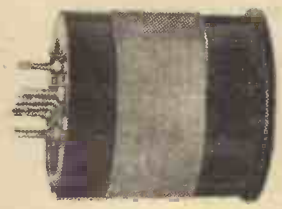
For all the space around this globe is filled with the stresses and strains set up by the electro-magnetic waves sent out by the world's wireless stations. Those waves, ebbing and flowing and permeating into every nook and cranny in creation, find their way to your tuning coil, and discover therein a sensitive instrument upon which they can express themselves.

In your tuning coil they recreate the conditions that gave them birth; and though of the great wireless waves that encircle the world with the speed of light only a tiny fraction—only an infinitesimal particle—can come to your coil, yet that tiny particle bears an authentic and unmistakable stamp of its origin.

The Miraculous Miniature

Exquisite miniature though it be, it is *exactly* like its parent, and this not merely in its size and speed (either of which are almost incredible), but in its living shape and volume, that is being modulated and moulded from minute to minute. Every current coursing round the turns of your coil not only leaps and lives in unison with the great electrical impulse which created it at a wireless station hundreds, or even thousands, of miles away, but it retains every finest gradation and variation that is impressed upon its parent's features!

Have you, honestly, ever heard of

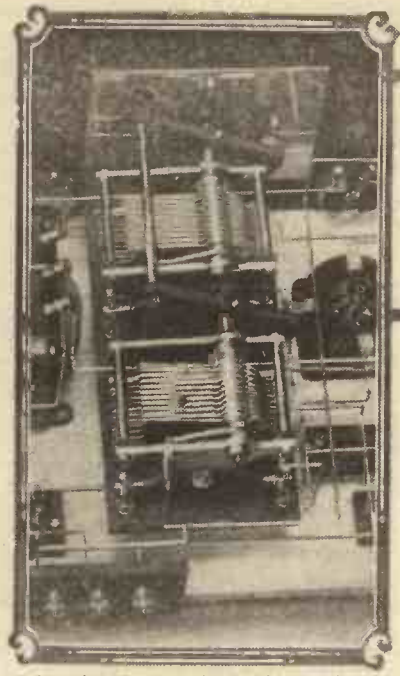


The standard 6-pin arrangement is a form of solenoid coil.

a miracle to beat this? Could any chain of events or coincidences be more curious than that which centres upon the behaviour of your coil? When it is receiving from, say, Langenberg, the currents which it carries are not merely miniatures of those flowing in the far-off aerial, but they live and leap and ripple, *in unison*, faster than the mind can follow.

One often hears the explanation that when your coil is tuned to a distant transmission it is "in sympathy" with it. But there is a good deal more in this than we generally mean by sympathy. There is a fierce, fine *life* in your coil, a rushing back and forth, a stir and a struggle, a very volcano in miniature, completely controlled by the distant transmitting aerial. The chief difference is one of degree, for your coil's currents are weak, but if you touched that transmitting aerial, or even came too near it, its invisible electrical commotion would kill you instantly.

(*Continued on page* 328.)



A twin-gang condenser in use in a receiver of modern design.

Using "Dual" Condensers

With the advent of neutralised and screened-grid H.F. circuits the need of simultaneous tuning by means of one knob has resulted in the design of a number of "gang" condensers. The author of this article discusses the various circuits in which such condensers can be used.

By C. P. ALLINSON, A.M.I.R.E.

ONE of the first questions the wireless amateur asks himself when seeing a new and interesting circuit is, "Can I make this up without spending any money?"

This is a very natural question to ask, for wireless can become a very expensive hobby if we are to purchase apparatus indiscriminately every time we see a new circuit that we would like to try out.

Easily Employed

There is no reason, however, why the amateur who possesses a dual condenser should not experiment with gang-controlled circuits, since these condensers can very simply be employed in some receivers.

They are obviously not suitable for all types of circuits, since in some of them it is absolutely essential that the two sets of moving vanes be insulated from each other. In this case, of course, it is necessary to have separate spindles with a coupling of some description made of insulating material.

There are, however, quite a number of circuits which may be gang-controlled by an ordinary dual condenser, and I should imagine that there are very few experimenters who have not got one lying about either in an old set, or in their junk box, or somewhere.

I feel sure that a little experiment with gang control circuits will show the experimenter exactly what their advantages are, and for their guidance I give herewith a number of circuits which may be employed with ordinary dual condensers to give gang-control.

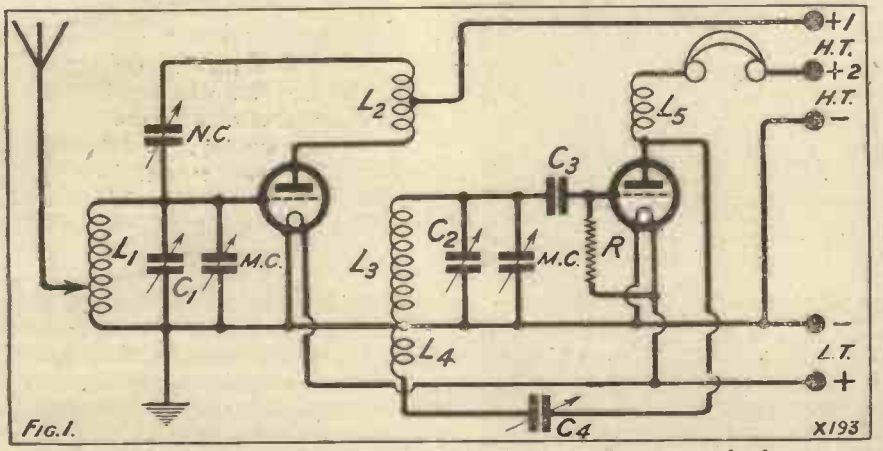
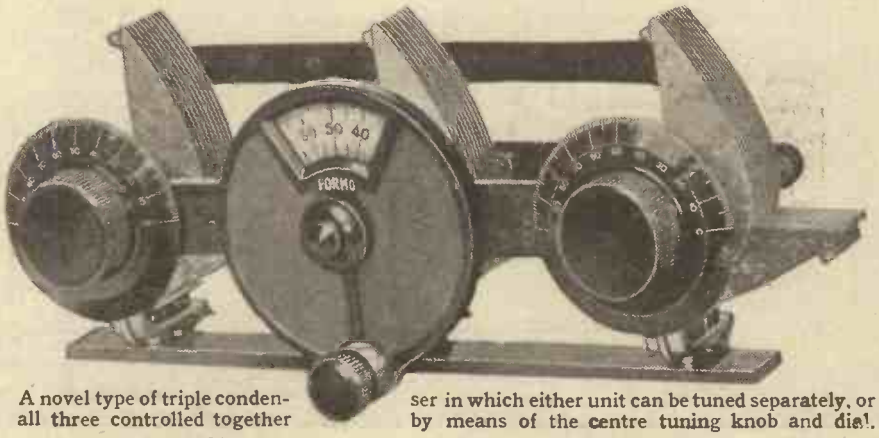


FIG. 1.

A Popular Circuit

The circuit shown in Fig. 1 consists of a two-valve receiver using a stage of high-frequency amplification. The two inductances L_1 and L_3 are both connected to L.T. negative at one end, the spindle of the dual condenser also being connected to L.T. negative One set of fixed vanes is then connected to the grid of the H.F. valve, while the other set of fixed vanes is connected to one side of the grid condenser C_2, which is connected to the grid of the detector valve. The grid leak R is then connected to L.T. positive, thus giving the correct bias to the grid of the detector valve.

Midget condensers, M.C., are then connected one across each half of the



A novel type of triple condenser in which either unit can be tuned separately, or all three controlled together by means of the centre tuning knob and dial.

dual condenser so that any discrepancies between the two circuits may be balanced out by suitable adjustment of these small condensers.

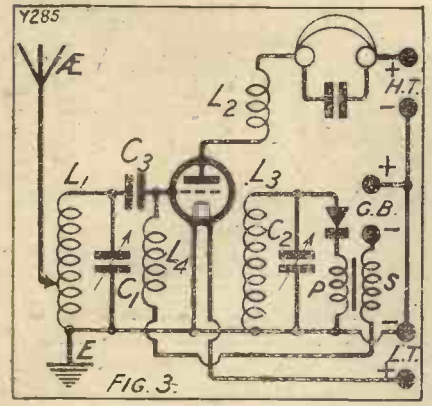


FIG. 3.

It will readily be appreciated that if the gang condenser is correctly balanced at the lower wave-lengths it will probably be unbalanced at the higher wave-lengths, and vice versa. With the scheme outlined in Fig. 1, however, it is a simple matter for a balance to be obtained at all wave-lengths by slight adjustments of the midget condensers.

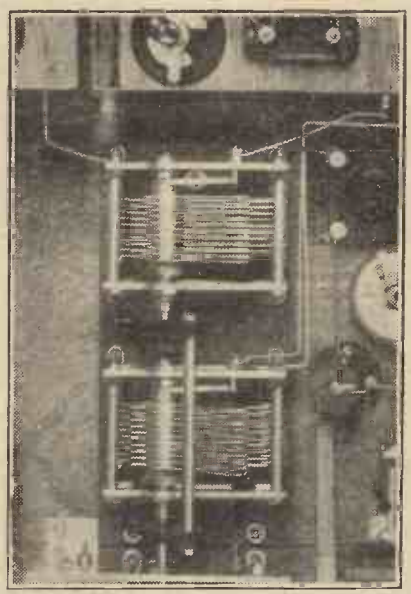
With Two H.F. Stages

It will be seen that I have shown a neutralised circuit, and this, of course, is advisable if you are to obtain the maximum range and ease of control with your receiver.

If it is desired to make up a receiver employing two stages of high-frequency amplification, then the dual condenser should be used for tuning the second H.F. and detector circuits, and the method of doing this is shown in Fig. 2. The aerial is auto-coupled to the first H.F. valve by being suitably tapped on to the coil L_1, which is tuned by a variable condenser C_1, having the usual capacity of ·0005. The two coils L_3 and L_5, which should be matched up as closely as possible, are tuned by the dual condenser, which is connected in a similar manner to that described with respect to the circuit shown in Fig. 1. Midget condensers are connected across each half as previously described, but if particular care is taken in matching up the two inductances L_3 and L_5 it may be possible entirely to dispense with the use of extra condensers for balancing purposes.

Broadening the Tuning

Where it is not desired to obtain a high degree of selectivity the question of exact matching may further be simplified by making the coupling between the primaries and secondaries of the two H.F transformers, L_2, L_3, and L_4, L_5, respectively, fairly tight.


One of the earlier types of gang variables in which two ·0005-mfd. condensers are controlled on one spindle.

This will have the effect of broadening the tuning of the secondary coils L_3 and L_5, thus making the adjustments of the condenser less critical, so that any slight lack of balance in the circuits will not be a serious matter.

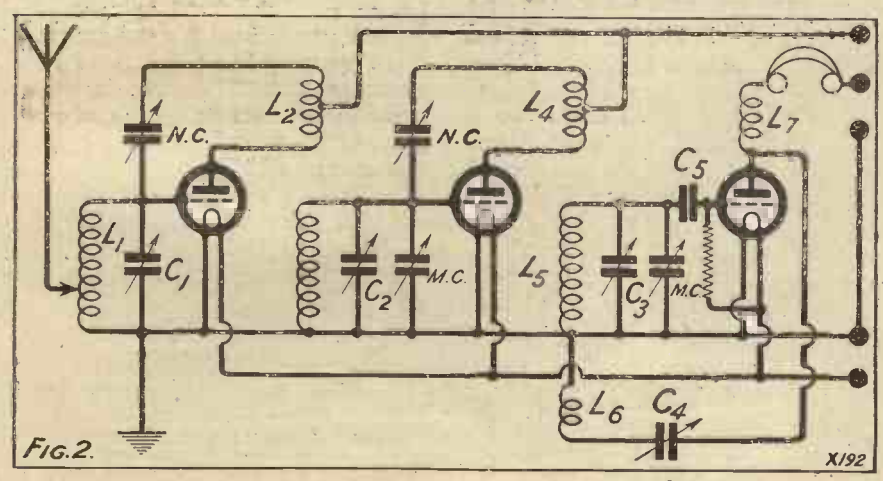


FIG. 2. X192

The split-primary form of neutralised circuit has been used as before, while reaction is again provided in the detector-valve circuit by the method used by Mr. Reinartz.

With an efficient H.F. amplifier of this description it will be found that very little reaction will be needed, and that practically the whole control of the receiver is confined to the two

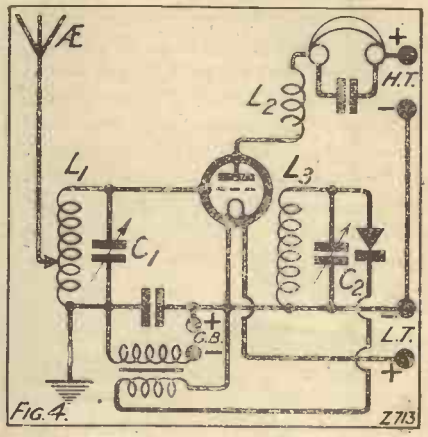


FIG. 4. Z713

tuning dials, one of these is the separate condenser which tunes the aerial circuit, and the other the dual condenser which tunes the last two tuned circuits.

Another circuit where the dual condenser may be used for gang control with particular advantage is in a crystal-valve reflex. Owing to the heavy damping which is imposed on the crystal circuit by the crystal detector the tuning is so flat that it is possible in this case entirely to dispense with extra condensers for balancing purposes.

Useful L.S. Set

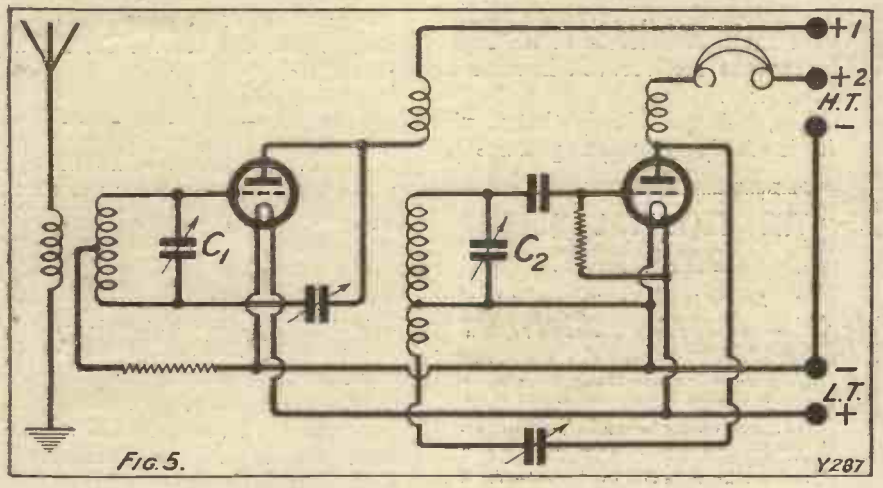
A circuit of this description is shown in Fig. 3, and this is a useful set to use for local loud-speaker reception. In this case it is necessary that the coils be matched up as closely as possible. They are tuned by the two portions of the dual condenser, the spindle as before being connected to L.T. negative, to which one side of each coil is connected. One set of fixed vanes of the dual condenser is connected to across the coil L_1, the other being connected to the other side of the coil L_3. I have shown the crystal detector D connected across the whole of the inductance L_3, which if desired may, of course, be tapped down it in the manner which is familiar to experimenters.

With the detector connected across the whole of the coil, however, it will probably be found unnecessary to use a neutralised circuit. This is more so the case in that since a power valve should be used in the reflex position,

the coil L_2 should be a fairly small one, and this in combination with the low amplification factor of the valve, together with the damping introduced by the crystal detector, may result in the H.F. side of the receiver being entirely stable.

Shunt Feed

Shunt-feed has been used for feeding the rectified output of the detector back on to the grid of the H.F. valve. This is done by connecting a condenser C_3, having a value of ·0003, between the grid and the tuned circuit L_1, C_1. An H.F choke L_4 is connected direct to the grid of the H.F. valve; the other side being connected to the secondary of the L.F. transformer, the primary of which is



connected in series with the crystal detector.

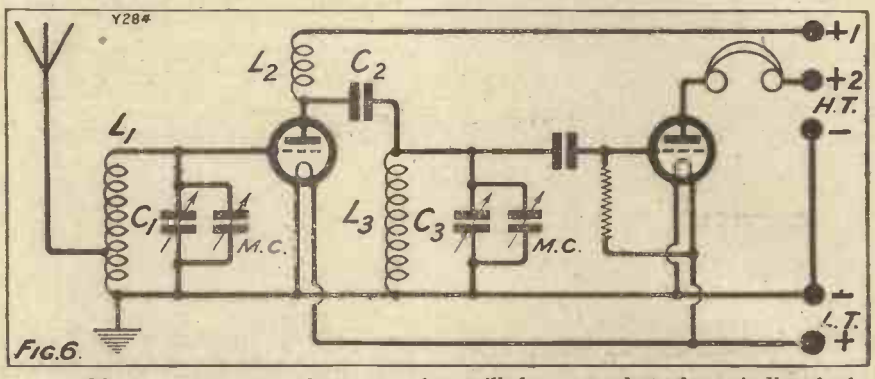
For the benefit of those who may prefer to use the more usual method, since it enables you to save the cost of two components, namely, the condenser C_3 and the choke L_4, I show in Fig. 4 the more usual method which has been employed up to now

It will be seen at once, however, from this figure, that this circuit cannot be used with an ordinary dual condenser for gang control, since the spindles of the two condensers C_1 and C_2, tuning the inductances L_1 and L_3, are not both connected direct to L.T. negative.

An Unsuitable Case

It will be seen that the variable condenser C_1 is connected to L.T. negative via the secondary of the L.F. transformer, and therefore if any attempt were made to use the dual condenser not only would the secondary of the L.F. transformer be short-circuited, but also the grid-bias battery through it.

I think I have said sufficient now to indicate the method of using dual condensers in gang-controlled circuits, and there is no need for me to give any further examples. I would, however, like to point out the type of circuit in which the use of a dual condenser is absolutely impossible. This is in the split-secondary type of circuit shown in Fig. 5.

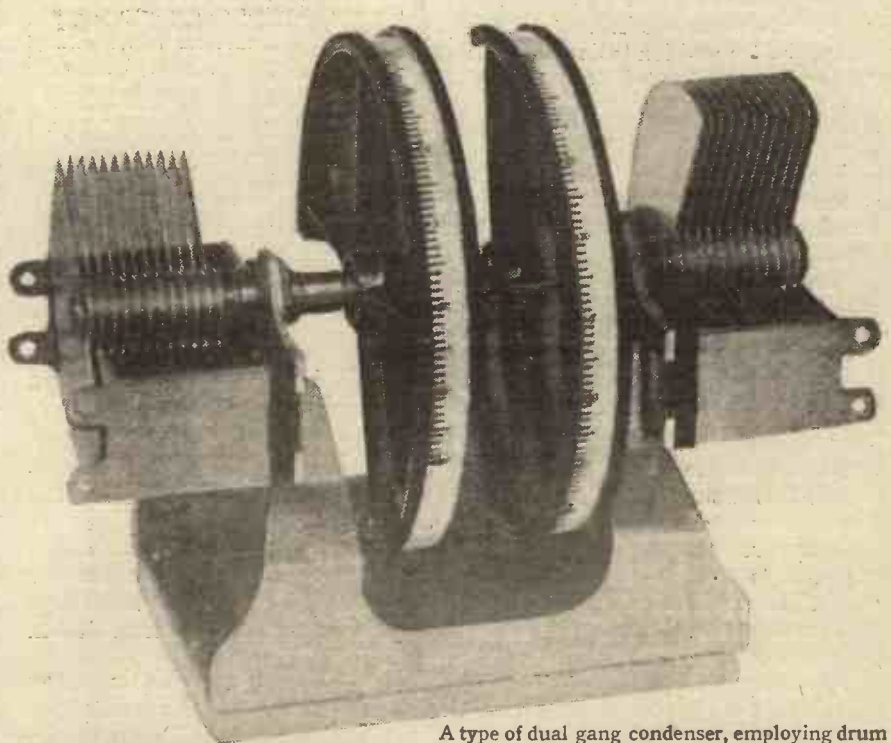


On examining this circuit it will be seen that the spindle of the variable condenser C_1 which tunes the H.F. valve grid circuit is not at L.F. potential on either side.

If, therefore, it is intended to use single-dial control with a set of this description it is absolutely necessary to use the type of gang condenser in which the two sets of moving vanes are entirely insulated from each other.

Solving the Problem

Similarly, a gang condenser cannot be used to tune an H.F. grid circuit and a tuned-anode circuit at the same time, since any attempt to do so would result in the H.T. battery being shorted. By an adaptation of the tuned-anode circuit (Fig. 6), which I have used with considerable success for a number of years, it is possible to employ the dual condenser for gang control.



A type of dual gang condenser, employing drum control, which is becoming very popular. The drums can be rotated either separately or together, so that either gang tuning or vernier control of each condenser can be obtained.

Suitable L.F. Valves

R. U. (Wallington) is using a powerful receiver for the reception of his local station. He is employing two resistance-coupled L.F. stages with an L.S.5A type of valve in the last socket. He asks whether he is correct in using a medium-magnification valve in the first L.F. stage.

In a case of this nature, where the signal strength before the first L.F. valve is very considerable, there is a danger of its being overloaded if of the medium- or high-magnification type. In view of the available signal strength it would probably be better to use a valve having a resistance of 6,000–8,000 ohms in this socket in conjunction with a 50,000-80,000-ohm anode resistance.

The grid bias could then be increased, and on the whole the L.F. side would be in a better position to deal with the large volume without distortion.

Split-Primary Transformers

T. P. (Hull).—"Will you please give particulars of the standard split-primary H.F. transformers as used in screened H.F. circuits?"

250-550-*metre band*—

The H.F. transformers consist of 90 turns of 30 D.S.C. wire wound unspaced on a 2-in. diameter former. The neutralising and primary windings each consist of 20 turns wound on a 1⅜-in. diameter former placed inside the secondary and arranged to come inside the centre. The neutralising winding is wound on first, then a layer of Empire tape, and finally the primary winding. The reaction winding consists of 25 turns wound below the primary. All windings should be in same direction.

Daventry Range—

Secondary, 300 turns of No. 40 S.S.C.; neutralising and primary windings, each 75 turns of No. 36 D.S.C.; reaction, 100 turns of No. 36 D.S.C.

A Super-Het. Query

S. D. (GLASGOW) wishes to know if the use of a high-value grid leak with the first detector of his super-heterodyne receiver will increase its sensitivity.

Yes, it is quite likely that it will. It is fairly common practice to employ grid leaks of four or even six megohms for the first detector of a super-het. In cases where no reaction is used it is desirable to keep the damping in the "frame" circuit down to a minimum, and a high-value grid leak helps to achieve this object.

There is no point, however, in using such a high value for the second detector, since this would tend to produce distortion on loud signals.

Curing a Whistle

R. T. (London).—"My receiver (a dét. and two L.F., transformer-coupled) has developed a whistle. Until just recently it was giving very satisfactory results, but now, however much the tuning is varied, this whistle still persists. Removing the aerial lead does not stop it. Can you suggest a remedy?"

In all probability the whistle is due to L.F. oscillation, and since the set was working satisfactorily until a few days ago, the first thing to do is to examine the H.T. battery. You will probably find that the voltage has fallen considerably.

Alternatively, one or two of the cells may have become faulty. This would produce an increase in the internal resistance of the battery and could easily account for the trouble you are experiencing.

The remedy is to purchase a new battery. Don't forget to examine the grid battery at the same time, and also to inspect the set for any joints, etc.

Wave-Trap for 5XX

L. C. (Buxton).—"I wish to make up a wave-trap for use on the Daventry wave-band (1000-2000 metres) similar to the "Standardised Wave-Trap" described in the November, 1927, issue of MODERN WIRELESS. Please give details of the windings."

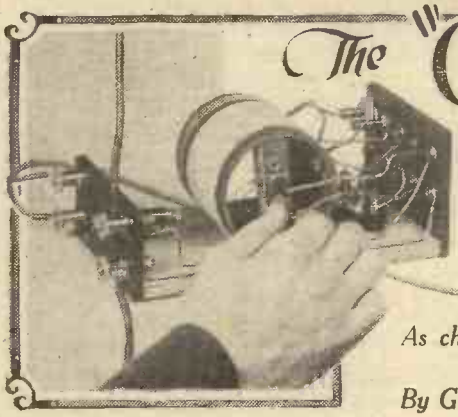
Use a 3-in. diameter former and wind on 230 turns of No. 30 D.S.C. wire. Take tappings at 75 and 100 turns and tune the full winding with one of the semi-variable or with one of the ordinary ·0005 variable condensers. Connect up in the same way as for the trap described in the November, 1927, issue of this journal.

Obtaining Oscillation

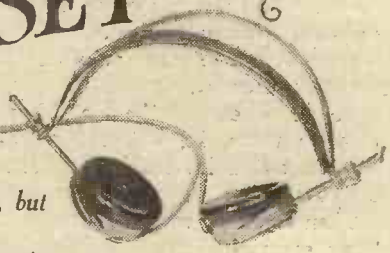
G. T. (CARDIFF).—"I have been trying to get results on the very short waves with an old det. and L.F. set which I had by me. Although I have used various coils in the aerial and reaction sockets, I find that it is impossible to make the receiver oscillate."

Probably your set uses direct aerial coupling. If so, you might try a very small condenser, such as one of the neutralising type, in series with the aerial. Another scheme would be to employ an "aperiodic" aerial coil, consisting of two or three turns of stout wire (about No. 20 D.C.C.), coupled fairly tightly to the existing "aerial" coil, which would then become the secondary.

You would require a size larger coil in this socket, and your aerial and earth should be joined to the ends of the "aperiodic" coil.



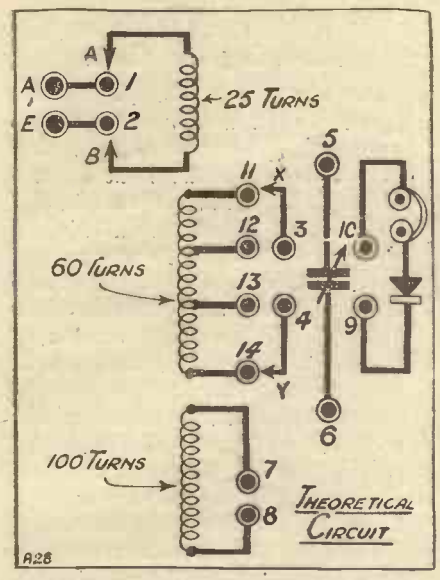
The "CENTURY" CRYSTAL SET



As cheap to build as the simplest of wave-traps, but capable of fulfilling scores of purposes.

By G. V. DOWDING, Grad.I.E.E. (Technical Editor).

IT appears to be an almost universal practice for technicians to commence their constructional articles with a kind of apologia, and such a thing is undoubtedly the least important part of an article from the reader's point of view. He—the reader—wants to know why he should build the set, and it is the author's duty to tell him. Therefore, I make the plunge by boldly declaring that there are several reasons why you should build the "Century" Crystal Set. But I am not going to enumerate them now. I want you to read this article, even though, at the moment, the construction of any sort of set is far from your mind. It may not be when I have finished with you; at least, I hope not!



"An Encyclopædia of Circuits"

The "Century" Crystal Set is not so much a set as an encyclopædia of wave-traps and crystal circuits, a sort of scientific indoor game, or a jigsaw puzzle; it all depends on how you, personally, look at it. It is not at all an expensive instrument. It may be that you are only requiring a good wave-trap. Well, here you have one at a cost very slightly exceeding that of a wave-trap. You want a good crystal set capable of covering all the broadcast wavelengths; the "Century." answers this requirement and offers, in the bargain, the choice of an innumerable number of circuits, so that you can choose exactly the one most suited to your own individual conditions.

"Sort of Switchboard"

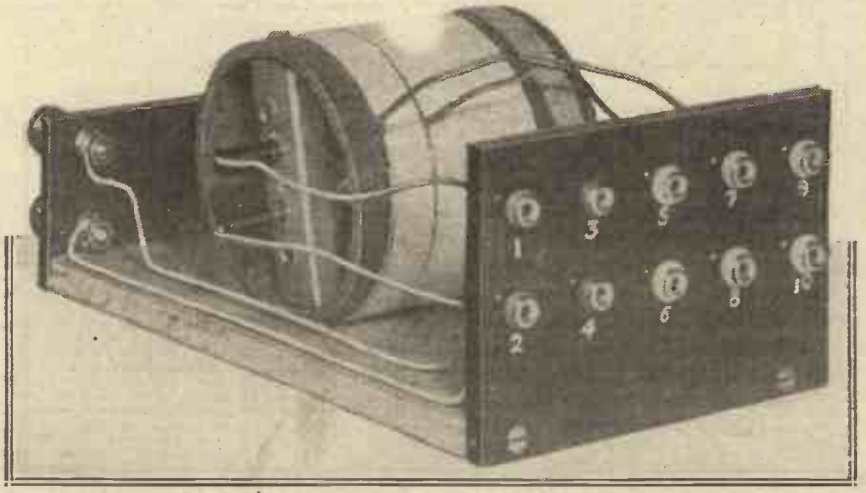
There is a small front panel on which are telephone receiver terminals and aerial and earth terminals, and the crystal detector adjustment. A back panel carries ten small sockets. These act as a sort of switchboard in conjunction with plug leads and connections. A cylindrical former carries three coil windings, one of which has two tappings. On the baseboard there is also a variable condenser of what is known as the "compression" type. This item does not cost much more than a fixed condenser, but it gives all the capacity control necessary for this set. The circuit is arranged in a way I shall tell you about later, just as you require it, by means of the plugs and sockets, after which you use the set in the usual way. The circuit juggling is most fascinating; it has crosswords beaten hollow.

I will now proceed with a description of the constructional details, and this is the part of the article that you can, if you so desire, jump for the time being.

PARTS REQUIRED.

- 1 Ebonite panel, 5 in. × 3 in. × $\frac{3}{16}$ in.
- 1 Ebonite panel, 5 in. × 2 in. × $\frac{3}{16}$ in.
- 1 Baseboard of wood, 5 in. × 7½ in. × ¾ in.
- 14 Clix sockets for panel mounting.
- 12 Clix plugs.
- 1 Panel-mounting crystal detector.
- 4 Terminals (marked A, E, and 'Phones).
- 1 Compression-type variable condenser (Formo, Igranic, etc.).
- 1 Coil former, 3 in. diameter, 3½ in. long (Pirtoid, etc.)
- Small quantity 32-gauge cotton-covered wire (2 oz. ample).
- Small quantity 36-gauge silk-covered wire (1 oz. ample).
- Glazite and screws.

Having got all the components and materials required together in accordance with the very short list I have



Scores of different circuits can be tried merely by linking the various sockets and plugs. Note the neat manner in which the various tappings are taken from the coil.

given elsewhere, I would advise you to make a start by winding the coils. A 3-in. diameter former, 3½ in. long, is used, and this can be of Pirtoid ebonite, or even well-waxed cardboard. Half an inch or so from one end drill two small holes through this former with a bradawl or other such sharp instrument.

Stitch an end of the No. 32 wire through these, in, out and in, and leave about 2 in. inside the former for connecting purposes.

Then carefully wind on twenty-five turns, securing the end of the winding in a similar manner to the beginning. Leave a space of about an eighth of an inch, and then commence the 60-turn winding.

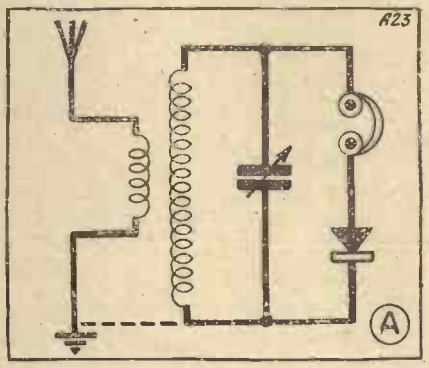
Making Tapping Loops

Having wound on twenty turns drill a small hole in the former and thread a loop of the wire through this. This tapping loop should be about 2½ in. long. Do not break the wire but carry on for a further twenty turns and pass another tapping loop through the former, this time about 3½ in. long. This 60-turn winding is concluded by winding on a further twenty turns and securing the end. The ends of both these windings and the tapping leads to the 60-turn coil will be left protruding through into the interior of the coil former.

Continuing the Winding

A space of about ⅜ in. is then left and the last winding, one hundred turns of No. 36 gauge wire, is wound on. You will not be able to get this winding on in a single layer in the same way as the others. Wind the wire on until you have covered about half an inch of former space, bringing the winding to within about a quarter of an inch to the end of the former, and then go back to the beginning and lay over this first layer of wire another layer. You should be able to accommodate the hundred turns in three or four layers. The ends of this winding, each an inch or two in length, should be left on the outside of the former. All these windings must be wound in the same direction.

You should now cut a strip of hard wood about a quarter or three-eighths of an inch thick (this can be ebonite, although it is harder material to handle), so that it will fit in the opposite end of the former to the 100-turn winding. In this piece of wood or ebonite you should fix four



of the Clix sockets, spacing them about half an inch apart. These four sockets will operate as the contacts to the ends and the tappings of the 60-turn winding.

Mounting the Coils

You can now proceed to connect these up to the sockets, doing this so that the tappings and ends make a definite arrangement. That is, take the beginning of the coil and fix this to the bottom socket, the first tapping to the second socket, the second tapping to a third socket, and the other end of the coil to a fourth socket. You will then be able to see at a glance exactly which socket goes to which point.

You can mount the coil unit on the baseboard by passing a ¾-in. wood screw up from the bottom of the baseboard through the coil former into the strip of wood carrying the socket. This strip of wood can be fixed at the

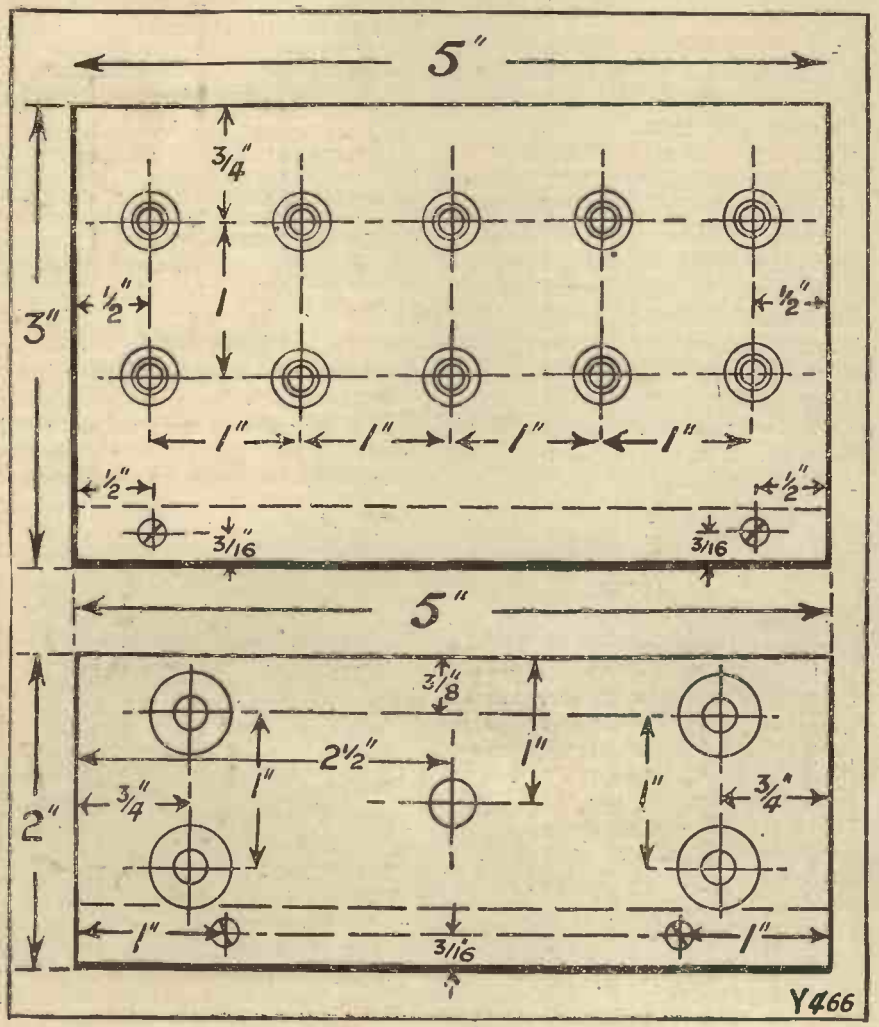
"The circuit juggling is most fascinating; it has crosswords beaten hollow!"

other end by means of small wood screws passing through the former. A small wood screw passing through the other end of the former from the inside into the baseboard will make the fixture very secure.

Very Simple Wiring

You can now drill the small ebonite panels. Having screwed on the terminals (and crystal detector) the panels can be fixed to the baseboard and the small variable condenser screwed in position.

The wiring is very simple, although you should do it carefully, otherwise you may confuse the numbers of the



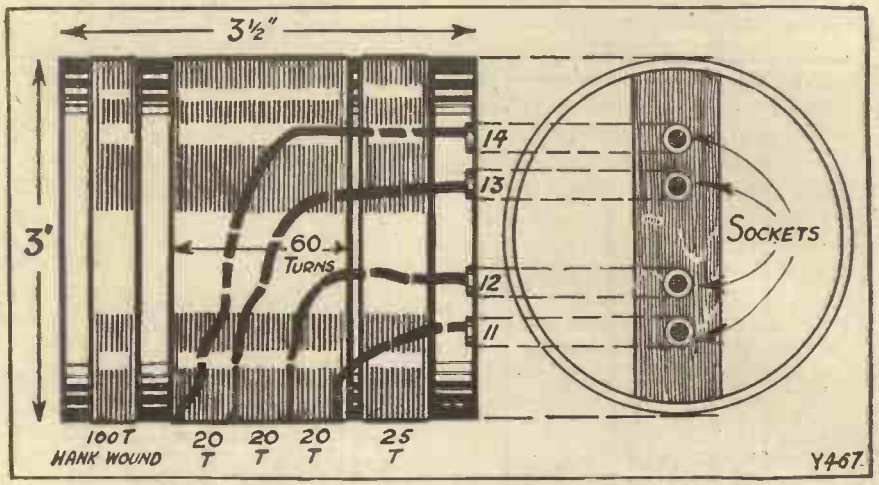
sockets and this will throw you all out when you come to hook up various kinds of circuits. Take the leads from the various sockets in such a way that access to the latter is not impaired. You must remember that it will be necessary to insert plugs from the back as well as from the front.

To sockets 3 and 4 should be secured pieces of flexible wire, each about 4½ in. in length. On the ends of these should be fixed plugs. Each side of the 25-turn coil drill a hole through the former large enough to pass through two more portions of flex wire. Tie a knot in the end of each to prevent it being pulled back.

The Flexible Leads

The ends of the 25-turn winding should be connected to the flexible wires by means of a soldered joint. To the other ends of the flexibles should be fixed plugs, preferably of different colour to those already used. The remaining connections are from sockets 7 and 8 to the ends of the 100-turn winding. Do not succumb to the temptation of taking the easy path of connecting the 36-gauge wire direct to the sockets. Such connections would be of a very flimsy nature.

The wiring of this receiver should be carried out with Glazite wire or some other stiff wire covered with Systoflex, or other insulating sleeving. And for the numbers 7 and 8 socket connections use short pieces of such material. These wires should terminate in small holes bored through the former so that they can be held rigidly in position. The 36-gauge wire is wound round the ends of these leads and gently soldered.

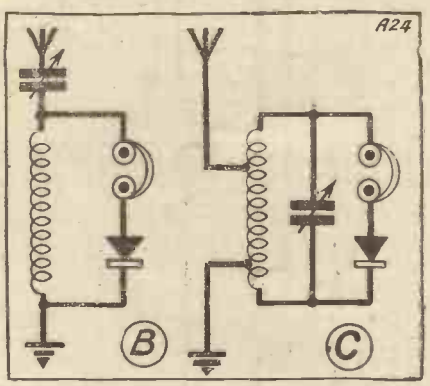


The Connecting Links

Six connecting links at least will be required. These comprise Clix plugs and flexible wires. Plugs should be connected to each end of these flexible leads, these being about 5 in. in length.

You will note that you are able to connect two plugs together, as each Clix plug is in itself also, in addition, to a socket. This is going to be of great value to you when you come to the hooking-up of circuits.

If you can paint numbers on the panel beneath each socket, so much the better, as this will facilitate connections. But in any case, these sockets are arranged in such a manner that you can see almost at a glance

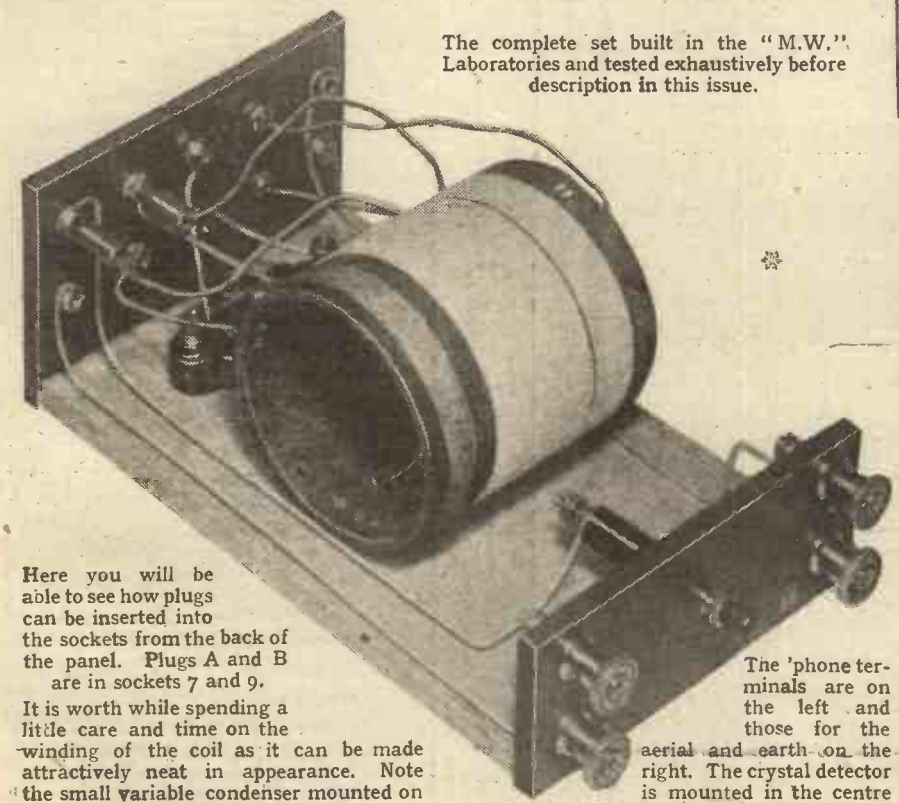


which socket is which. You will note that the sockets in the ends of the coil unit are numbered from top to bottom—11, 12, 13 and 14. Now for the various circuit arrangements it is possible to obtain with the "Century" Crystal Set.

Choosing a Circuit

It is possible to hook-up practically any conventional crystal circuit arrangement. Hitherto, you might have been faced with the problem of choosing one particular crystal set. A large number have been described from time to time incorporating different circuits. One circuit might operate under certain local conditions and with a certain aerial-earth system much better than some other circuit. With the "Century" arrangement you can try them all. You can make just the compromise between selectivity and sensitivity necessary to give you optimum results in any circumstances.

The complete set built in the "M.W." Laboratories and tested exhaustively before description in this issue.



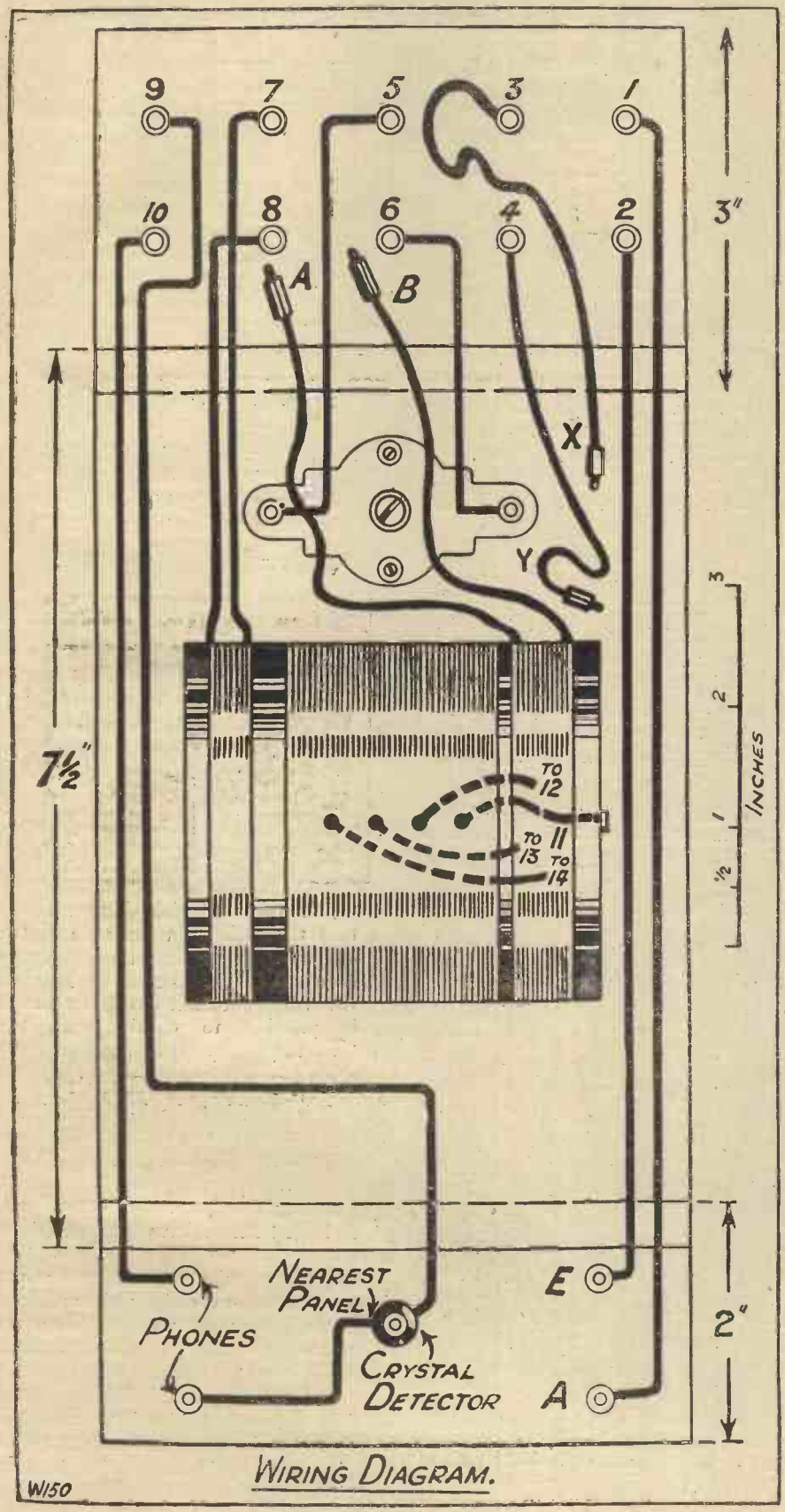
Here you will be able to see how plugs can be inserted into the sockets from the back of the panel. Plugs A and B are in sockets 7 and 9.

It is worth while spending a little care and time on the winding of the coil as it can be made attractively neat in appearance. Note the small variable condenser mounted on the baseboard.

The 'phone terminals are on the left and those for the aerial and earth on the right. The crystal detector is mounted in the centre of this small panel.

I have drawn eight simple circuits, all of which you can make up in a few seconds.

Circuit A is the conventional loose-coupled aerial arrangement. This is a very selective scheme and is the one you should try first of all should you experience interference. This is how you hook it up. Insert plug A in socket 1, plug B in socket 2, plug X in socket 11 or 12, and plug Y in socket 14. Link sockets 3, 5 and 10, and 4, 6 and 9 together. If you want to earth the secondary circuit link the 4, 6, 9 group with No. 2 socket. You are now using the No. 25-turn winding as an untuned aerial coil, the No. 60-turn winding being tuned. The two windings are, of course, inductively coupled.



WIRING DIAGRAM.

Selectivity or Sensitivity!

Now you should be able to separate 2 L O and 5 G B with the greatest of ease. With plug X in socket 11 the wave-length range will be from about 300 to well above 500 metres. The 100-turn winding is not in use. You tune by means of the small variable condenser, which is operated with a long-handled screwdriver, or a stick of wood sharpened to a chisel end.

Circuit B is a plain series-capacity tuning arrangement and is notable for its sensitivity but not for its selectivity. This is how you hook-up circuit B. Link the following sockets together: 1 and 5; 3, 6 and 10; 2, 4 and 9; and insert plug Y in socket 14, and plug X in any of the following sockets: 11, 12, 13. With plug X in socket 11 you have the whole of the 60-turn winding in use, and if you require its additional inductance you can bring in the 25-turn coil in series in a very simple manner. You break the link between sockets 2, 4 and 9.

POINT-TO-POINT CONNECTIONS.

Beginning of 60-turn winding to socket No. 11.
First tapping of 60-turn winding to socket No. 12.
Second tapping of 60-turn winding to socket No. 13.
End tapping of 60-turn winding to socket No. 14.
Join aerial terminal to socket No. 1.
Join earth terminal to socket No. 2.
Join one 'phone terminal to socket No. 10.
Join other 'phone terminal to one side of crystal detector.
Join other side of crystal detector to socket No. 9.
Join beginning of 100-turn winding to socket No. 7.
Join end of 100-turn winding to socket No. 8.
Join variable condenser terminals to sockets Nos. 5 and 6.
Join flexible leads carrying plugs to sockets 3 and 4 and to ends of 25-turn winding.
Prepare at least six links (see text).

The "Ultra" Tuner

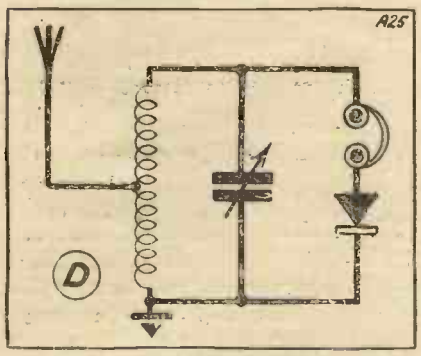
Then insert plug A in socket 4, insert plug B in socket 2, and link sockets 2 and 9. If you want to bring the 100-turn coil in series with the whole lot, withdraw plug B from socket 2 and then insert plug B in socket 7, linking sockets 8 and 2 together.

Circuit C is my own "Ultra" tuning method in which two tappings

are so arranged on a coil to give what are known as "balanced end" effects. The circuit has been proved to have great possibilities in both sensitivity and selectivity. Anyway you can very easily try it for yourself. The following is the arrangement for the ordinary broadcast band. Link the following sockets together: 1 and 3; 2 and 4; 5, 10 and 11; 6, 9 and 14. Insert plug X in socket 12 and plug Y in socket 13.

Aerial and Crystal Taps

Circuit D is the well-known aerial tap scheme and E the same system with a crystal tap, this latter providing additional selectivity. In F the aerial tap arrangement has the modification of a variable condenser in the series condition. The circuit G is a plain straightforward arrangement which used, at one time, to figure in practically every crystal set. And you will probably find this hook-up the best one for 5 X X, although it will be necessary to use

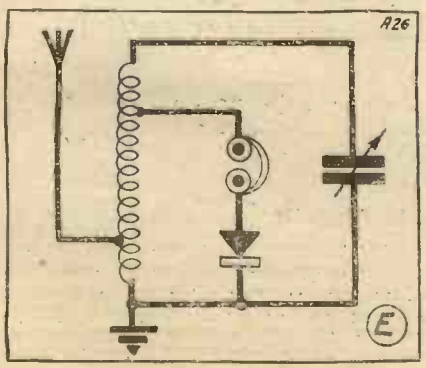


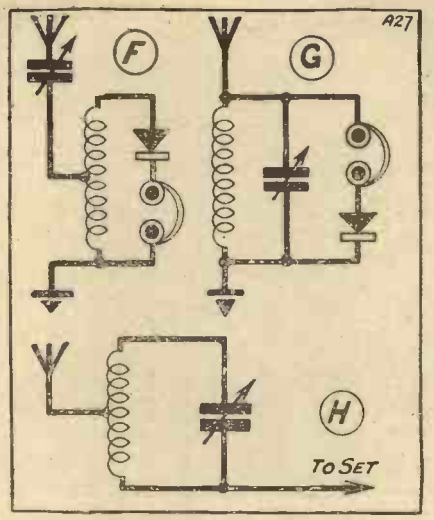
the whole of the three windings in series. This is how you do it:

Insert plug A in socket 1; insert plug B in socket 3; insert plug X in socket 11; insert plug Y in socket 14. Link sockets 4 and 7; sockets 1, 5 and 10; sockets 2, 8, 6 and 9 together.

An Efficient Wave-Trap

If you want a really good wave-trap you can hook your "Century" up in accordance with circuit H in a very easy manner. Link sockets 1 and 3 together, and also sockets 2, 4 and





6. Insert plug Y in socket 14 and plug X in one of the following three: 11, 12 or 13. Take the aerial lead to No. 1 socket. Join socket No. 2 to the aerial terminal of the set. You can now proceed to absorb any interfering station on the broadcast band by varying the adjustment of the small variable condenser.

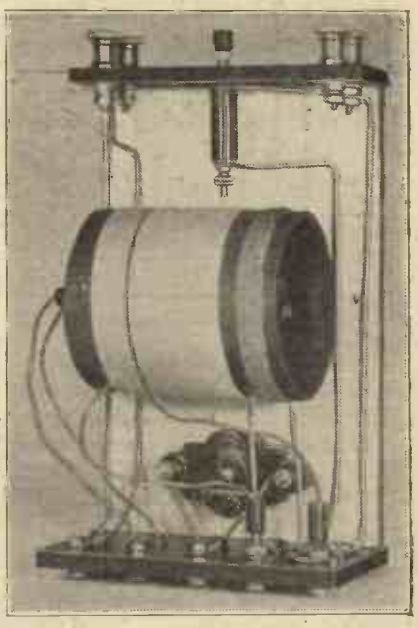
Bewildering Possibilities

And in the preceding I have only been hinting at the number of arrangements possible. As you are now probably aware, you can actually do far more than I have indicated. For instance, you can place any of the coils in parallel to give you inductance variations. By linking sockets 11 and 14 together and inserting plug X in socket 11 and plug Y in socket 13 or 12, you get, at sockets 3 and 4, a 20-turn coil in parallel with one of 30-turns. The resultant inductance will be something considerably less than that provided by a 20-turn coil alone. And you can parallel two 20-turn sections of the 60-turn winding and connect it in series with either of the other two coils. Connecting coils in series, by the way, gives you an inductance greater than the inductances of the individual coils added together when both are wound together. Further, you can parallel either of the other coils, and so on.

The "Puzzle Element"

As far as I can see, there should be at least one hundred different arrangements possible, and this is the reason why I have called the instrument the "Century" Crystal Set. You will find it very interesting to endeavour to work out the maximum number of arrangements (excluding freak hook-ups of unknown values). In a future short article I propose to describe the connections for a further short series of circuits. I have purposely given but a few in this article in order to leave the puzzle element to amuse you. But you might ask, apart from its entertainment qualities, has the scheme any real value?

In answer to this, I can say that on three different aerials certain different circuit arrangements gave definitely better results; definitely better in an audible manner, and not merely from a meter point of view. On one aerial in one certain locality there was considerable Morse interference on 2 L O, and this was definitely eliminated. On another aerial there was no interference and the arrangement that gave the loudest signals could be used. Which one was this? Well, it's not much good recommending it to you, for on your aerial some other arrangement might give even better results! By the way, you will note that in many of my diagrams I show the telephones and detector in the reverse order according to conventional practice. But you can easily change them over if you so desire; you will probably note very little difference, if any, in results.



The plugs from the 25-turn coil plug in at the back of the "socket" panel.

RADIO IN OTHER LANDS

It is estimated that one Canadian in every thirty has a wireless receiving set.

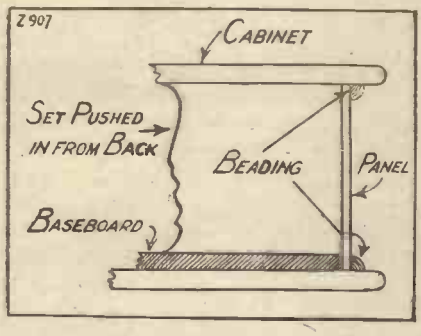
* * *

According to reliable statistics recently prepared, Germany exports more wireless apparatus than any country in the world except the United States.

HINTS FOR THE HOME CONSTRUCTOR

Cabinet Appearance

NEARLY all sets push into a cabinet from the front, and in this respect there are certain disadvantages. Firstly, if the fit is a bad one, it is only too obvious, and the appearance is consequently ugly. Then, again, a plain effect only can be



obtained with the panel edges flush with the wall of the cabinet.

A much better design, which overcomes the drawbacks mentioned, and also has the additional advantage of presenting a neat, artistic, and finished appearance, may be obtained by simply pushing the set in from the back of the cabinet instead, in the manner shown in the drawing. The cabinet it will be seen has a beaded overlap all round the panel area, which looks much better and also hides any slight panel misfit.

A.C. Circuit Characteristics

ENTHUSIASTS who, having A.C. mains, experiment with H.T. and L.T. eliminators, should not forget that A.C. current does not conform to quite the same laws as D.C. Calculations in the case of D.C. are very simple, for the three factors of pressure, current and resistance are of very definite natures. Ohm's law applies to A.C., but the three previously mentioned factors in this case are not quite so straightforward.

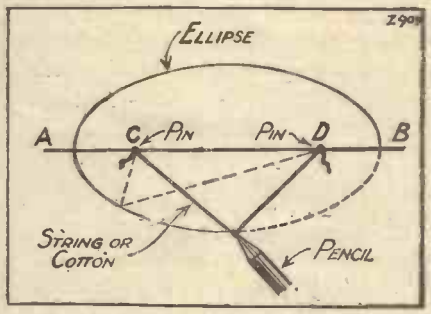
Alternating current is not one steady flow but a succession of complete reversals. The current first flows in one direction, rising from zero to maximum and falling again to zero, and then it flows in the other direction, repeating the same operations. Therefore, one has to take average voltages and average currents and these are referred to as Root Mean Squares. Two hundred and fifty volts R.M.S., for instance, means an average voltage of 250. The current flow in an A.C. circuit will depend upon the R.M.S. voltage and the impedance of the circuit, and not just the ohmic resistance as in the case of D.C. To the impedance of a circuit inductance, capacity and ohmic resistance all contribute. The simple formula is :

$$\text{Current} = \frac{\text{Voltage}}{\text{Impedance}}$$

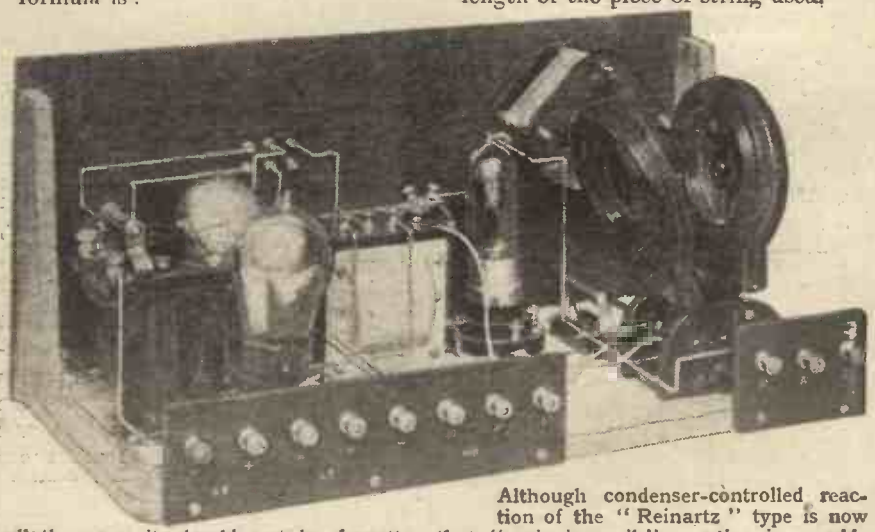
Impedance is expressed in ohms, but you must not confuse it with resistance. A circuit might have a D.C. resistance of 1,000 ohms, but an impedance of as much as 2,000 ohms, although there would have to be considerable inductance in the circuit in order to obtain this value.

Describing an Ellipse

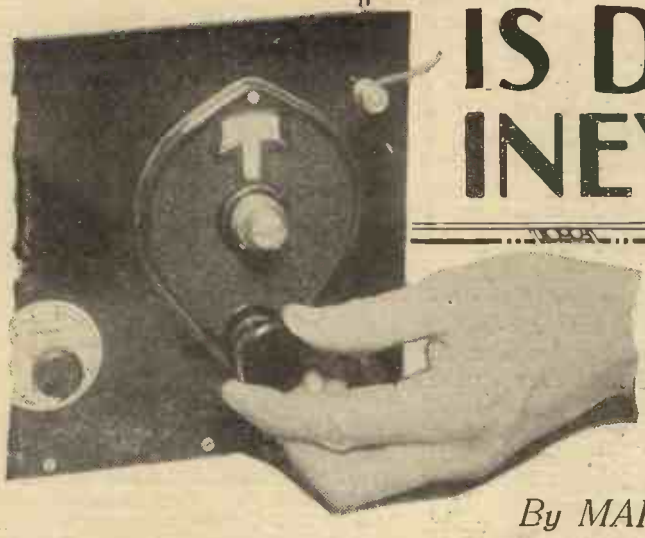
NOW that ornamental loud speakers having fretted fronts and flares are fashionable, it is advisable to know how to describe a geometrically true ellipse. A cut-out of this shape may be required for a cabinet front to match an artistic loud speaker, or perhaps the loud-speaker body is to be designed by the constructor himself. The diagram given shows one of the simplest ways



of making a perfect ellipse, to any dimensions, with great ease. First draw a line AB upon a piece of paper. Insert pins C, D, as shown, then describe the ellipse by means of a pencil guided by the piece of string placed as indicated. The size of the ellipse is governed by the distance between pins C and D, and also by the length of the piece of string used.



Although condenser-controlled reaction of the "Reinartz" type is now all the rage, it should not be forgotten that "swinging-coil" reaction is capable of giving extremely good results if a first-class coil holder is employed. In fact, many adherents of magnetic reaction affirm that "Reinartz" reaction never gives quite the "punch" associated with the older method illustrated above.



IS DISTORTION INEVITABLE?

"Much is often made of avoiding distortion in various small forms, while all the time much greater imperfections always exist which are seldom or never considered," says the author in the following very interesting article.

By MARCUS G. SCROGGIE, B.Sc., A.M.I.E.E.

IN the matter of high-quality broadcast reception there is a marvellous amount of straining at gnats and swallowing camels. To put it less figuratively, much of the discussion on amplifier couplings and

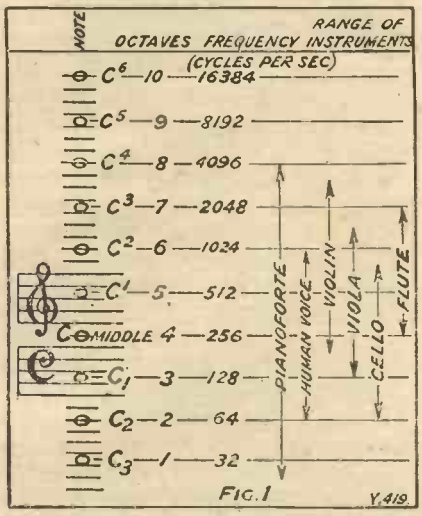


FIG. 1

other details of a receiver reveals a faulty sense of proportion. It is one of the many examples of over-attention to the means obscuring the ends. Let us get away from the mass of detail about distortionless transformers and tone-correctors for a few minutes to think about what we want to achieve.

True Reproduction Impracticable

If every link in the long chain of apparatus between the sounds created in the studio and those impinging on the ear of the listener were such as to operate equally at all amplitudes and frequencies, and arranged to deliver the reproduced sounds at the same intensity as the originals, and if the room at the receiver end were of the same size, shape, and acoustic character as the studio or public hall used for transmission, then conditions of reception would approximate very closely to the ideal.

These conditions are impossible, or at any rate impracticable. So at the start we have to be reconciled to a certain degree of imperfection. Going a bit farther, it will also be fairly obvious that if any one link in the chain of apparatus diverges from the perfect to the extent of, say, 50 per cent, then much toil and patience expended on smoothing out humps and hollows of 10 per cent in the characteristic of any other component is a sheer waste of time. Much is often made of avoiding distortion in various small forms, while all the time much greater imperfections always exist which are seldom or never considered.

Exaggerated Notes

The reader will probably at this stage vigorously demand to know two things. First, why, if these glaring imperfections are always present, can such pleasing results be obtained? Second, if the foregoing is true, what is the use of trying to improve things? The answer to the first lies in the fact that the ear, which

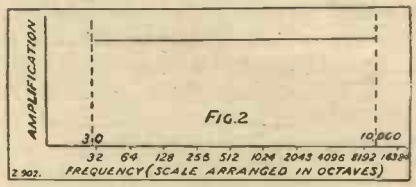


FIG. 2

is marvellously sensitive to changes of pitch, is a crude indicator of intensity.

Now broadcasting, unlike the gramophone, is incapable of interfering with the pitch of transmitted sounds, except by introducing spurious notes one or more octaves higher, which at least harmonise with the

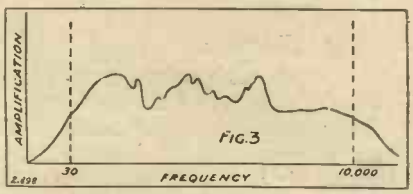


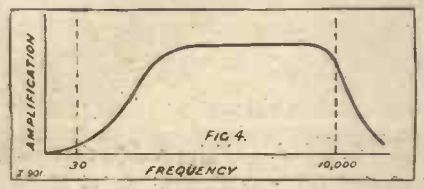
FIG. 3

genuine notes. The greater part of distortion consists in an exaggeration or suppression of certain parts of the musical scale. Which is not, of course, confined to music, but includes speech, atmospherics, and any other form of audible sound; that is to say, it is

The author states that when an orchestra is broadcast natural reproduction can only be achieved, first by eliminating the usual causes of distortion, and then reproducing the acoustic combinations of the studio or other place of origin.

the continuous sort of scale part of which can be covered by a trombone or violin, not the discrete scale of the piano (Fig. 1).

Fortunately, quite large variations in intensity or loudness, of the order of 30 per cent to 50 per cent, can occur before the ear is aware of it, and still larger irregularities fail to produce a seriously unpleasant effect. This can be demonstrated by switching over from an amplifier which is as

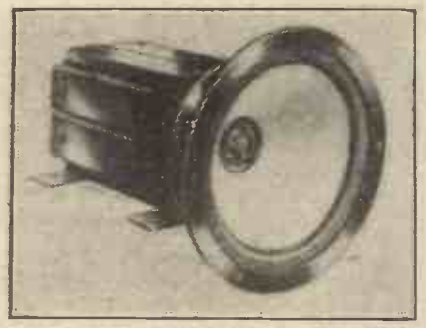


nearly as possible perfect to one which is characterised by some irregularity, the remainder of the apparatus being the same in each case.

The first can well be made to amplify all frequencies from 50 to 10,000 equally within 5 per cent (Fig. 2), while the latter is arranged to deal with part of the band of frequencies at double or half the strength of the rest, the overall intensity being, however, the same. It is a matter of fact that even a careful listener cannot in general decide with certainty which is which. It is clear then that a considerable departure from perfection is not incompatible with a pleasing result (Figs. 3 and 4).

Peculiar Effects

Distortion is generally considered to be a property of the receiver and loud speaker, though uncharitable people further extend its scope to the transmitting system. But distortion in its wide sense includes several effects which are less frequently considered. When listening to some music, either from loud speaker, gramophone, or the original, try putting your hand over your ear, leaving



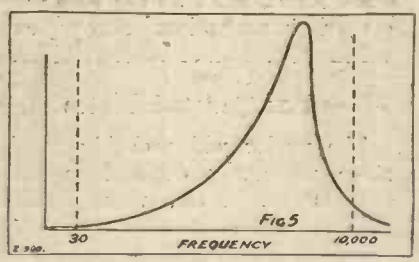
Here is the essential portion of a Rice-Kellogg moving-coil loud speaker, showing the large permanent magnets and the cone diaphragm. Very excellent reproduction is possible with such an instrument when coupled to an efficient and powerful receiver. (*B.T.H., Ltd.*)

an entrance between the thumb and first finger, forming a sort of porch or ante-room to the ear.

There will be a very noticeable alteration to the character of the sounds heard, and probably a certain note will always be much accentuated. That is to say, distortion is occurring due to acoustic resonance in the chamber formed by the hand. The same effect is present in every room, and the character of the reproduction from a loud speaker is largely determined by the room in which it is placed, and even by the position in the room.

A Simple Experiment

Another little experiment which most people have already tried is to go into a room (preferably a bathroom or other scantily furnished apartment) and sing or hum a note, beginning low down and going through every pitch up to the highest one can manage. At one pitch or frequency the sound is magnified owing to the room resonance. If a loud speaker were operated there, every time that particular note occurred it would be distorted by being intensified above the others. Various ornaments often act as resonators in a similar manner, and however successful one may be in obtaining a receiver with a "straight line" the final result will contain many irregularities depending on the surroundings.



Another fact which is easily verified by the listener is that the character of the sounds heard by two people in the same room may be, and usually is, entirely different. When the tuning note is being transmitted, turn it on good and hard, and wander about the room, preferably with one ear "plugged." It will be found that there are certain places, not necessarily far from the loud speaker, where the sound almost dies away. Moreover, by rapidly moving the uncovered ear from immediately in front of the speaker to the side of it, the general tone of the note will probably be noticeably altered.

The explanation of the first effect is that indoors sound reaching the ear arrives not only from its immediate source, but also in the form of reflected waves from the walls and, in fact, from all surfaces. Now sound waves are made up of alternate contractions and expansions of the air, somewhat

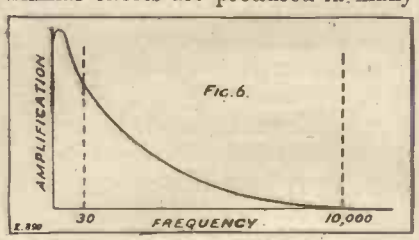
A small horn-type loud speaker of good make will do justice to the reproduction of a large number of the smaller sets on the market.

similar to the alternate raising and lowering of the surface of water when it is traversed by waves.

If one's ear happens to be so situated that the sound from one direction produces a compression of the air just at the moment when the sound from another direction produces an expansion, then the two effects will tend to neutralise one another, and, if they are equal, will destroy one another entirely. On the other hand, by moving the ear slightly a position will be found where they tend to assist one another, resulting in a loud sound.

Loud-Speaker Positions

This is a phenomenon very common in nature, and is known as interference or standing waves. Incidentally, it is the same thing as heterodyning. The importance of this effect is that in any position which the listener may adopt, some notes will be cut down and others accentuated, resulting in a form of distortion. Similar effects are produced in many



cases from the loud speaker itself, because the sound generated from one part of the diaphragm may be either assisted or counteracted by that from another part.

The change of tone noticed by moving to the side of the loud speaker depends on the fact that the tuning note, particularly if brought in very

strongly on a set with inadequate H.T., contains harmonics or overtones, which are notes of higher pitch than the main note. At the side of a loud speaker the main note is heard strongly, as the low tones tend to travel round to the back, whereas the high notes are projected straight ahead by most forms of reproducer.

Unequal Increase

We are not nearly finished yet. If one has a coil-driven loud speaker, or some other type which is capable of reproducing a wide range of musical pitch, and an amplifier with which it is possible to work it at considerable intensity without overloading, it is instructive to tune in a symphony orchestra or military band gradually. When it is still faint, probably only the higher-pitched instruments—violins, flutes, etc.—will be prominent.

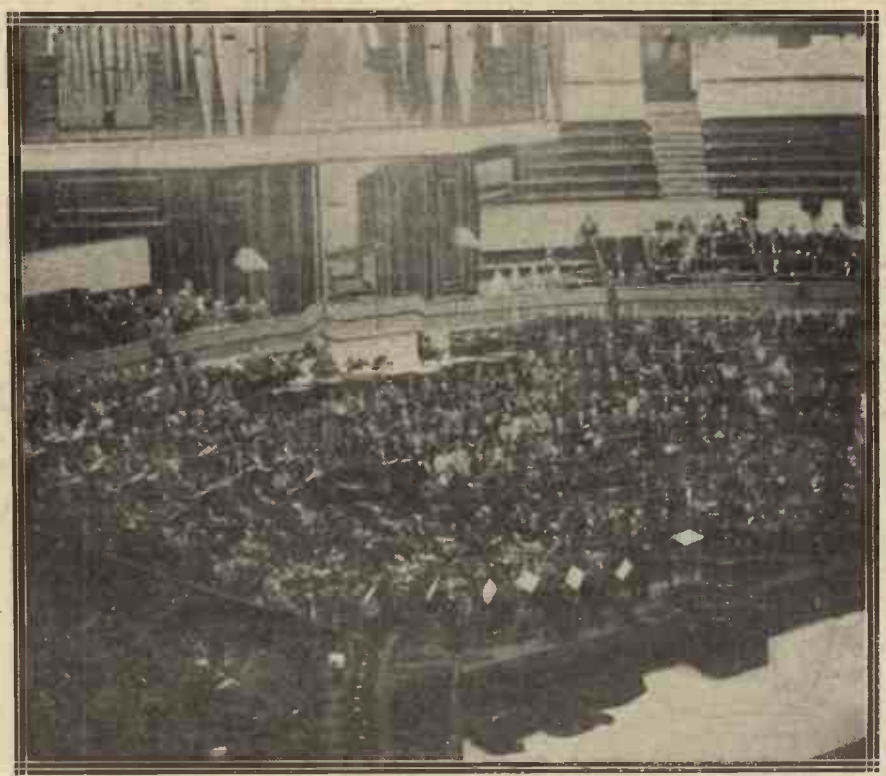
Plucked double basses and the boom of tympani will not appear to any extent, though they are being played. When the music is being reproduced at an intensity comparable with the original, this state of affairs is entirely altered, and it will not be merely a case of proportional magnification like a map drawn to a different scale or an enlarged photograph, but the whole balance of the music will be different. If this test is not available, one can listen to a band in the park from different distances, or to a piano, first from another room and then by putting one's head inside it. To sum up, one cannot hope to obtain a true reproduction to any desired scale, but it must be at approximately the same intensity as the original.

Consider, again, what happens when the receiving set is in the same room, or perhaps even in the same box as the loud speaker. With antiphonic valve holders and modern valves one is seldom now bothered with the howling set up by the effect of the sound from the speaker striking the valves, but the effect is usually present to some extent short of actually causing a continuous hum. The note it is trying to howl at will be emphasised every time it occurs; again a form of distortion.

Electrical Distortion

The foregoing deals with acoustic distortion. But there are unsuspected forms of electrical distortion. An amplifier may be ever so perfect, considered by itself, but its performance is entirely altered if the H.T. battery or its equivalent possesses appreciable resistance. As little as 100 ohms may have a profound effect (Fig. 5).

It is not possible in a small space to go into a full explanation, but it may be briefly stated that any resistance, or more correctly, impedance, which is common to the anode circuits of two or more valves in an amplifier, alters the amplification to an extent which depends on frequency, thus modifying to a greater or less extent the claim of the apparatus to give true results. The effect is diminished by the use of a large fixed condenser (several microfarads) across the H.T. terminals of the receiver, but is not by any means abolished. An H.T. accumulator possesses the merit that its resistance is negligible.



This photograph shows the Halle Orchestra and Chorus at the Albert Hall on the occasion of an historic B.B.C. broadcast. You could not expect really natural reproduction of such a broadcast in a small drawing-room.

Small dry cells are a frequent source of trouble, and may even couple the stages sufficiently to cause audible oscillation. Some "Battery Eliminators" produce the most irregular effects of this nature; for example, the low frequencies may be reduced and certain high notes super-amplified, or by reversing a transformer or adding another resistance coupling the opposite is likely to occur, perhaps to the extent of "motor-boating" or oscillating at a very low frequency.

The demand for selectivity has also led to a type of distortion which cuts off the high notes. The sort of receiver which is proudly claimed to be able to bring in at will station after station without mutual interference is the offender in this respect. The largest interval of frequency between two consecutive stations in the European broadcast gamut is 10,000 cycles.

Side-band Cut-off

This means that a selective receiver must give practically zero intensity 5,000 cycles off tune, and with normal designs where the number of tuned circuits does not exceed three such a receiver will give a serious cut-off above about 2,000 cycles; in other words, the high notes will suffer. When the selectivity is obtained by a single circuit forced as far as possible with reaction, conditions are worse still. (Fig. 6).

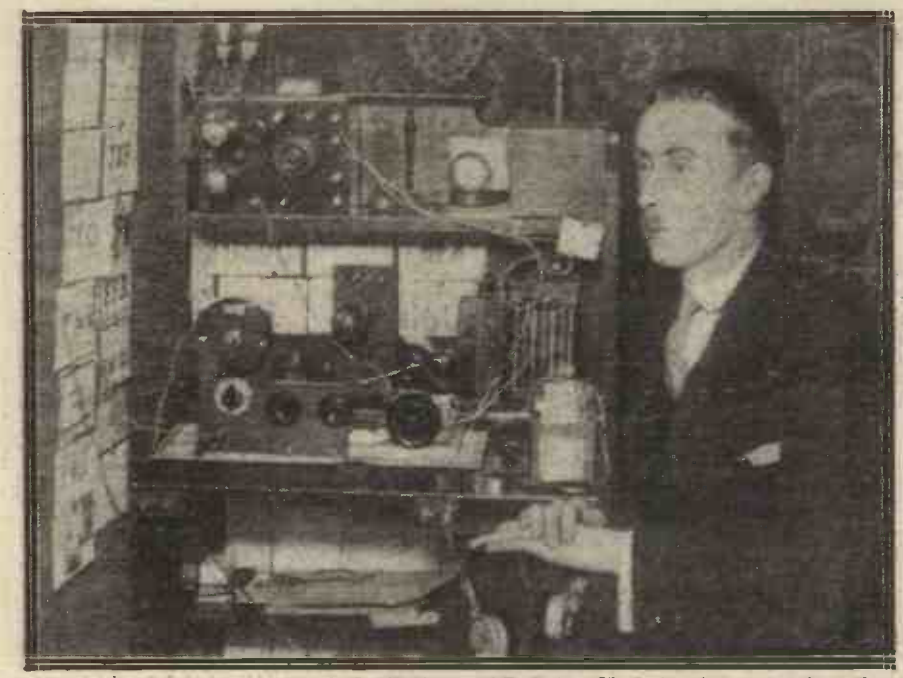
Anode-bend rectification has acquired a reputation for abolishing distortion, while the conditions for applying it have not been given equal prominence. If the amplitude of the "signals" (relic of telegraphy practice!) applied to the detector (or rectifier) valve is weak, then not only will anode-bend rectification be inefficient, but it will tend to favour loud sounds to the disadvantage of weaker ones, particularly in heavily modulated telephony.

To obtain satisfactory results with anode-bend the input should be large, and the best way of securing this is to use an L.F. amplifier of low magnification—one good stage, say—so

that one is bound to bring up the H.F. magnification to get the volume. Fortunately, screened valves have abolished any excuse for not being able to get plenty of H.F. amplification; any other system need hardly be given consideration now.

Many Bad Receivers

These are some of the sources of distortion found in most receiving sets, and the enumeration of them should serve to shake, if not to destroy, the illusions of any who suppose that they are obtaining "distortionless" reproduction. The fact that the acoustic forms of distortion are present when a concert is heard direct in a hall will rob them of terror as far as the radio designer is concerned.



This well-known amateur, Mr. C. C. Mortimer, of Bromley, Kent, has been experimenting with a buried aerial. Stations working on short waves in America, India, and Japan have been received comparatively free from atmospherics on a wire which is buried 3ft. below the ground.

It is only necessary to avoid very gross blunders, such as standing the loud speaker on or near something that rattles or inside a box with a pronounced resonance. The object in discussing this part of the matter has been to demonstrate that meticulous care in ensuring perfection at any one point is not profitable, as the ear is not at all troubled by relatively large liberties taken with the sounds on their way to it.

And now to deal with the other matter—why should one strive to effect improvements at all? The answer is that even at this date many receivers distort to such an enormous extent, expressed in actual figures, that even the tolerant ear cannot fail to notice that something is wrong. It may sound a sweeping statement, but it is one which it would be difficult to disprove, that the vast majority of broadcast receivers if adjusted to give a reasonably ample volume would cruelly overload the last valve.

Barring exceptional arrangements it may be said that, even in small rooms, anything less than 150 volts on the anode of the last valve is inadequate. To give the volume obtainable from the latest models of gramophone with an electrically cut record, something like 400 volts (or, alternatively, a number of power valves in parallel) is required, even if a moderate amount of overloading is tolerated. This can be verified by actual measurement. Yet many people try to do it with 60 volts. It is no use discussing the mote of "resistance or choke coupling" while the beam of overloading blocks one's auditory sense.

Those Straight "Curves"

Given that the apparatus is capable of handling the broadcast without overloading, we can now examine the curve showing response to the frequency scale. It looks nice in advertisements to see a horizontal line drawn dead straight from 50 to 10,000 cycles to express the performance of the gear to be sold, but, as has been pointed out, that is a refinement the ear cannot appreciate as well as the eye.

Roughly speaking, if no frequency between the above limits drops in strength below half the maximum, then the best loud speaker will fail to do justice to such an excellent set, and, if it did, one would not be much the wiser. The early types of inter-valve transformer were responsible for some frequencies dropping to a negligible proportion of the maximum, and the improvement effected here is obvious on making a change-over test. But the defects of certain modern transformers are so slight as to make self-deceivers of those who suppose they are getting materially purer reproduction by the use of other couplings.

Watch the H.T.

The H.T. supply distortion which has been described is enough to play havoc with the best amplifiers, and is certainly of practical importance with more than two L.F. valves (including the detector) unless H.T. accumulators or large capacity dry batteries are used.

As regards the selectivity distortion, unimpeachable quality is not usually expected with the long-range type of set, and certainly is not obtained with the present chaotic state of broadcasting in Europe. Nevertheless, the moral for those who want distance is to use an ample number of H.F. valves, and so obtain a type of tuning which combines selectivity with a reasonably even response to audible frequencies.

The subject being dealt with thus broadly, it has not been possible to discuss individual matters in detail, but the object has been to clarify the conception of good quality reproduction in general, and to advocate the consideration of the matter as a whole rather than piecemeal. It is then possible to discover the directions in which effort is likely to be worth while.

DO YOU KNOW THAT—

The only satisfactory way of choosing a loud speaker is to hear it working upon your own set.

The old-fashioned plan of reversing L.F. transformer connections is often very effective in reducing the hum due to an H.T. battery eliminator or a mains unit.

Time-signals are now sent out from the Rugby high-power station on 18,740 metres at 10 a.m. and 6 p.m. daily.

The "RADIO-GRAM" FOUR

A super-set for the man who wants good loud-speaker signals with a minimum of trouble. It includes arrangements for using a "pick-up" so that electrical reproduction of gramophone records can be carried out as an alternative to broadcast reception.

By A. JOHNSON-RANDALL.

I HAVE often been asked what I consider is the most useful de-luxe type of receiver suitable for alternative programme reception anywhere in the British Isles.

Now, it is evident that one of the essential features of such a receiver must be high-quality reproduction.

Since the set is to be of the de-luxe type it is necessary for its capabilities to be of a standard sufficiently high to enable it to be used with loud speakers of the moving coil variety.

Then there is the problem of the high-frequency side. If the receiver is to be employed mainly for the reception of regional transmissions simple tuning and perfect stability is a necessity. In addition considerable H.F. amplification is very desirable, because one of the most common causes of distortion is an inefficient H.F. valve, or a detector with reaction pushed up to the limit.

If the H.F. stage is being operated near the point of self-oscillation in an endeavour to obtain adequate volume no adjustment of the low-frequency stages will prevent distortion.

High Quality

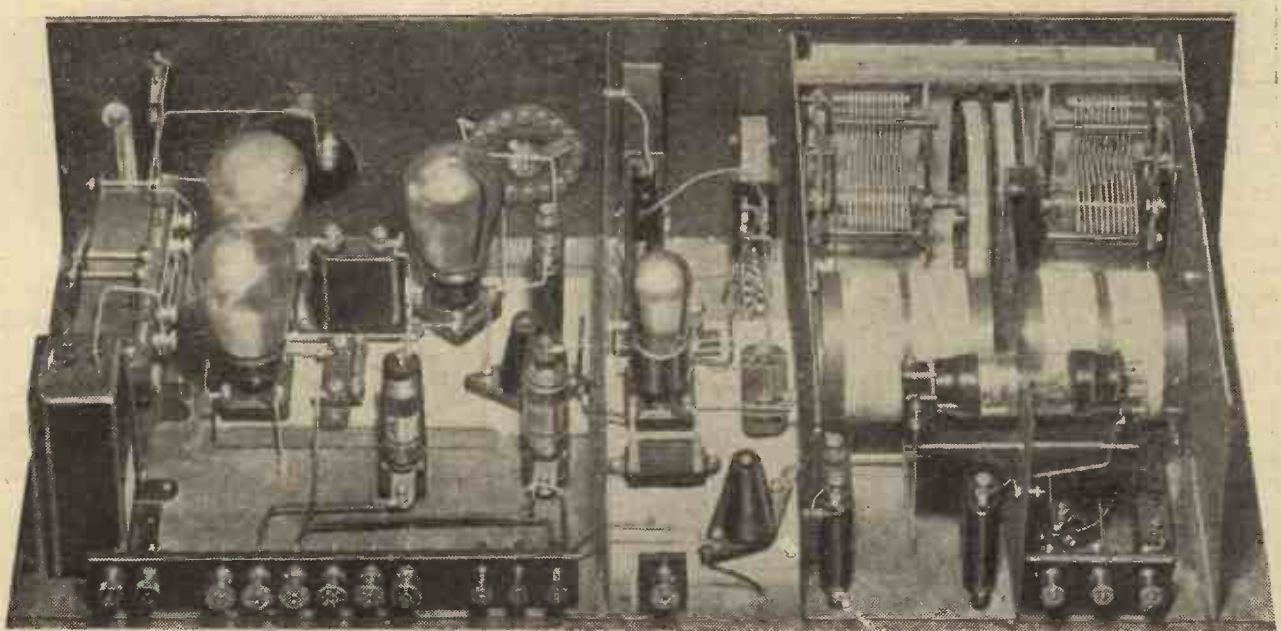
Therefore in designing this receiver I had in mind the requirements of the music lover rather than those of the long-distance enthusiast.

Signal strength has deliberately been sacrificed for purity and ease of handling. The set, as a matter of fact, is practically a Chinese copy of an experimental receiver which I use consistently for the reception of 2 L O and 5 G B at my house in Kent, fifteen and a half miles south-east of 2 L O.

Results Obtainable

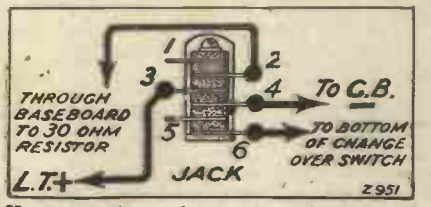
The receiver, as described, will give loud-speaker results on 2 L O and 5 G B, using a rather inefficient indoor aerial consisting of a couple of lengths of frame-aerial flexible wire stretched across the drawing-room. On the ordinary outdoor aerial the volume is overpowering. Using a 2-ft. frame, the set will just operate a moving-coil loud speaker, but, of course, not at full strength.

The circuit is shown overleaf, and, as can be seen, consists of one stage of H.F. employing a screened-grid valve, an anode rectifier and two stages of resistance-capacity-coupled low-frequency amplification. In my experimental work on reproduction I



This back-of-panel view of the completed receiver shows the carefully planned layout. Note particularly how the screening is arranged around the dual condenser. It is essential to adhere very closely to specification at this end of the set if perfect stability is to be obtained.

have tried out various forms of high-frequency amplifiers. The popular neutralised valve magnifier can be very satisfactory, provided great care is taken to eliminate stray effects which may produce feedback, and assuming that the inter-electrode



Here are the various connections to the gramophone jack contacts.

capacity of the valve itself is perfectly neutralised. The slightest trace of feedback, either in the valve itself or in the leads or batteries, tends to produce instability and quality frequently suffers.

"Grid-Losser" Circuits

In addition, the magnification per stage is not very high unless special precautions are adopted, such as, for instance, the use of carefully designed Litz-wire coils. These, moreover, by reason of their extremely low H.F. resistance do not help matters from the point of view of quality. Reaction can be used to boost up the signals but only to the detriment of reproduction.

Alternatively, there is the parallel-feed scheme employing a tuned-grid circuit and a grid-losser operating on the aerial circuit. This has been employed in various circuit arrangements suggested by the B.B.C. and is quite satisfactory, giving good stability and ease of handling, but unfortunately the magnification is small. Using this arrangement I have found difficulty in obtaining adequate volume from 5 G B in a set employing five valves.

One of the experimental receivers I had in use needed three L.F. stages before it would give anything like the necessary strength.

Even so, the results on an indoor aerial were hopeless.

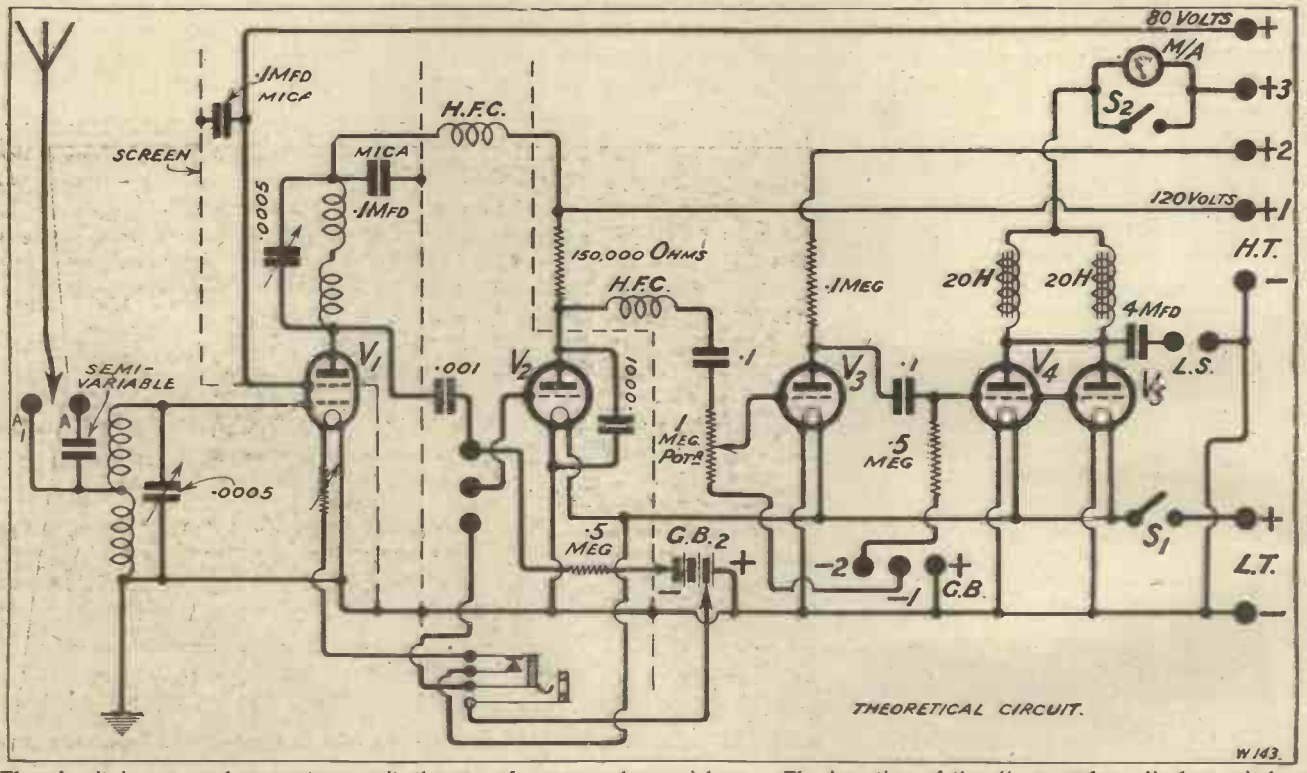
With the advent of the tetrode (screened-grid valve), however, this problem of obtaining adequate and stable H.F. amplification has become relatively easy to overcome.

ORIGINAL COMPONENTS

1 Panel 26 × 7 × ¼ in. (Peto-Scott).
1 Baseboard 26 × 11 × ⅜ or ½ in.
1 Copper floor, 26 × 11 in. (24 gauge copper).
4 Copper shields to dimensions given.
4 1-mfd. mica condensers (Dubilier).
1 Drum-control twin condenser with screen (Cyldon).
2 H.F. chokes (Burne-Jones Co.).
1 Formodenser ·00015-·0005 (Formo).
1 Screened-grid valve holder (Collinson).
1 ·001 fixed condenser (Dubilier).
1 ·0001 fixed condenser (Dubilier).
1 Jack, type P66 (Igranic).
1 Telephone plug (Igranic).
1 D.P. change-over switch (Burndept or Wilkins & Wright). (See text).
2 Dumetohm holders, etc. (Dubilier).
2 5-meg. grid leaks (Lissen).
2 20-henry chokes (R.I.-Varley).
1 Mansbridge type 350-volt, 5-mfd. condenser (Dubilier).
1 Grid-battery holder.
2 On-off switches (L. and P.).
1 0-50 milliammeter (Weston).
1 150,000-ohm anode resistance (R.I.-Varley).
1 100,000-ohm anode resistance (R.I.-Varley).
1 30-ohm baseboard rheostat (Lissen).
4 Valve holders (Bowyer-Lowe).
1 1-meg. potentiometer (General Electric Co.).
15 Terminals, and ebonite for terminal strips.
2 Angle brackets (Burne-Jones & Co.).
Some 6 B.A. terminals, tinned copper wire, and soldering tags.
Note.—The makes actually used are given above. See note elsewhere.

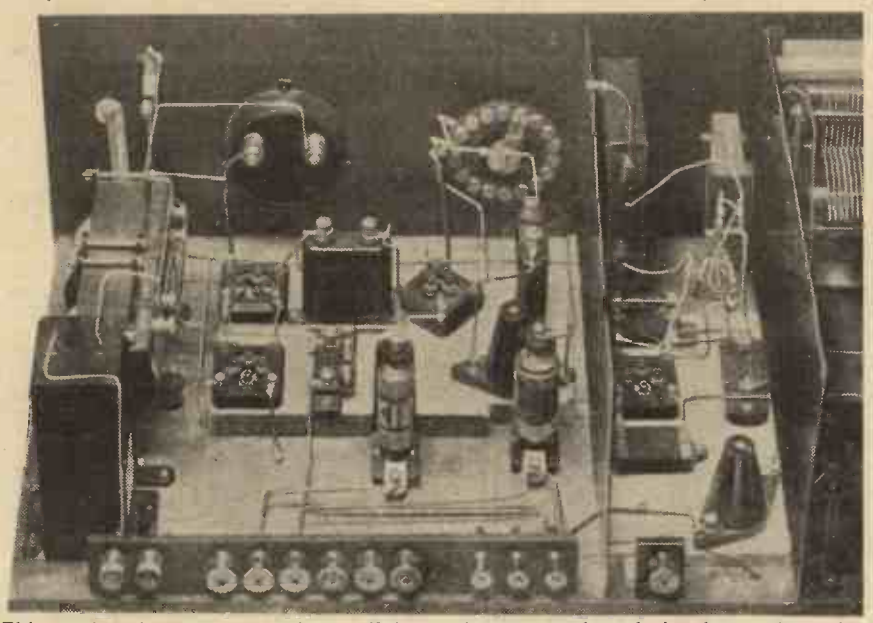
The Coils

The first valve in the circuit described is therefore a tetrode, circuit tuning being carried out with the aid of a centre-tapped aerial coil and ordinary straightforward tuned-anode. The coils themselves are of the Round



The circuit is arranged so as to permit the use of a gramophone pick-up. The insertion of the "gramophone" plug switches out the H.F. valve, and with a simple movement of the change-over switch the detector valve becomes an additional L.F. stage.

astatic type, and the method of making them was fully described in my article entitled, "Easily Made Astatic Coils," and published in the December issue of this journal. Normally I use two sets of coils. Those for maximum sensitivity are exactly as described in the above article, being wound with Litz. The other set I use purely for the local transmissions and I employ solid wire wound on 2-in. diameter formers. I shall give details of these windings later on in the article.



This receiver incorporates a highly efficient volume control, and signals can be varied from a whisper to maximum strength in a moment.

Two aerial terminals are provided. A_1 going direct to the centre tapping on the aerial coil, and A being joined to the centre-tap through a Formodenser. By adjusting this semi-fixed condenser selectivity may be increased and, in addition, one may balance up the condenser drum readings fairly easily.

By-Pass Condensers

In the anode circuit the usual H.F. choke and by-pass condensers serve to prevent battery coupling effects which might produce instability. You will note that I have used ·1-mfd. mica condensers for by-pass purposes. I have done this because I prefer to employ this type of condenser whenever H.F. currents have to be by-passed; but at the same time ·25-mfd. Mansbridge condensers can be used as satisfactory alternatives, with a slight sacrifice of insulation resistance.

The detector valve is an ordinary anode rectifier, but it is connected to a jack and change-over switch, so that a gramophone pick-up can be used, if desired.

The operation is as follows: The pick-up transformer is joined to a telephone plug. Upon the insertion of the plug into the jack the H.F. valve is automatically switched out. Changing over the panel switch connects the jack to the grid of the detector valve and alters the grid bias, the valve now being in a position to operate as a low-frequency amplifier.

The L.F. Side

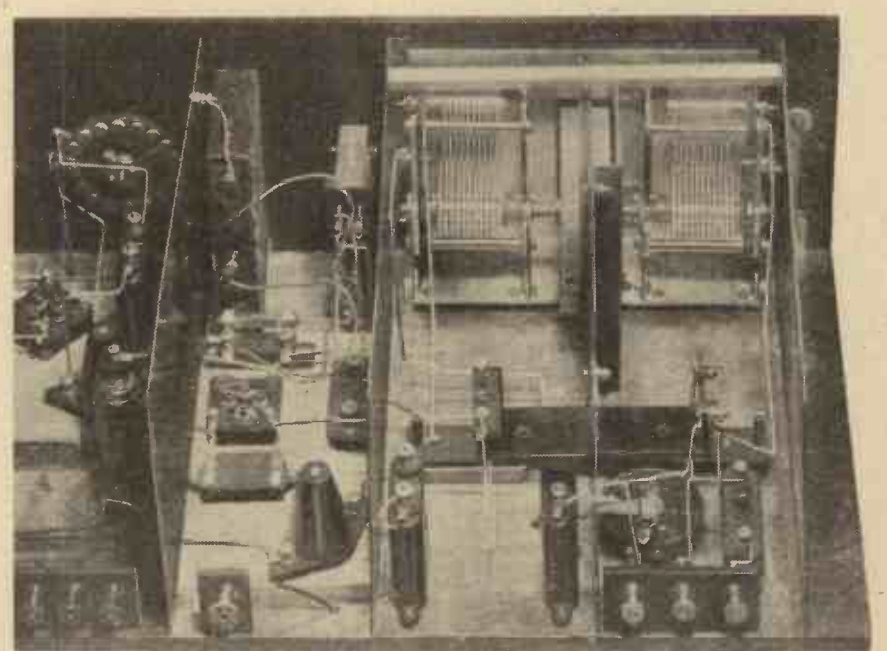
Then comes the low-frequency side of the set. Straight resistance coupling is employed, and I use this method because you do know where you are, whereas with transformers one's choice of suitable instruments is very limited and the arrangement is not so fault-proof. The anode resistance in series with the detector has a value of 150,000 ohms, and I chose this comparatively low value because if one goes much higher the amplification of the upper musical frequencies begins to fall off. This effect is increased by the use of the small condenser between the anode and L.T. negative. Therefore its value should not be greater than ·0001 mfd. In the second stage I have employed a resistance of 100,000 ohms, and I do not recommend any increase in this value.

Volume Control

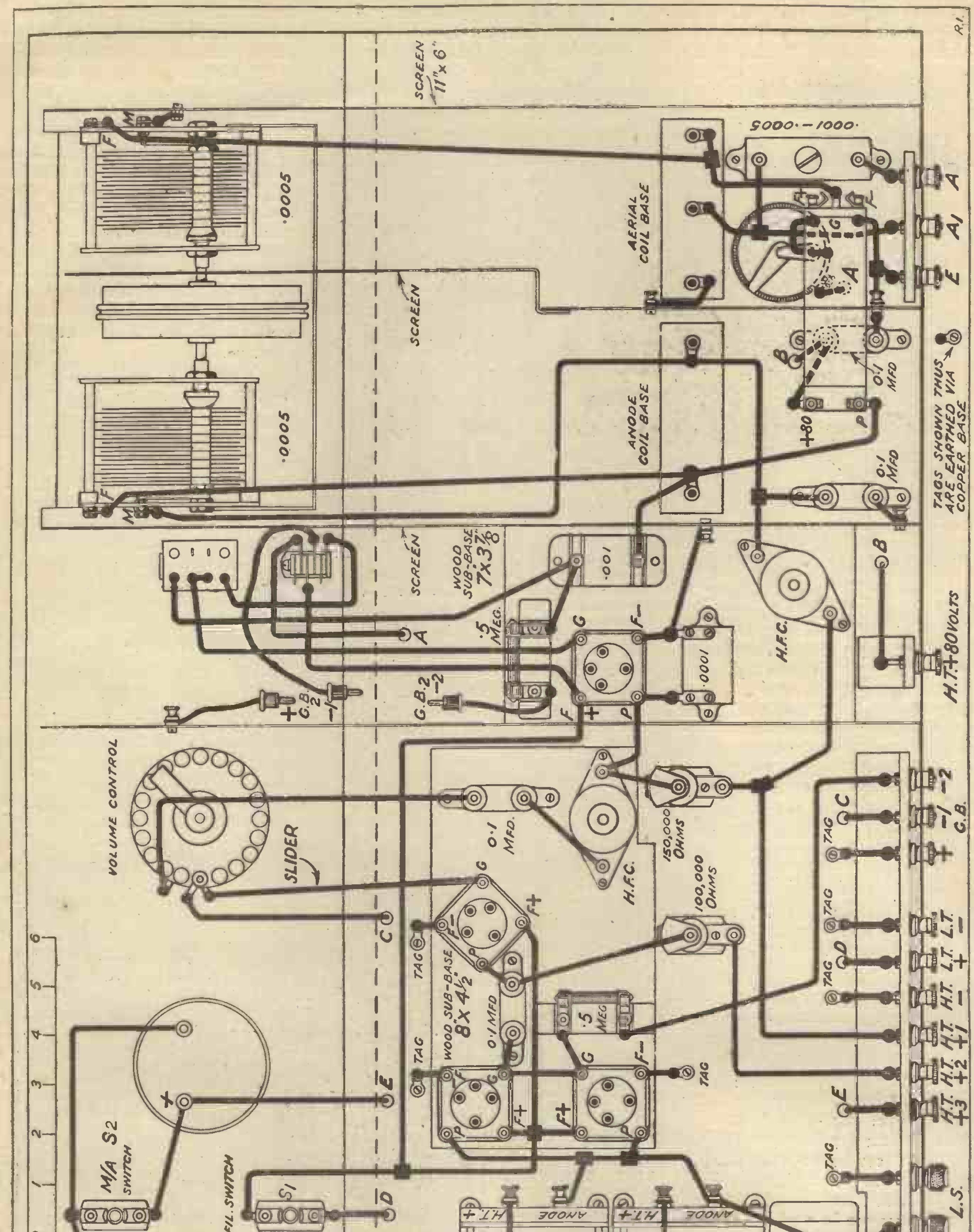
The reasons are, firstly, because of the danger of the upper musical frequencies being weakened, and, secondly, owing to the fact that a low-resistance valve may be used in this position if signals are very strong. With the values given the frequency characteristic should be pretty flat in the neighbourhood of 4,000–5,000 cycles.

Control of volume, without introducing distortion, is provided for by the high-resistance G.E.C. potentiometer operating on the grid of the first L.F. valve.

One is thus enabled to tap off any desired proportion of the total available voltage across the resistance, and quality does not suffer because the value of the grid resistance itself is constant the whole time. In practice the device is highly satisfactory and



The detector valve is placed in a separate compartment, which includes the gramophone switching device and the detector grid battery. Make quite sure that there is clearance between the body of the jack and the baseboard screening.


SCREEN 11"x6"
SCREEN
·0005
·0005
AERIAL COIL BASE
ANODE COIL BASE
0·1 MFD
TAGS SHOWN THUS ARE EARTHED VIA COPPER BASE
WOOD SUB-BASE 7X3⅞"
·001
·5 MEG.
·0001
H.F.C.
H.T.+80 VOLTS
G.B.2 -2
VOLUME CONTROL
SLIDER
0·1 MFD.
150,000 OHMS
100,000 OHMS
WOOD SUB-BASE 8X4½"
0·1 MFD
·5 MEG
TAG
G.B.
L.T. -
L.T. +
H.T. -
H.T. +1
H.T. +2
H.T. +3
L.S.
M/A S2 SWITCH
FIL. SWITCH
S1
ANODE
H.T.+
20 HENRIES
4 MFD

it is surprising that the scheme is not more widely adopted. The potentiometer incorporates stud contacts and

A neat and simple panel appearance has been retained in spite of the versatility of the set

is quite noiseless. The second grid resistance has a value of ·5 meg., and this, in conjunction with a ·1 coupling condenser, will give all the bass required.

Output Chokes

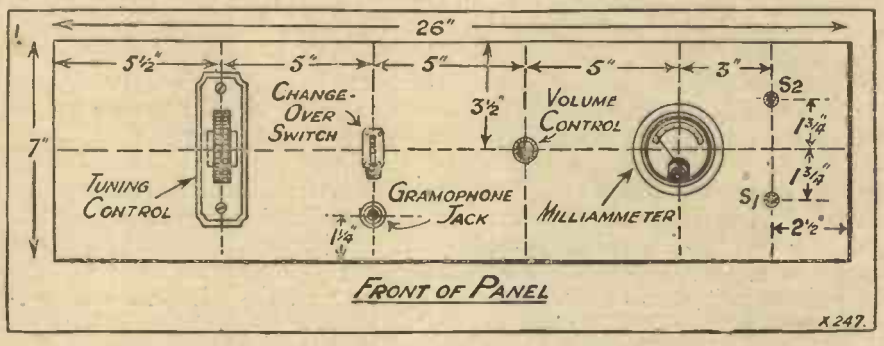
In fact, if considerable volume is being handled one might even try a ·25-meg. grid resistance, since the danger of blocking the grid condenser, due to a momentary flow of grid current, is minimised. The lower value will reduce the bass a little, but using a moving-coil loud speaker I have been unable to detect the difference in quality aurally, and, if anything, I prefer the lower values.

The last stage consists of two valves in parallel, and in view of the fact that some readers may wish to pass a current of 40 milliamperes or so I have placed two R.I.-Varley chokes in parallel. Readers will appreciate the fact that as the anode current increases the voltage drop across the choke also increases, and in addition the inductance value of the choke falls fairly rapidly. By placing two chokes in parallel the voltage drop is halved and the inductance value at 50 milliamperes is 12 henries, a higher figure than would be the case if only one choke was used. If the current to the valves is low, say, only about 20-25 milliamperes, one choke only can be employed. It depends upon the use to which the set is to be put.

Baseboard Screening

So much for the circuit, and now for details of the actual construction. The baseboard has on its underside two ⅛-in. battens, to give clearance for the wiring which is taken through and underneath it. These battens can be obtained from Messrs. Hobbies, Ltd., of Holborn, London.

The floor of the baseboard is covered with a sheet of 24-gauge copper, the copper sheet running the whole length of the baseboard. All L.T.—, G.B.+ and H.T.— leads go direct to this metal sheet, which is thus at earth potential, and helps in statically screening certain leads.



POINT-TO-POINT WIRING.

Join L.T.— terminal to soldering tag on metal floor.

Take L.T. + connection from terminal on strip through baseboard to "on-off" switch.

Other side of "on-off" switch to F+ of L.F. valve holders, to F + of detector valve holder, and to contact 3 on jack.

Take lead from contact 2 on jack through baseboard to baseboard resistor. Other side of resistor goes to F+ on screened-grid valve holder.

Join A to one side of Formodenser.

Other terminal of Formodenser to centre socket of aerial-coil base.

Join A_1 to same socket.

Join G of screened valve holder to outside socket of aerial coil base and to fixed vanes of aerial tuning condenser.

Join moving vanes to screen. Join earth terminal to screw on screen and F — on screened valve holder. Remaining aerial coil socket to screen.

SECOND COMPARTMENT.—Join anode of screened-valve holder to side of anode coil holder nearest third screen and to fixed vanes of H.F. tuning condenser, and also through third screen to one side of ·001 grid condenser of detector. Join moving vanes of H.F. condenser to other side of anode coil holder, to one side of ·1-mfd. condenser nearest third screen, and through the screen to one side of first H.F. choke.

Other side of ·1-mfd. condenser goes to terminal on screen.

Connect one terminal on ·1-mfd. condenser nearest second screen to terminal on screen.

Other terminal on this condenser goes to terminal on screened valve holder for inner grid and through baseboard to H.T.+ terminal.

THIRD COMPARTMENT.—Join remaining terminal on ·001 fixed condenser to one side of Dumetohm holder and to top contact of change-over switch. Join a flexible wire to other side of Dumetohm holder for G.B.2 for detector.

Join two centre contacts of change-over switch together and to G of detector valve holder.

Join bottom contact of switch to bottom contact (No. 6) on jack.

Connect P on valve holder to one side of ·0001 fixed condenser and through fourth screen to one side of second H.F.C. and to top of 150,000-ohm resistance. Join other side of ·0001 condenser to F— on detector valve holder and to terminal on screen.

Join remaining terminal on first H.F.C. to bottom of 150,000 resistance and to H.T.+1 terminal.

Take G.B.2.,—1 lead for detector when used as gramophone L.F. valve to contact 4 on jack. G.B.+2 le d goes to screen.

Join other side of second H.F.C. to one side of first ·1-mfd. coupling condenser. Other side of coupling condenser goes to top contact of volume control. Moving arm of volume control goes to grid of first L.F. valve holder.

Bottom contact of volume control is taken through the baseboard to G.B.—1 terminal on strip.

G.B.+ terminal is joined to tag on metal floor.

P of first L.F. valve holder goes to one side of second ·1-mfd. coupling condenser and to top of 100,000-ohm anode resistance.

Bottom of 100,000-ohm anode resistance goes to H.T.+2.

F— on first L.F. valve holder goes to tag on metal floor.

G.B.—2 is joined to one side of second Dumetohm holder. Other side of Dumetohm holder goes to the grid terminals of the paralleled valve holders, these two terminals being joined together, and to remaining side of second ·1-mfd. coupling condenser.

F— terminals on these two valve holders are joined to metal floor.

The two P terminals are joined together and to anode terminals on both 20-henry chokes. The two F+ terminals are also joined together.

H.T.+ terminals on 20-henry chokes are joined together and to one side of milliammeter switch, thence to terminal on milliammeter not marked +.

Other side of m/a switch goes to + terminal on milliammeter, thence through the baseboard to H.T.+3.

H.T.— is connected to tag on metal floor.

Anode terminals of 20-henry chokes are joined to one side of 4 mfd. condenser. Other side of condenser goes to L.S. terminal. Other L.S. terminal is joined to tag on metal floor.

Now, the satisfactory functioning of the screened-grid valve involves a certain amount of shielding. In the receiver the main shield is that upon which the valve itself is mounted, since it also acts as a screen between the H.F. valve grid and anode circuits. The two halves of the tuning control are statically screened from each other, this screen being supplied with the condenser.

The Shields

Attached to this screen is the shield upon which is mounted the valve. The photographs will show how the shield is arranged. You will see that almost at the point of attachment to the condenser screen the shield is bent at right angles so as to bring the partition as nearly as possible midway between the two halves of the condenser. I was forced to do this owing to the difficulty of getting a drum-controlled condenser having a static screen between the two drums. The bottom of the copper partition must be bent at right angles along its length to enable it to be attached to the baseboard. On each side of this main partition or shield are two simple screens. If you inspect the photographs you will see that the aerial and anode coils together with the tuning control are practically enclosed in a metal screen.

For instance, the front of the drum condenser is of metal and is attached to the main shield. The main partition or shield also makes electrical connection with the copper floor, and if a back and lid were employed, the screens would really become metal boxes. Such elaborate shielding, however, is in this case not necessary. The screens on either side of the coils tend to balance up any slight loss of inductance due to the cutting of the coil magnetic field with the screen and help to make the matching easier. (This loss of inductance is very small owing to the restricted field of the astatic coils.)

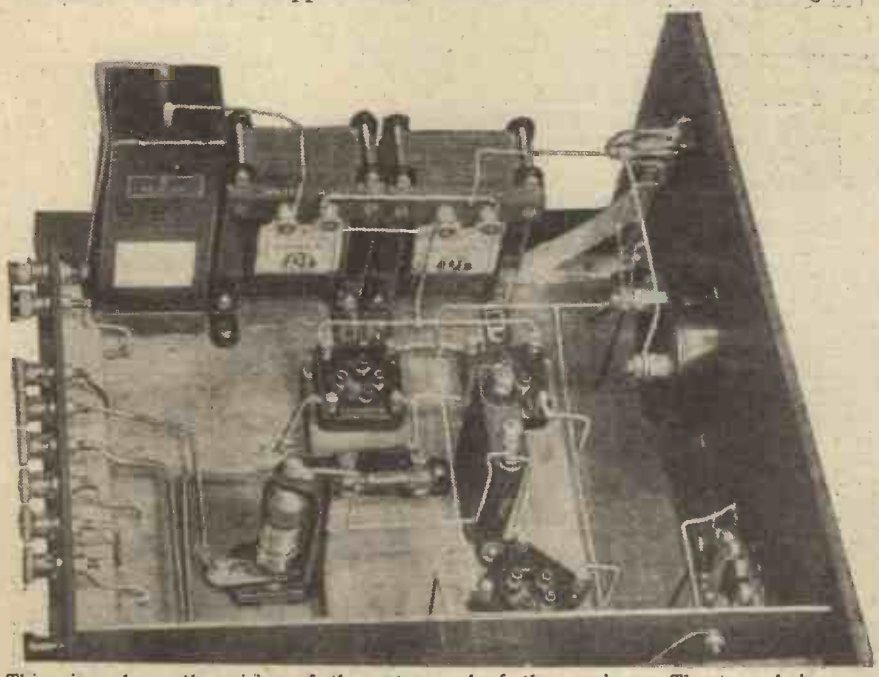
The third screen also acts as a static shield between the H.F. and detector wiring. In addition a fourth screen shields the detector portion statically from the L.F. side. These screens can be obtained from Messrs. Burne-Jones & Co., Ltd.

An Important Point

These screens all have certain leads passing through, and I think the best and simplest method of insulating them is to employ high-grade Systoflex, which can be slipped over 16- or 18-gauge round tinned-copper wire. The two coil bases are mounted on short lengths of $\frac{3}{8}$-in. thick wood in order to keep the valve sockets and wiring away from the metal floor.

In addition the series resistor in the positive filament lead of the screened-grid valve should be well insulated from the copper baseboard. This is very important, since failure to carry this out properly will short-circuit the L.T. battery, which has its negative lead connected to the screens. The components in the detector screen are also mounted on $\frac{3}{8}$-in. plywood. On the L.F. side certain components are mounted on a $\frac{1}{2}$-in. sub-base, but this is not necessary in the case of the two anode resistances, the output chokes, and the 4-mfd. output condenser.

The various details can be clearly seen from the photographs. These wooden sub-bases are screwed down to the main baseboard with ordinary wood-screws, but it is, of course, necessary first to drill through the copper floor. I am afraid that this continual drilling through the metal floor will be found a little tedious, but it is well worth while to make a good workmanlike job.



This view shows the wiring of the output end of the receiver. The two chokes are connected in parallel in order to minimise any risk of distortion occurring due to heavy anode currents.

I feel that it is unnecessary to go into the construction in great detail, because the photographs and drawings show the construction more clearly than I can describe it.

With regard to the panel drilling, this is not half so difficult as might appear at first glance.

The Cyldon condenser, for instance, is supplied with a template, and it is fairly easy to mount it.

I used a fretsaw to cut the hole through which the drum projects.

Drilling the Panel

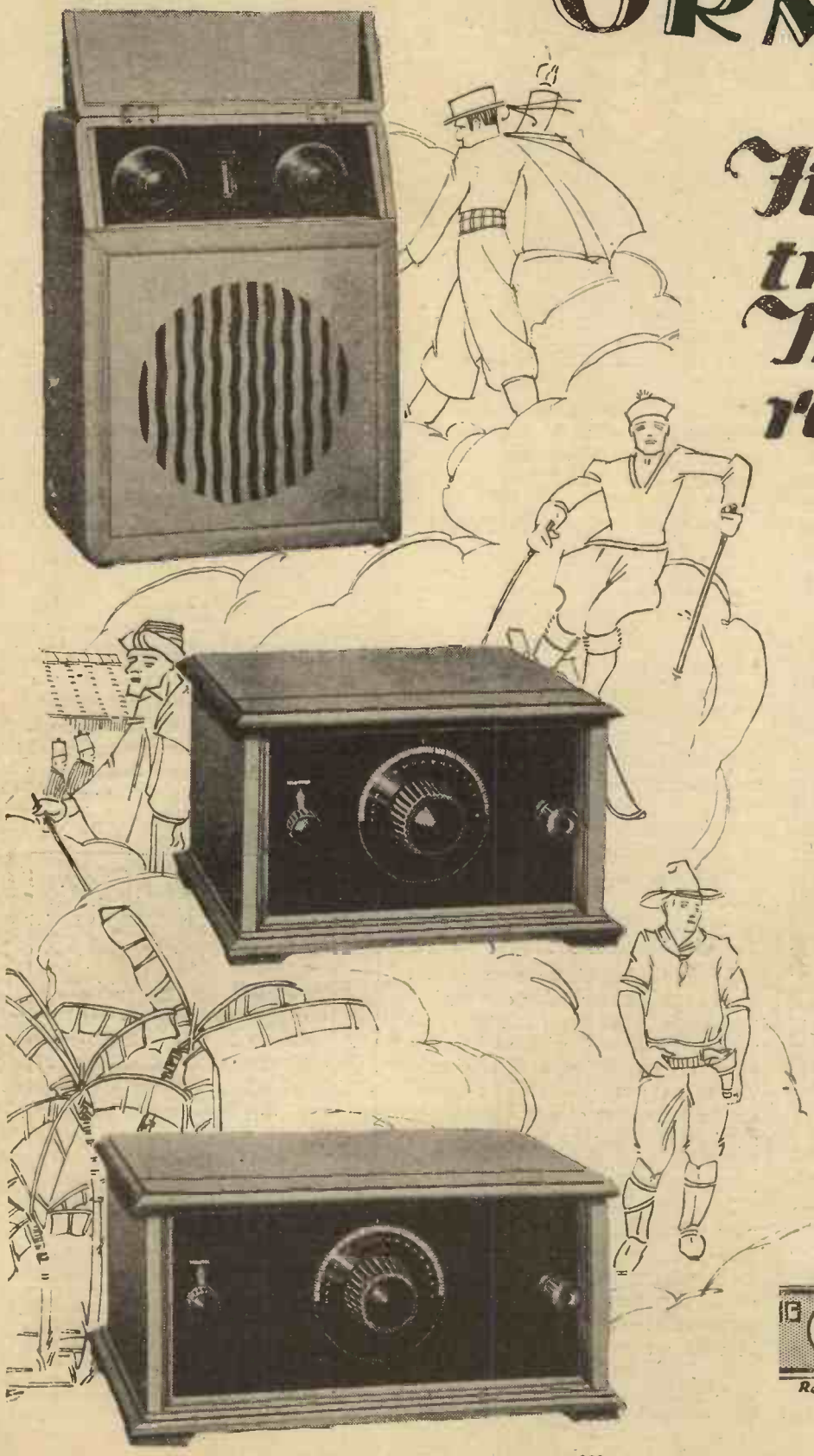
This is, in my opinion, easier than the usual scheme of drilling dozens of small holes and then chiselling the ebonite out. So much filing is necessary with this last scheme. The change-over switch is also supplied with a drilling template, and here again the fretsaw can be employed.

Four holes, one in each corner of the portion to be removed, will permit the saw to be manipulated into the correct position for cutting.

You will observe that I have apparently used a perfectly good Burndept change-over switch with six contacts when three would have sufficed. The reason is that Messrs.

(*Continued on page* 324.)

GO ABROAD WITH ORMOND



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RADIO and the GRAMOPHONE

A New Section for the Music Lover.
Conducted by KEITH D. ROGERS

I SUPPOSE that out of the two or three millions of listeners in this country about thirty or forty per cent have gramophones of some sort or another. Many of these gramophones may be of old types which have been more or less laid aside as indifferent standbys in case "the wireless" should ever break down.

Their reproduction may be very,

With the recent rapid developments, in L.F. amplifiers and loud speakers and in the production of gramophone records, it is only natural that these two sections of the radio and gramophone industries should be combined for the benefit of the music-loving public.

The electrical "pick-up" has enabled this combination to take place, with the result that anyone with a valve set can, for a very small outlay, enjoy all the benefits that radio and the gramophone have to offer.

Therefore it has been decided, for the benefit of our readers, to devote a section of "Modern Wireless" each month to this subject, and to discuss from every angle the potentialities that arise from the amalgamation of Radio and the Gramophone.

very doubtful, and in many cases the gramophones will have been discarded altogether. Many of the wireless sets will be crystal sets with amplifiers; but the remarks I am about to make will apply to owners of these as well as to those possessing multi-valve receivers.

The New Records

We have heard during the last year or so a great deal about electrically reproduced gramophone records, and all the gramophone companies have been advertising these with great energy. But electrical recordings require really good machines to reproduce them if they are expected to give of their best.

If you run an "electrical" record on a "dud" machine the results you will get will be little better than those obtained four or five years ago. Put them on a good machine and you will notice the difference at once, while the real value of electrical recording becomes apparent.

"But," you will say, "it costs a lot of money to buy a gramophone, and as they are being improved so rapidly we cannot keep on buying new machines in order to make sure that we get the best reproduction." That is quite true, it does cost a lot of money, but there is another way out of the difficulty.

Gramophone Pick-Ups

During the last six or seven months there have been a number of electrical "pick-ups" put on the market at various prices and with various degrees of sensitivity and efficiency. These, as you will already know, enable the owner of a wireless set or a valve amplifier to use his set and loud speaker as the reproducing unit for his gramophone.

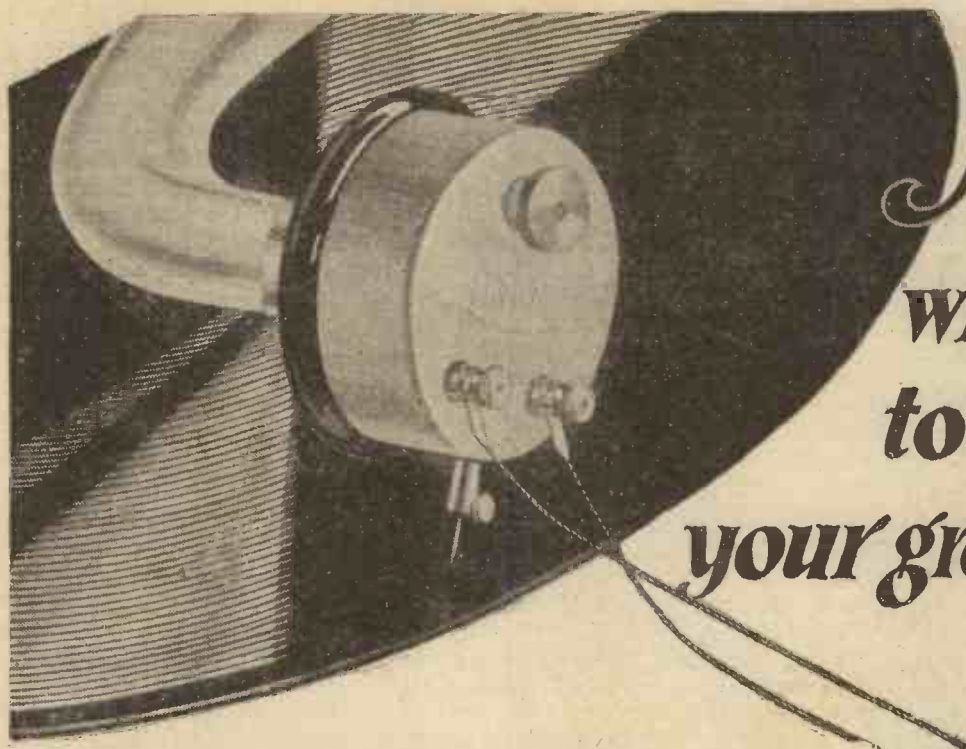
In other words, the pick-up is used to take the place of the sound-box on the gramophone, and it converts the vibrations given to the needle by the impressions on the record into electrical vibrations, which in turn are amplified and put out through the loud speaker in the form of sound. Thus the whole of the horn and reproducing department of the gramophone is left out of action, and all that is required is a turntable with a reliable motor, together with a pick-up and an amplifier of some form or other. The sound-box and the horn of the gramophone do not come into the picture at all.

Remarkable Quality

Thus it will be seen that anybody with an old type of gramophone (so long as the turntable and motor are quite all right) can use that gramophone, together with a pick-up and a wireless set, for the reproduction of gramophone records.

"But," you will ask, "supposing we do this, what is the advantage?

In many theatres, and cinemas, auxiliary orchestral, or vocal items are supplied by means of gramophone records electrically reproduced, and distributed by loud speakers. The photograph shows one of these auxiliary "orchestras" in action in the wings of one of our leading theatres.



How to use your wireless set to amplify your gramophone

AN ordinary gramophone with an ordinary horn and an ordinary sound box will not reproduce notes below middle C of the musical scale. Now with the new LISSEN Electrical Pick-up your gramophone will not only reproduce the low notes on your records as you never heard them on your gramophone before, but will amplify your gramophone music to any degree of loudness to fill a large room or a large hall for dancing. —you can make one gramophone supply every room in the house with music—you can use your old records, long discarded, because needle-scratch is now largely eliminated. Your new records, too, will play better because needle noise is largely subdued.

TO ELECTRIFY YOUR GRAMOPHONE
the Lissen Pick-up not only largely eliminates needle scratch, but brings out the low notes on a record which no ordinary sound box is capable of reproducing.

INSTRUCTIONS.

Slip on the new Lissen Electrical Pick-up in place of the sound box on the tone-arm of your gramophone—take one connection from the Pick-up to the grid terminal of the Lissen Pick-up Adaptor (sold separately and having plugs and sockets corresponding to those of an ordinary valve-holder) and take another connection from the Pick-up to the negative filament terminal on the Adaptor (a trial on each of the filament terminals in turn will clearly show which is negative). When the Adaptor is used in the way just explained, care should be taken that NO connection is made to the plate terminal on the Adaptor, otherwise the H.T. battery will be short-circuited.

Alternatively, a connection from the Lissen Pick-up, instead of going direct to the negative filament terminal on the Adaptor, can be made to the negative terminal of a grid-bias battery. A connection should then be made from the positive terminal of the grid-bias battery to the negative filament terminal on the Adaptor.

The connected Adaptor, with a valve fitted into it, should be plugged into the detector valve socket of a two or three-valve set. Volume can be controlled by the round milled nut on the Lissen Pick-up.

Lissen Electrical Pick-up 15/-
Adaptor for same 1/6

Obtainable at most dealers, but if any difficulty send direct to factory, no postage charge. Or can be sent C.O.D.

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Why not use the gramophone? Why should we go to the trouble and expense of getting a pick-up, however cheap they may be, when we can still reproduce records on our 'gramophones?" The answer, of course, is in the quality that is obtained with the pick-up as compared with that obtained through the gramophone itself.

In another page is given a brief list of records specially suitable for use with gramophone pick-ups, and next month this section will be enlarged to include not only practical data concerning the electrical reproduction of gramophone records, but brief discussions on the latest issues of records, from the point of view of pick-up operation.

Excellent electrical recordings are now being issued by the leading gramophone concerns, such as The British Brunswick Co., Ltd., British Zonophone Co., Columbia Gramophone Co., Duophone and Unbreakable Record Co., Edison Bell Ltd., His Master's Voice (The Gramophone Co.), Parlophone Co., Ltd., and Vocalion Gramophone Co.

Use Your Present Set

Really the difference in quality has to be heard to be believed. I know of no gramophone, except, perhaps, the very latest types, that can challenge good pick-up reproduction as given by an efficient pick-up, a good amplifier and a decent loud speaker.

There is no need to go to the trouble and expense of having a costly loud speaker in order to get good reproduction, and there is no need to get a really expensive pick-up. Nor is there any necessity for the amplifier to be of the latest "push-pull" or mains-operated type. Anybody with any set worth calling a set, and with any speaker worth calling a loud speaker, can buy a pick-up for, say, two pounds or less, apply it to his ordinary cheap, out-of-date and discarded gramophone, and without any alteration to the set at all can play the new electrically reproduced records with a quality that will really do them justice.

In further articles I hope to be able to give some more technical and practical data, but in this article I think we will confine ourselves to a brief chat on the general use of pick-ups with the average wireless set.

Easily Fitted

Let us deal with the pick-up side first. The prices of these little instruments vary from about 15s. to about £5 or more, so that there are models and types suited to every pocket. Naturally, the more expensive ones are nearer perfection than the cheaper models; but they are all, with very few exceptions, well worth serious consideration.

The fitting of them to a gramophone is, of course, simplicity itself. When you buy your pick-up you merely state the make of your gramophone, and a pick-up is supplied to you with a fitting which enables it simply to take the place of your present sound-box, for, as you know, most gramophones have detachable sound-boxes. If you just turn them a little to the left they pull straight off.

When you put the pick-up on, you put it on the arm, just as you would the sound box, and it is ready for use. The needles are inserted in the usual way, and all you have to do is to put your needle in, wind your gramophone up, put the record on, and, with the pick-up connected suitably to your set, put it down on the record and the music comes out of the loud speaker.

It is all very simple, and I think

A moderately priced gramophone "pick-up" which gives excellent results.

With the aid of an adaptor this high-resistance pick-up can be plugged into the detector or L.F. valve sockets of almost any set.

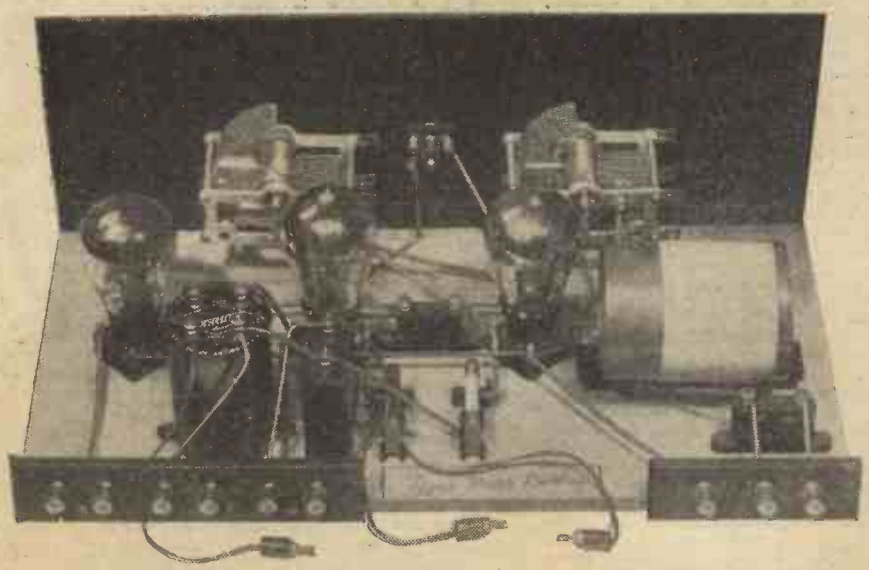
the reason why pick-ups are not more widely used is the misapprehension that something electrical, mysterious, and difficult to operate and arrange has to be done before suitable reproduction is obtained. This is all wrong, the use of a pick-up is simplicity itself, and there is no reason why the veriest tyro should not use his old gramophone, or even his new one for that matter, with a pick-up and his wireless set, and obtain really good reproduction.

Approaching Perfection

It is amazing the amount of bass that can be got out of quite an old record by means of a pick-up, although the recently issued "electrical" records are, of course, better Bass that you never heard before, that you never thought was in the record, while the old chattering and resonant noises which used to worry you with the old gramophone are to a great extent eliminated.

Pick-ups are not perfect; wireless amplifiers are not perfect; loud speakers are not perfect; neither are records; so that perfect reproduction is not yet obtainable, but with average apparatus we are so near to perfection that it is often very difficult to imagine what is still to be improved.

And then, if you use a pick-up, you have the advantage of having your



The "Music Master," described in last month's "Modern Wireless," is readily adaptable for use with any gramophone pick-up of the high-resistance type. The aerial coil is removed and the pick-up valve-plug adaptor is inserted in the detector-valve holder, the detector valve being placed in the sockets provided on the adaptor. Care should be taken that the pick-up is wired to the adaptor in such a way as to make connection between grid and L.T. ***negative*** sockets.

own alternative programmes, either when the broadcast programme or the artist's rendering is not to your taste, or if broadcasting is not on. And the reproduction obtained from that pick-up and the loud speaker is little different from that obtained from the broadcasting itself. In some cases I even think I prefer pick-up-and-record reproduction to the actual broadcast transmission. The modulation is more even, and a stranger who does not know what is happening may very easily mistake one for the other.

The old "gramophoney" quality which we used to talk about in earlier broadcast days so much has gone for good, while we can now choose the artists and items we prefer, turn them on and get a remarkably life-like quality and reproduction. And we can have music in every room of the house, by means of extension leads, if we want it.

The fitting of the pick-up to your set, as I remarked before, is exceedingly simple, and many have little plug gadgets which fit into the detector sockets of practically any receiver. All you do is to remove the detector valve, push in this plug, fit the detector valve back in the special sockets on to the top of the plug, and there you are. Nothing else has to be altered.

Electric Gramophones

Others require a transformer which can easily be fitted to the set either in the first stage of amplification or before the detector stage. We will go into that matter later on in another article, but in the meantime anyone who buys a pick-up will find that suitable directions are supplied with the instrument, though if he should have any difficulty he can always write to the paper, or to me, and I will give him any assistance that I can.

As regards the amplifier—or the set — provided you have two stages of amplification (either a detector and one stage of L.F. or two stages of L.F. without detector) you will find that you will get ample signal strength from your gramophone. Two valves are quite sufficient to work a pick-up at full loud-speaker strength on the majority of records.

Naturally the better the amplifier and the better the loud speaker the better will be the reproduction, but in most cases, unless you possess one of the latest and most expensive models of gramophones, you will find that the use of a pick-up and your set or amplifier and the loud speaker will give you better reproduction than that obtained from the gramophone itself.

You must not think that I am decrying the modern gramophone. It is a really wonderful instrument, with truly wonderful reproduction; I am merely trying to show that those of you who have old machines and who also have wireless sets can use those instruments to the best advantage at very little expense. I myself, for instance, use quite an old gramophone for pick-up work, and I find it quite suitable. After all, there is no reason why it should not be.

Further, there are now on the market mains units each consisting of a turntable, motor governor, switch and speed regulator, which can easily be rigged up and which plug into any electric-light mains, and you have all the essentials then of an electric gramophone.

The whole outfit should cost you much less than ten pounds, and that together with your wireless set and loud speaker will give you reproduction and convenience that can only be equalled by a very expensive gramophone; for electric gramophones are by no means cheap.

The technical considerations, that is, the choice of needles, of records, the angle at which the needle should be played and all those little points which go for the absolute perfection, we will leave for a later article, though at the end of this article I

RECORDS WORTH TRYING

BAND SELECTIONS.

Colonel Bogey March .. H.M.V. B2408
(Coldstream Guards)
Washington Post March Brunswick 3675A
(Walter B. Rogers and his Band)

CHOIRS AND CHORUS.

Pilgrims' Chorus—Tannhäuser
H.M.V. D1292
(State Opera Chorus)

ORCHESTRAL SELECTIONS.

Petit Suite de Concert ..Columbia L1808
(Coleridge Taylor)
(Queen's Hall Orchestra)
Wotan's Farewell and Fire
Music from Valkyrie .. H.M.V. D1333
(State Opera Orchestra and Chorus)

ORGAN ITEMS.

Serenade .. .. H.M.V. B2444
Russian Lullaby.. .. .. H.M.V. B2560
In a Monastery Garden .. H.M.V. C1285
Minuet in G ..Vocalion Broadcast 291-B
(Beethoven)

VOCAL.

Oh, Kay (Duet) .. Brunswick 3381B
O, Star of Eve—Tannhäuser H.M.V. D1146
(Baritone Solo)
Baby and the Silk Worm Edison Bell
(Mabel Constanduros) [Electron 0205
Just Another Day Edison Bell Electron
(Josephine Trix) [0197
Humorous Record Vocalion Broadcast 191-A
Meanderings of Monty .. .. Columbia
(Milton Hayes)
(Series of Records. Monologues)
Little Joan .. .. .. Columbia 4680
(Flotsam and Jetsam)
Layton and Johnson.. .. .. Columbia
(Records all good)

INSTRUMENTAL.

Le Cygne .. .. H.M.V. D.A.776
La Bohème .. .. .. Columbia 4542
(Albert Sandler and Orchestra)
Londonderry Air .. .. H.M.V. C994
(De Groot and Orchestra)
One Summer Night Brunswick 3621A
(Violin)
Melody in F .. .. .. H.M.V. B2614
(Cedric Sharpe, 'Cello)

DANCE RECORDS AND SELECTIONS.

Polly (Foxtrot) .. .. Zonophone 5046
(Rhythmic Eight)
Blue Serenade (Yale Blues) H.M.V. B5355
(Rio Grande Tango Band)
Mediterranean Blues (Foxtrot) Columbia
(Debroy Somers) [4610
The Desert Song Selection Columbia 9200
(Debroy Somers)
The Vagaboud King Selection H.M.V. C1333
(Savoy Havana)
I Ain't Got Nobody .. .. H.M.V. B5383
(Coon Sanders and his Orch.)
Humpty Dumpty
(Yale Blues) .. .. Parlophone R3464
(Frankie Trumbauer's Orchestra)
Charmaine .. .. Columbia 4559
Muddy Water (Black Bottom) Brunswick
[3414-A
Diane .. .. ..Vocalion Broadcast 195-B
Leonora .. ..Vocalion Broadcast 196-A
Doll Dance.. ..Edison Bell Electron 0187
(Xylophone, Teddy Brown)

NEXT MONTH

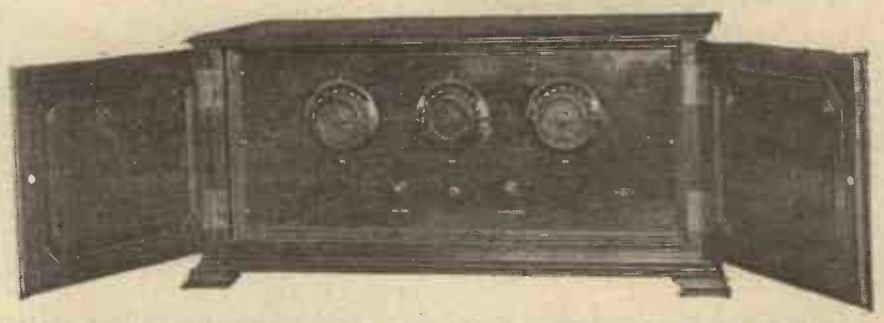
This section will contain articles on the following.

The use of Pick-ups with the "Melody Maker," the "Master Three" and the "R.C. Threesome."

Review of recent records specially suitable for electrical reproduction.

Practical hints and tips for the radio-gramophone enthusiast.

Test reports on various pick-ups.



Many of the commercial sets now on the market include provision for the use of "pick-ups," and this Gecophone four-valve receiver has a special plug-and-jack arrangement so that the set can be used with the gramophone.

mention a few recent records that I have found exceptionally suitable for pick-up use.

Most of the big wireless firms have pick-ups on the market: Amplions, G.E.C., Marconi, Edison-Bell, Bowyer-Lowe, Lissen, Celestion, Brown, Igranic, Rothermel, Burne-Jones, to mention just a few, and these are obtainable at prices to suit every pocket. At present I am busy carrying out tests with these various pick-ups and will report on them later. The Lissen, Igranic and Amplion strike me as three excellent propositions at reasonable prices, the former at 15/- being very good value for money.

Alternative Programmes

Pick-ups are certainly well worth your attention, and I would advise every one of you who has not yet heard one to go round to a friend who has got one in operation, or to any of the good wireless dealers and hear a demonstration. You will be surprised at the quality obtainable, and I feel sure it will not be long before you are the possessor of one yourself.

There is something exceedingly fascinating about an electrically reproduced record, and the advantage of being able to provide your own alternative programmes, to hear your favourite items when and how you want them, all with a clarity equal to that obtainable from the best broadcasting, is one which has to be experienced to be realised.

A number of the wireless manufacturers are now arranging for the use of pick-ups in their receivers so that by just the movement of a switch either gramophone or radio can be chosen at will. And all valve sets having two or more valves (one of which, of course, must be an L.F. valve), described in this paper, are suitable for use with gramophone pick-ups. The "Solodyne," the "Viking Four," the "Music Master," are all suitable for pick-up work, while the "Radio-Gram" receiver described by Mr. Johnson-Randall in this issue has, as will be noticed, a special switch arrangement so that a pick-up may be included without having to alter the receiver in any way. Next month I shall also discuss the use of pick-ups with the three popular three-valve commercial sets discussed by Mr. Dowding in this issue.

A general view of one of the broadcast studios, from which many famous artistes have been heard. Many of these artistes are now available on gramophone records, and thus can be heard over and over again though their voices may have been lost over the ether.

Easy Volume Control

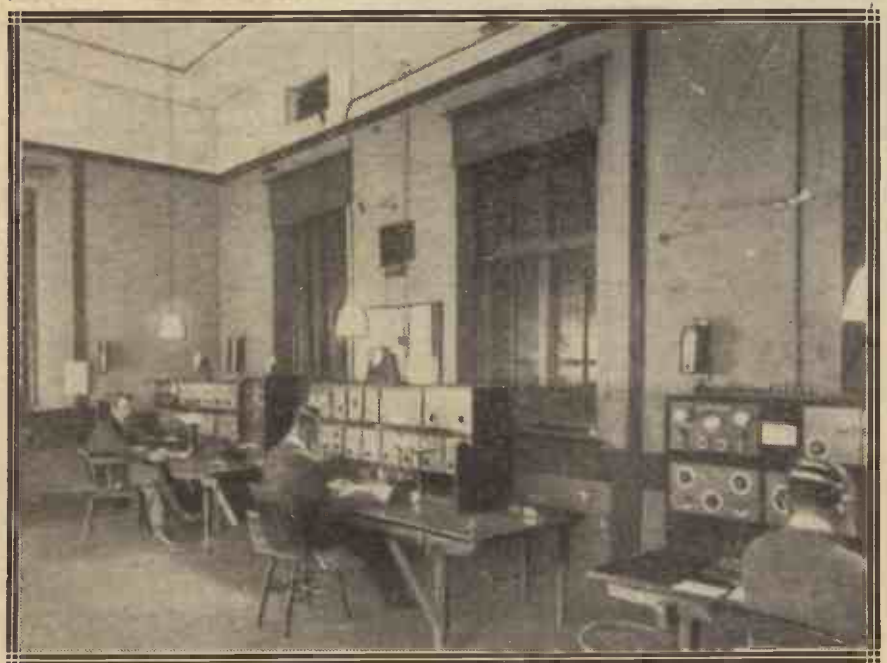
Another great advantage of the pick-up is that in the majority of cases a volume control is supplied with the instrument, and this enables very fine variations of volume to be arranged. The maximum volume obtained will, of course, depend upon the amplifier used, but with an ordinary two-valve amplifier the volume is quite sufficient for an ordinary room, and this may be toned down by means of the control until it is merely a whisper.

This volume control is, in my opinion, one of the main features of the pick-up, for everybody knows that with the ordinary gramophone if the volume is to be cut down by means of shutters a frightful amount of damping, or smothered effect, and sometimes "dither," is introduced, which is quite absent with the electrical method, as in the case of the pick-up.

It will be seen therefore by the foregoing brief chat that the electrical pick-up is really worth while trying. It is simple to use, inexpensive to buy, is easily attached and gives advantages over the ordinary gramophone which, as I said before, have to be heard to be realised. Personally I am absolutely lost without my gramophone and pick-up, especially on Sundays, when the radio programme is not always that which is required by the family, and during the long wait between the afternoon and evening programmes.

As Good As Broadcasting

In a very short time one acquires a stock of records of broadcast and other favourites which, in connection with the pick-up and amplifier, form a broadcast repertoire of music and entertainment which can be obtained in no other way. And it must not be forgotten that when the apparatus is properly arranged the reproduction from the pick-up is every whit as good as that obtained from broadcasting, and in my opinion very many items can even be better.



A section of one of the latest of our long-distance "posts." This receiving installation is situated at Burnham, and is one of the "ears" of the famous Devizes station.

FERRANTI AUDIO-FREQUENCY TRANSFORMERS

Fig. W 66

This transformer, as the three views indicate, can be fixed in any position suitable for the set in which it is used. This adaptability has many advantages which the constructor will appreciate, and is obtained by means of feet, which can be detached and placed in any position.

Fig. W 23.—The Coil Formers.

Fig. 23. The coil formers indicate precision of workmanship, and attention to detail characteristic of all Ferranti products.

Note the special design to ensure low self-capacity.

Fig. W 21, showing the secondary coil, is typical of the Ferranti construction, using an insulated spider with sub-division of windings, and indicates also the general character of workmanship.

Fig. W 21.—The Secondary Coil.

Fig. W 19.—The Fixed Condenser.

Internal view of Fixed Condenser.

Fig. W 19 shows the ·0003-mfd. mica insulated condenser which is placed across the primary. This condenser is built into the terminal block and then moulded in by a special moulding process ensuring high insulation and immunity from moisture. The incorporation of this condenser ensures the use of one of the correct capacity, and, incidentally, saves the user of the Ferranti Transformer the necessity of purchasing the separate condenser required when other transformers are used.

The "exploded" view shows the sound mechanical construction of the AF-3 transformer.

Fig. W 25.—Exploded View.

This is a page from the Catalogue which will be sent on request.
Delivery of A.F. Transformers is being made in strict rotation.

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MY BROADCASTING DIARY

Under this heading month by month our Broadcasting Correspondent will record the news of the progress of the British Broadcasting Corporation, and will comment on the policies in force at B.B.C. headquarters.

The Danger of Stagnation

THE effective suppression by the Post Office of all discussion of the Regional Scheme has gone so far that there is now real danger of nothing at all happening in 1928. Six months ago I called attention to the danger to broadcasting if 1928 merely marked time. There is now no doubt that my forebodings were justified. It looks as if the mandarins of the Post Office have had their way.

Even if the Regional Scheme is approved during the spring—and this is by no means probable—it will not be humanly possible to bring into operation the first of the new stations until well on into 1929. So far as 1928 is concerned, it is left to the ingenuity of the B.B.C. to devise expedients to attract public support, without the help of any extension or improvement of the technical facilities of distribution. That it will make a gallant effort goes without saying. But the essential tragedy remains, that the broadcasting service is being steadily and surely threatened by outside officialdom.

European S.B.

To turn to something more pleasant, European S.B. is practically an accomplished reality. Recent relay tests from Liège and Cologne, with the equally successful return relay of 5 G B to Central Europe, mark the realisation of an interesting and potentially important development of the amenities of broadcasting.

There is more in it than this. The efficient, rapid, effective, business-like way in which a very complicated arrangement has been handled shows up in striking contrast to the tortuous, aimless, inconsequent methods of the British Post Office and other Government organisations elsewhere. The B.B.C. and its opposite numbers in other countries got together on a common problem, wisely avoiding contact with Governments of any kind. The result is success.

The Old Generation Passes

The rumour that Rex Palmer is going to a gramophone company, if true, means that nearly the last of the old brigade of broadcasting will have passed on. Cecil Lewis is known to be anxious to break what little connection he still has with Savoy Hill. Captain Eckersley is restless because of irrational opposition to his Regional Scheme. Other pioneers are seeking new worlds to conquer. I should not be surprised if 1928 sees radical alterations in broadcasting personnel.

Controversy: Reported Government Plan

It is reported on good authority that the early deliberations of the Government on the subject of the application of the B.B.C. to include controversy in its programme are tending towards a decision on the lines suggested by Mr. J. C. Squire, editor of the "London Mercury." This idea is to set up an independent and separate paid Board of Censors, who will decide on the precise limits of what is safe and unsafe for broadcasting. No doubt such a solution would be greeted with thankfulness by certain officials at Savoy Hill.

Everyone who has experienced "mast-head" trouble, or has allowed the aerial halyard to run out of the pulley, will appreciate the task of this workman. He is fitting foot-spikes to one of the masts of the Air Ministry's new wireless station at Mitcham, Surrey. In the event of anything going wrong at the top of the mast the spikes will be used as an inspection ladder.

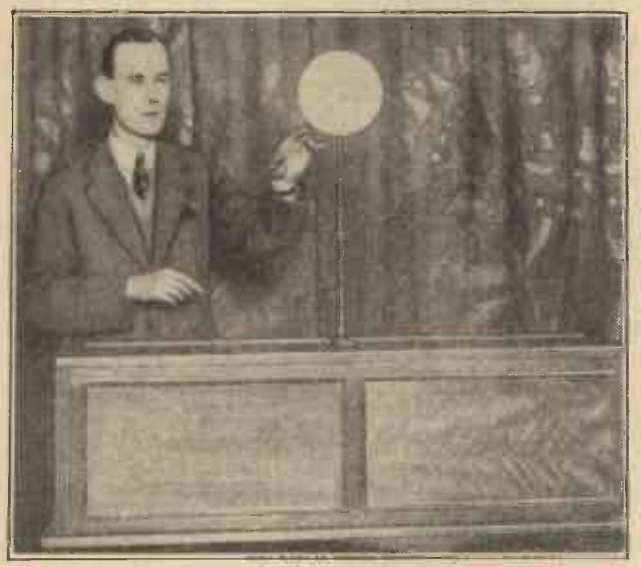
Certainly its application would have the effect of "passing the buck." It is generally agreed that presuming some measure of freedom is conceded, the B.B.C. would come in for far more criticism then than ever before. The complaint would be that the wrong kind

of controversy is given, and in the wrong way. How much easier it would be to divert the attack to the new paid, alleged independent Board of Censors!

Apart from this human point, I have grave doubt whether the scheme would work. There would be endless trouble about the selection of the members of the Censors' Board. In the end, they would be made up of such "safe" people that they would do nothing. If there is to be controversy in the programmes, the B.B.C. should be given a free hand, and judged by the results.

Nothing else will be of any value. But, anyway, all the talk about controversy has singularly little reality except in the minds of the younger school of ephemerally clever, aspiring politicians and pseudo-dramatists. The listening public, whose wishes appeared to be ignored in this matter, is indifferent. What it wants is more and better light entertainment.

MYSTERY-MUSIC FROM THE AIR



According to Mr. Noel Maskelyne, of conjuring fame, the production of mysterious music from the air as recently demonstrated in London is an old stunt, and was popular with R.A.F. wireless men ten years ago. Above, Mr. Maskelyne is shown demonstrating with an instrument that incorporates some of his early experimental apparatus.

Predicament of the Governors

The B.B.C. Governors do not appear to be having such a happy time this year at last. Last year it was recognised that Lord Clarendon and his colleagues wisely and diligently applied themselves to a careful study of the work for which they were responsible. Apart from this, they were presumed to be following the procedure customary with boards of directors of confining their attentions to broad issues of policy.

Towards the end of the year, intelligent observers were of opinion that the Governors had settled into the sound tradition of the Directors of the Company. Then came the extraordinary Press attack by one of the Governors on the policy of the Board. Out of the numerous troubles and confusions to which this episode gave rise there has been created in the minds of the public a misgiving as to the fitness of the Governors for their jobs.

Concerning Controversy

There has been a revival of inquiries as to personal qualifications. Meanwhile, however, the troubles have calmed down and the old atmosphere of serenity has been restored, at least to all appearances. What the public is interested in is not any nice distinction between the functions of a Board and those of an executive. The only point that concerns the public is that the programme service should be the best available, and that every possible penny should be devoted to the programmes.

Despite occasional irritation and disappointment, the vast bulk of the listening public have implicit confidence in the permanent organisation at Savoy Hill. They believe that, on the whole, the job of broadcasting in this country has been carried out very well, and they want to see it go on developing.

The suggestion that a group of eminent outsiders, menaced by their own good intentions, should begin to tamper with the delicate task of programme-building, fills the average listener with alarm and rage. I would suggest seriously to the Governors that the more they keep in the background the better for all concerned. This does not mean that they should be inactive. Let them keep a close eye on everything; but let this be done free from the disabilities and dangers of personal publicity.

Incidentally, let them avoid a repetition of the blunder of the now famous "Five hours for five lines" Press statement, which told an expectant Press and public that the Governors had been "considering" the problem of controversy in programmes for some time!

Another Season of B.B.C. Proms.

It is now practically certain that the B.B.C. will put on another season of Proms. at the Queen's Hall. I hear this is likely to be of eight weeks' duration, instead of the six weeks' season of last year. Savoy Hill is wise to extend the season slightly, but not to run to the whole ten weeks which the Prom. enthusiasts have been demanding.

It is better to handle these things just under the anticipated demand, rather than just over. Incidentally it looks as if the Proms. will become the permanent perquisite of the B.B.C. Whether they will always be given from Queen's Hall is another matter. There are indications that the price may soon become prohibitive, or that the hall will be sold for other purposes. I wonder why the B.B.C. doesn't make a bid for the hall with a view to building the much-talked-of Broadcasting House around it.

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IN PASSING

THIS month I write in a chastened mood. My ears droop and my tail is pointing to the floor. As a radio fan I feel about as cheap as Willie's first crystal set side by side with the golden, gem-studded, fifteen-valver made for the Maharajah of Bogglywolla. All my triumphs are as dust in the mouth, and ashes on the head.

A Back Number

Triumphs? My dear sir, why go out of your way to bandy sarcasms with a crushed varmint? Still, I may make so bold as to remind you that I exhibited a wireless-controlled mousetrap at the last Annual Meeting of the Notting Hill branch of Our Dumb Friends' League, and that I was the first amateur to establish three-way communication with an aviator—when he was going up, when he was up, and when he was coming down. It would have been four-way, but he came down against his will and dropped radio in favour of his parachute.

Is all this nothing? Yes! I am a back number and my second name is Semaphore. Its all I am fit phore. If I could lay my hands on a potsherd I would scrape myself with it, as Job did during his black fits. But my

. . . and came up beaming . . .

china-merchant says they don't make them nowadays. What luck!

This insanitary condition of my ego was produced as a result of my recent visit to the home of John Toob. I went there as a guest; I remained there for a week as a criminal on the rack, and I left there as The Boneless Wonder. I believe I poured myself out through his keyhole.

Before his Uncle died and left him The Midden, Little Haypatch, Essex, Toob cast no shadow whatever, cut no ice, and mattered not a row of beans. He just bimbled up to some low place of business in Seacoal Lane, or Hanging Sword Alley, and doddered back again. He did not touch radio, preferring to scratch about in the dirt behind his house and call the activity horticulture. I believe he once tried to mend a clock but left the hairspring out under the impression that it had "got into the works and clogged 'em." And once, I know, he "took up" photography, and photography jolly soon took him down.

Toob Disappears

Then Uncle passed, leaving The Midden and numerous quids to Toob, who promptly threw up his job and retired to his hay-patch. Asked what he proposed to do *pour passer le temps* (see Hugo), he said that he was going to devote his days and nights to science. Naturally, we said, "Haw, haw! *What* science? Bee-keeping or astrology?" But the wily old brute would give no hint. The fact is he hadn't the foggiest. He was going to *chercher* for his *metier*. (I say, this parley-voo stuff is not my regular pidgin. I've been seeing a French girl on to the bus lately.)

So old Toob disappeared from London and we heard no more of him until——

One night I was having a chat (16 metres) with Ivan Obolshi (3 Z Z, Vladivostok), and he said: "Please, mister, I thinking 5 P F, Falkland Islands, wanting speak you. Yes, please! No, thank you!"

Round the World

So I gave 5 P F a shout. He replied, "Mon, I tell ye thon daft foreigner of 8 S Q, Valpar-r-r-aiso has been ca'in' ye the nicht."

I called 8 S Q and got him. "Señor," said he, "have the goodness to make callings with estation 9 T P, Nueva Zelandia, for because he ouishes spik quik."

I thought I was on to one of those prayer chains one hears about, and was half a mind to shut down. However, curiosity is the root of all evil, and deuced strong, so I tried some juice on 9 T P. He was waiting on me, and said:

An Unwelcome Message

"4 N R, Bulawayo, asked me to say from 5 G G, Essex, 'Will you come stay Midden, little haypatch essex warm welcome lots fresh milk butter honey toob.'—Sounds awful, but I hope y' enjoy it. 4 N R OVER."

I acknowledged this with a voice which trembled with somnolence and apprehension. I logged the evening's stroll round the globe with a pen propelled by a hand trembling with amazement. Toob! 5 G G! I fled to the nursery to look at Rupert, aged one year and three hours.

. . . . once tried to mend a clock . . .

Thank Heaven! He did not appear to have anything radio about him, though as I watched he tried to place his left foot in his mouth. Just like his pa! Always ambitious!

We Meet Again

So I took a week off from the office. Nerves, I said it was. Nerves it proved to be. Little Haypatch is at the end of a branch line which the Great Eastern Railway forgot in 1876. I had to bribe the engine-driver to go down it, and I had to stop at Upper Cowpush while he took his tea. At Lower Pigswill he stepped off to inquire about his auntie's leg, and at Great Dykedrop I had to get out and help shove the outfit over the level-crossing because the level-crossing sweeper on duty had gone to choir-practice.

Decanted at Little Haypatch, I found that the representative of the railway was almost as suspicious as a Customs official on the Danzig-Poland frontier. If I had been a postcard he would have taken me home to read. I argued a little, but my finest points got entangled in his whiskers, and my ticket appeared to frighten him. So I patted him on the head, chucked my suitcase over the hedge, did an A1 vault after it

and began to smell my way towards The Midden.

I had tracked it for less than fifty metres when behold! Toob in a Morris-Cowley! A rejuvenated Toob, dressed in the most additional plus-fours I had ever seen on a man of his size in drumsticks, a pull-over of the type known as a "blinder," and cap, collar, tie and shoes to match. A perfect links-hound! Out he scrambled like a boy and came up beaming.

"Hallo, Jones, old man. How goes it? I heard you and the station-master making love, and came to save you a climb. My place is up there."

"Toob," I replied. "I am glad to see you, but sorry to find that you are as big a liar as ever. What do you mean? *Heard me!* Why, your place is half a mile away!"

Toob chuckled.

"D'ye see that kite?" He pointed stationwards and, looking up, I saw a fine box-kite. "Well, what of it? Have you got an observer up there, with a telephone?" I asked.

The First Shock

"Have I not," returned Toob. "Hanging from that kite is one of my long-distance microphones, which picked up all you said. Man"—here he whispered—"the things I've heard with that gadget! But there, in you get; noting the midget radio receiver, chronometer, barograph, seismograph and police-trap indicator, all on the left of our dashboard."

"You old brute!" I remarked, as he scattered a covey of fowls. "Whatever possessed you to send me an

. . . the door flew open. "Just a little radio idea," said Toob. . . .

invitation relayed all round the globe?"

More chuckles. "Haw! Jolly fine joke, eh? *Thought* that would surprise you Mind out, you're resting your elbow on my midget four-metre transmitter! You see, when I came down here—— Excuse me for a moment; Mary's calling. Hello, hello! That you, Mary? Yes, I've got him. One minute and a quarter Keep the joint hot. What? No! No cocktails! 'Bye."

"By gum!" I said. "How—what——"

"Oh, it's nothing! Just a low-power set. When I speak—that button on the windscreen frame is a microphone—and hold this other button down, we get very fairish sigs up at Midden from anything up to seventeen miles. Yes, in the tool-chest! No tools! Ain't worth the bother of carrying them."

I Experience Some More

"Yuh—yes! But how——?"

"Oh, that's another little idea of mine. Mary sends in Morse and I answer with speech. Owing to the noise of the car, I prefer to read by the eye. Watch the clock."

He pressed the button and after a few moments said:

"Mary, my lamb, send us a few v's." I then saw a spot on the clock-face flicker in longs and shorts—V's.

"Righto!" said Toob. "Thattle-do, Mary. We're here."

I began to feel faint. Was this the dormouse-like Toob I had known in yesteryears?

As we trod on the doorstep of The Midden, the door swung open.

"Just a little radio-idea," said Toob, as he took my hat and suit-case. "I tread on a certain spot and complete a circuit, which operates a small transmitter upstairs. This works a relay which brings an electro-magnet into play, thus pulling back the latch. A spring does the rest."

"But——"

"That's nothing, Jones, old man. Come and have a wash."

Every door had its button and its wireless opener. While we washed a loud speaker in the corner said:

"Lunch in five minutes!"

"How on earth did Mrs. T. know we were here?" I asked.

Ruled by Radio

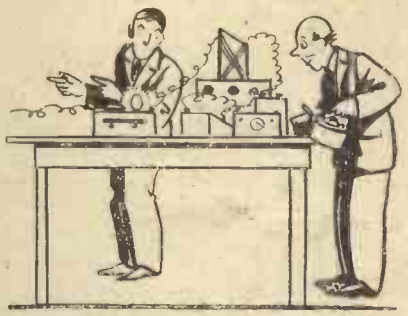
"Oh, she DF'ed us, old man. I've got a trifling little hook-up in the hall, which is operated when anybody steps on the floor of any room. I have bunged on a dictaphone sort of affair which says: 'Pantry,' or 'Best Bedroom,' or 'Dining-room.' It's useful, you see, with these country servants. Never used to know where the blighters were loafing."

"But how——?"

During lunch we were entertained by the Dmitri Osloff Quintette from Buenos Aires. I could not find the loud speaker. Toob smiled at my puzzled air and then pointed to a fine epergne of five branches.

"Each branch has a different characteristic," he said. "Trombones come out of the middle one, and so forth. Just a little idea, that's all." I choked on my asparagus and looked appealingly at Mary.

"Yes, Mr. Jones," she said. "He has come on, hasn't he? But he can't mend a clock, and as for putting up a shelf or seeing to the water-pipes in winter—he's hopeless! *And* the holes in his socks! Dreadful!"



. . . showed me how he made a collection of signals . .

After lunch, Toob showed me how he made a collection of signals from Rugby, Ongar, Eiffel Tower and Nauen work a lawn-mower. Then he added together the milli-volts gathered from Lyons, North Foreland, 2 L O, New York, Salt Lake City and seven lightships, and with their aid boiled a kettle for our cup of tea.

"Why," he asked, "should I pay for coulombs, when all this stuff is flying around for anybody to collar?"

The Last Straw

At night came the final humiliation. The bloke had, by some means or other, got together a set which knocked up the whole world. He dragged me through all the hemispheres known to geographers. He was on speaking terms with all the towns in the gazetteer. He just said, "Is that you, Abe?" and got a fine loud-speaker reply from Ephraim Q. Pennybunker, of Portland, Oregon; or, "Hi! there, Dave," and got, "Wow, you goldarned kid!" from Wilbur N. van Slyven, of Cold Springs, Pa. I lived through some moments, you can guess—me, with my piffling mouse-trap, etc.

The finishing touch was given to my nerves when Toob returned me to old whiskers at the station in a wireless-controlled car.

There was some hitch in his radio-controlled domestic arrangements; and Mrs. T. controlled the car by Morse, so that I went flickering down to the station in longs and shorts.

BEFORE DECIDING TO PURCHASE ELSEWHERE READ K. RAYMOND'S OFFERS.

CALLERS TAKE ADVANTAGE OF OUR BARGAIN COLUMN

MAGNIFICENT VALUE
Sold to Customers only when buying other goods. See matter at side.

LOUD SPEAKER UNITS

BRAND NEW
LIST PRICE 9/11
OUR PRICE **5/-**

TO CUSTOMERS SPENDING 20/- OR MORE IN ORDINARY GOODS AT THE SAME TIME.

ACCUMULATORS, 2 v. 40 amps.

TO CUSTOMERS SPENDING 20/- OR MORE IN ORDINARY GOODS AT THE SAME TIME.

BRAND NEW.
LIST PRICE 8/11
OUR PRICE **4/11**

DOUBLE READING VOLTMETERS

For H.T. & L.T.
BRAND NEW.
LIST PRICE 7/11
OUR PRICE **3/11**

TO CUSTOMERS SPENDING 20/- OR MORE IN ORDINARY GOODS AT THE SAME TIME.

LOUD SPEAKERS

THESE LOUD SPEAKERS are really wonderful value. And you can purchase at same time with other goods value from 20/- up to 50/-. Many well-known non-proprietary makes are shown in window.
BRAND NEW. With other goods only.
LIST PRICES: 16/11 20/-, 21/-, 25/-, 30/-, 40/-, 50/-.
OUR PRICE **8/11, 10/6, 12/11, 15/-, 21/-, 30/-**

HIGH TENSION BATTERIES

JUST AS MANY HIGH-TENSION BATTERIES are being sold (but they *must* be good).

A 7/11 60-v. for 3/6 with 20/- worth ordinary goods.

A 12/11 100-v. for 5/11 with 25/- worth ordinary goods.

AMERICAN CABINETS

(Mahogany Polished) Hinged Lid. Baseboard.
NO WIRELESS SET is complete without a cabinet, is it? So just to help you on the way, you can buy a 12 in. by 8 in. for 5/- with 25/- worth of ordinary goods, and 14 in. by 7 in. for 7/11 with 35/- worth.

12 x 8		14 x 8	
BRAND NEW. LIST 10/9	OUR PRICE **5/-**	BRAND NEW. LIST 15/11	OUR PRICE **7/11**

(ALSO OAK, SAME PRICE).

SIX-PINH F Transformer long or short wave. Spli

Primary or Split Secondary
THESE are a first-class make and need only to be seen to be appreciated. A purchase of a further 15/- worth of goods entitles you to buy one at 2/6.

BRAND NEW.
LIST PRICE 7/6
OUR PRICE **2/6**
With other goods only

S.L.F. VARIABLE CONDENSERS ·0005 & ·0003

THIS IS A FIRST-CLASS CONDENSER for true tuning (and with the addition of a vernier dial you have as good an article as can be bought elsewhere for treble). It only needs you to purchase 12/6 worth of ordinary goods to secure one.

BRAND NEW.
LIST PRICE 4/11
FOR **1/6**
with 12/6 worth of ordinary goods.

ABOVE GOODS SOLD TO CUSTOMERS ONLY.—Please read matter at side of each item carefully to avoid mistakes.

MARCONI, EDISWAN, OSRAM, B.T.H., COSMOS VALVES at USUAL PRICES.

UNITS and PICK-UPS, all makes
AMPLION, CLIMAX, BENJAMIN, WEARITE, COLVERN, DETEX, DUBILIER, PENTON, EDISWAN, ORMOND, FERRANTI, HARLIE, IGRANIC, LOTUS, LISSEN, FORMO, MARCONI, MULLARD, OLDHAM, WATMEL, POLAR, EXIDE, W. & B., DUBILIER, McMICHAEL, UTILITY, HELLESEN, B.T.H., SIEMENS, BURNDEPT, EVER-READY, LEWCOS, BELLING-LEE, and all proprietary lines stocked.

OAK CABINETS

American type, opens at back, compartment underneath for batteries, etc.
12 by 8 by 9 in. deep 18/11
16 by 8 by 9 in. 25/11
Reduction made if you buy your parts here.
Carr. & Packing, 2/6.

THE "STRAIGHT THREE"

EXTRAORDINARY OFFER

D. and 2 L.F. Circuit

Illustration shows the assembled set. For Local, 5 GB, 5 XX, and Continental Stations.

PARTS FOR ABOVE SET

2 L.F. Transformers, 3 Lotus Valve Holders, 2-way Coil Holder (geared) with 3 Coils (or, if preferred, a Tuner), ·0005 Variable and Geared Dial, ·0003 Fixed and Grid Leak, Rheostat, D.P.D.T. Panel Switch, 8 Terminals, Square Wire, Baseboard. Screws free.

42/11 THE LOT NETT

All very best quality. CABINET with above kit, 12/6. If cabinet to go by post or rail, 2/- extra. Valves, H.T. Batteries, Loud Speakers, Panels, at moderate prices.

PERSONAL SHOPPERS

WE ARE OPEN
TWO SHOPS
If one is closed the other is open.

ALL DAY SATURDAY
ALL DAY THURSDAY
ALL DAY EVERY DAY
Hours 9 a.m. to 8p.m
Sat. 9 a.m. to 9 p.m.
Sunday morning 11-1

TELSEN
L.F. TRANSFORMERS

The "RADIOGRAND" affords perfect reproduction over all frequencies of speech and music. This instrument weighs 1 lb. 9 ozs. General efficiency is unvarying with high or low input values, and special care has been exercised regarding the windings, both primary and secondary, the capacity losses being comparatively negligible. 3-1 and 5-1, **12/6**

The TELSEN "ACE" illustrated above is smaller and more compactly built than the "RADIOGRAND." The weight (13 ozs.) has been reduced to a minimum. The same care has been exercised with the windings and construction as with the "Radiogrand." 3-1 and 5-1, **8/6**

THE NEW No. 3
ORMOND
S.L.F. CONDENSER ·00025, 5/6. ·00035, 5/9. ·0005, 6/-. With 4-in. Dial. With Friction 5/-. 4-in. Dial, 6/- each extra.
ORMOND, Square Law Low-Loss. ·0005, 9/6; ·0003, 8/6 (1/6 each less no vernier); **Friction Geared**, ·0005, 15/-; ·0003, 14/6; ·00025, 13/6. **Straight Line Frequency Friction Geared**, ·0005, 20/-; ·00035, 19/6. S.L.F. ·0005, 12/-; ·00035, 11/-.
FILAMENT RHEOSTATS, Dual, 2/6; 6 ohms or 30 ohms, 2/-. **Potentiometer**, 400 ohms, 2/6. ·0001, Reaction, 4/-; Air Dielectric, 2/-; Neutralising, 4/-; Neutrodyne, 2/-. **Twin Gang**, ·0005, 32/-; Triple, 40/-. **H.F. Choke**, 7/6. **Geared Dial**, 5/-. **Logarithmic**, ·0005, 14/-; ·00035, 13/-; ·00025, 12/-.

BULLPHONE

Gramophone Attachment
15/-
Cone Unit
15/-
Cone Paper 2/6

LISSEN

Valve-Holders, 1/-; Fixed Con., 1/-, 1/6; Leaks, 1/-; Switches, 1/6, 2/6; Latest 2-way Cam Vernier, 4/6; Rheostats, 2/6; B.B., 1/6; Lissenola, 13/6; L.F. Transformers, 8/6; 100 v H.T., 12/11; 60 v. H.T., 7/11; Coils 60 X, 6/4; 250 X, 9/9.

K. RAYMOND

27 & 28a LISLE ST., LONDON, W.C.2
Come to LEICESTER SQUARE TUBE
This address is at the back of Daly's Theatre.
'Phone: Gerrard 4637.

"MULLARD MASTER THREE"

NO SOLDER—ONLY 20 WIRES TO CONNECT

SET OF COMPONENTS

The components specified:

2 Terminal strips, 2½ in. x 2 in. x ¼ in.
1 Coil base.
1 S.L.F. variable condenser, ·0005 mfd. (J.B.)
1 S.L.F. variable condenser, ·00035 mfd. (J.B.)
1 H.F. choke (Climax).
3 Anti vibratory valve holders with terminals.
1 Pair panel brackets.
4 Terminals A, F, L.S.—, L.S.+ (Belling-Lee).
1 Set of A B C connecting links (Junit).
2 Spade terminals—1 red, 1 black
Master Three Coils.
1 On and Off switch (Bulgin).
1 R.C.C. unit, type A (R.I-Varley).
1 L.F. transformer, G.P. (R.I.-Varley).
1 Combined grid leak, 2 megohms, and condenser, ·0003 mfd
8 Wander plugs—4 red, 4 black
Suitable length of red and black flex.
1 Ebonite bush, ⅜ in. diam., ⅜ in. hole, 3/16th in. thick.
Baseboard.

And 3 Mullard P.M. Valves.

ABOVE KIT **£6 17 6**

FREE. High-grade Aluminium Panel (drilled), G.B. Battery and 108 volt H.T. given free with above. Cabinet 18 x 7 x 10 deep (American type hinged lid) for 17/6 with above kit only (list price 25/-.).
Carriage, etc., 2/-.

EDISWAN NEW THREESOME

LIST OF COMPONENTS.

Three Coupling Units, Tubular Fixed Condenser, Multi-flex Cable and Plug, ·0003 Variable with S.M. Dial, 2-way Geared Coil Holder, Connecting Wire, Red & Black Flex.

The lot post free 42/- nett.

EBONITE PANEL 5 Ply Baseboard **2/6** The two with above kit only.

Ediswan Valves, 10/6 each; Power 12/6.

→ You can also buy with Threesome Parts ONLY—60-volt H.T. Batteries at 4/6; 2-volt 40-amp. L.T. at 6/11. Best makes. Post 1/6 extra for Batteries.

SET OF THE SEASON
COSSOR MELODY MAKER
COMPONENTS FOR SAME

Post **£4.10.0 Kit.** *Extra*

2 Ormond ·0005; 2 Do. S.M. Dials; 6 T.C.C. Condensers, ·001, ·002, two ·0003, ·0001, 2 mfd.; 2 Grid L.K. Clips, B.B.; 2 Var. H.B. Rheostat; 3 Dubilier Leaks, .25, 3, 4 meg.; 3 Lotus W.H.; 1 Ferranti L.F.; 2 Panel Switches; 1 Cossor Melody Wound Coil; Terminals, Name Tabs, Glazite, 9-v. Grid Bias (all as specified).

NOTE Drilled High-grade 21 x 7 Polished Panel, with Radion Strip, FREE with above kit.

ALSO All Valves Stocked

You can buy a handsome Cossor Melody American type Oak Cabinet, hinged lid, baseboard, at 15/- with kit of parts (mahogany polished, 18/11). List prices much more. Kindly add 2/- extra if cabinets to go by post, etc.

CABINETS

Large stocks of really useful cabinets kept or made to order. Solid oak, American type, hinged lid, baseboard.

12 x 8 x 9	11/6
14 x 7 x 9	13/11
16 x 8 x 9	16/11
18 x 8 x 9	19/11
20 x 8 x 9	22/6
21 x 7 x 9	25/-
24 x 7 x 9	27/6

Carr. & Packing 2/6 extra

MAHOGANY POLISHED 5/- Each Extra.

Reduction if you buy your parts here.

IT IS IMPOSSIBLE TO ADVERTISE ALL THE WIRELESS PARTS NOW ON SALE, BUT IF YOU WANT THEM TRY RAYMOND'S FIRST!

BE SURE YOU VISIT THE Bargain Window. New 100-page Catalogue. Profusely illustrated. Price 1/- Post FREE, allowed off first 10/- order.

In Our Test Room

A Magnum H.F. Choke—A Lissen Centre-Tapped Coil—Ediswan "One-Der" Loud Speaker—An Amplifier Coupler—A Cheap Grid Leak, etc.

A Magnum H.F. Choke

MESSRS. BURNE-JONES & CO., LTD., recently sent us one of their new H.F. chokes for test. This is a small cone-shaped device, the cone shape corresponding with the design of the winding, which is wound in a manner claimed to be the best for giving the component a wide wave-band of efficiency. And for its very small size (its actual dimensions are: overall height 2 in., base $2\frac{3}{4}$ in. by $1\frac{1}{2}$ in., weight 3 oz.) it is a very efficient article.

It has an inductance of 160,000 micro-henries, while its self-capacity is of the very low order of 8 micro-microfarads. It will function satisfactorily from 150 metres to 3,000 metres, and thus it can be incorporated in a receiver with the knowledge that it will be suitable for the reception of any stations employing ordinary wave-lengths.

This Burne-Jones component is efficient despite its abnormally small size.

The body and the base of the device are of high-grade bakelite material, and the neat little terminals, which are provided with soldering tags, are nickelled. In some receivers the H.F. choke is not a particularly vital component, but, as a rule, it would be safe for the amateur to regard it as something of a "key" component, and for this reason he should see that it is of reputable make and of proved reliability. In our opinion this Magnum component can be included in this category. The retail price is 7s. 6d.

Manufacturers and traders are invited to submit for test purposes radio sets, components and accessories to the "Modern Wireless" Test Room at Fleetway House. Under the personal supervision of the Technical Editor all tests and examinations are carried out with the strictest of impartiality.

Readers can accept the Test Room reports published monthly under the above heading as reliable guides as to the merits and demerits of the various modern productions of the radio industry.

A Lissen Centre-Tapped Coil

A new Lissenagon centre-tapped coil is one of 300 turns. It is of the plug-in variety and enables a high wave-length band to be covered with a circuit employing centre-tapped coils for either auto-coupling or neutralising purposes. It embodies the familiar hexagonal self-supporting winding and the tapping terminal is taken from the cut-away base.

It is quite as efficient as any of the other Lissenagons and operates well in appropriate circuits. For sets employing tapped-anode-coil neutralising circuits and similar arrangements, this new Lissenagon carries the wave-band up to 5 X X, Hilversum and others of the lower-frequency stations with results of excellence comparative with those given on the lower band using the smaller coils of the same variety.

Ediswan "One-Der" Loud Speaker

It may occasion some surprise when we state that one of the best loud speakers we have had under test for some time is of the horn type. But it is so, and it happens to be the new Ediswan "One-Der" Loud Speaker, a full-size model which retails at £2 10s. In our opinion it is some way ahead of many cones that there are on the market at prices in excess of that figure. Far from it being the fact that the worst "cone" is better than the best horn type of speaker (as one dogmatic technician has stated in the Daily Press), there are not more than some half-dozen cone speakers available at any price which on the average set will give superior results to this Ediswan "One-Der."

The Ediswan "One-Der" Loud Speaker.

Quite a few of the cones, especially the cheaper models, colour their reproductions so badly that they play havoc with the whole range of musical frequencies. If this Ediswan "One-Der" has a falling characteristic on the lower notes—and what speaker of any type has not?—it does render a great proportion of the register with brilliancy. Interested readers should take the first opportunity of listening to it themselves.

A Burndept Valve Holder

We recently received a Burndept screened-grid valve holder. This was designed specially to take the new screened-grid H.F. valve as manufactured by Messrs. Marconi, G.E.C., and Cossor. The holder consists of two separate brackets which can be mounted in practically any desired position and can be adjusted to suit the varying lengths of the same type of valve. The brackets are made of polished bakelite and are fitted with spring clips to take the valve pins, one bracket having three clips and the other two.

The arrangement of these clips is such that it is impossible to insert the valves in the wrong position. The clips are extended to form soldering tags, and screw terminals are also provided. The holder is eminently suitable for sets in which the valve is mounted through a screen. It is well made, takes the valves snugly, and retails at the reasonable price of 4s.

Dionoid Accumulators

Samples of L.T. and H.T. accumulators have reached us from the Dionoid Battery Co., Ltd., Victoria Works, Darnall, Sheffield. The design of the low-tension accumulator specially appears to us to be most original and sound. It incorporates a number of features which will strongly appeal to the practical listener. These are all indicated in the photograph of the accessory which appears on this page.

The attention to detail is most commendable. All the fittings are covered with anti-sulphuric enamel, and the "Unigrip" carrier is heavily coated with lead before the enamelling is done, thus preventing any corrosion taking place. A feature of the H.T. battery is that interspacing ribs are placed between each 2-volt cell, thus eliminating creeping, while this battery also has its metal fittings heavily lead-coated before the enamelling process.

We have had both batteries in use for some time now, each having been discharged and recharged with moderate frequency. At times they have been made to do abnormally heavy work, but both retain an uncommon freshness in appearance; cleaned out, they would still look as good as new. If every Dionoid is as good as those sent us the name deserves to be widely known.

This is a Dionoid H.T. accumulator. Note the convenient carrying handle.

The L. and P. "High-Low" Coilholder which was reviewed in our January issue.

An Amplifier Coupler

The Graham-Farish Mfg. Co., of Bromley, Kent, have produced a three-valve coupler which incorporates all the components necessary for a three-stage L.F. amplifier. With the addition of one or two other components it can operate equally well as a three-valve set. It is a small, flat unit. It incorporates in its interior construction various fixed condensers, while three sets of valve sockets and clips for holding the anode and grid resistances are neatly fixed in the top. A number of neat little terminals provide the connections for the various batteries.

The anode resistances and grid leaks are, as indicated, interchangeable. This device considerably facilitates the assembly of an amplifier or a set, and at the price of 12s. 6d. appears to be very cheap when compared with the cost of the various items embodied in it if purchased separately. It is well made, and insulation tests prove that it is up to standard in this regard. Incorporated in the amplifier of standard type it gave good results. It is supplied complete with instructions, and these embody diagrams.

A Cheap Grid Leak

With grid leaks manufactured by a reputable British firm available at 1s. each there is no excuse for purchasing doubtful foreign products. The shilling grid leak is a new line of that well-known firm of Cambridge, Messrs. W. G. Pye & Co. Seven values of resistance are available, from ·25 megohm to 3 megohms, at that one price.

This Pye grid leak is of the conventional type, but at each end is a soft copper wire. These copper wires can be twisted into loops, and the grid leak fixed between two terminals by this means. Alternatively, these leads can be soldered direct to any desired point of contact. The samples of Pye grid leaks which we have had pass through our hands have proved perfectly satisfactory, and we have used several as anode resistances with good results in stages employing "high-mu" R.C. valves.

Columbia H.T. Batteries

Until quite recently the normal H.T. battery was more or less an assembly of flash-lamp cells but for some time the Columbia has afforded an example of "special construction for a special purpose." The cells are "Layerbilt," and occupy a minimum space for a maximum capacity. Apart from recent samples sent us from Messrs. J. R. Morris, of Kingsway, London, W.C.2, we have had many

A Dionoid accumulator with its special features illustrated.

Columbia H.T. batteries in use in our laboratories. We have always found them completely satisfactory.

In fact, we have been impressed by their consistent reliability and high capacities even when subjected to continual hard usage. Owing to the aforementioned unique method of assembly the size of a Columbia H.T. battery is no indication whatsoever of its capacity. We have no

(Continued on page 327.)

THOSE UNNECESSARY FOUR VOLTERS

With the present popularity and efficiency of two-volt valves, and the "power" offered by the sixes, do we really need that tiresome intermediate voltage?

By KEITH D. ROGERS.

OF the 350 odd valves of the ordinary receiving type (excluding mains valves and other special types), there are about 100 which have been designed for use with 4-volt accumulators. These valves have gradually developed from the ·06-amp. filament type, which used to need about 2·8 volts, and which were really brought in for use with dry cells, for the man who had difficulty in getting batteries charged.

Gradual Improvement

Since then, however, valves in general have been gradually improved, so that we now have a fairly complete range of receiving valves requiring only two volts low-tension supply. Simultaneously with the development of these 2-volters the 4-volters were still further developed, and we have at the present time three ranges of valves, taking 2-, 4-, and 6-volt L.T. batteries.

The average man who wants to choose valves for his receiving set thus has a choice of about 350 valves in three voltages, and in the average case he does not know what on earth to do. How could he? The various classes have so very little difference that the poor man nearly is in a dilemma when he comes to choose valves for his set.

If he has an accumulator on hand, then his voltage is already chosen for him, and he has to use valves of a certain type, but if he is going to buy a new accumulator he is rather at a loss as to the voltage he shall obtain.

What Figures Prove

Now with these three voltages on the market it is not only natural, but almost inevitable, that one or other will be more popular than either of the other two, and the sales figures of the various valve manufacturers show that this is the case. As a matter of fact, one voltage is very much more popular than either of the other two, that voltage, of course, being the 2 volts. The sales figures show that about 65 per cent of the valves sold are of the 2-volt class, the remaining valves being made up of 20 to 25 per cent 6-volters, and about 12 per cent 4-volters. Thus it will be seen that the 4-volt valve is in reality not at all popular.

The 2-volter has it all the way, with the 6-volter running a very bad second, and the 4-volter being left a long way farther behind.

Now why is this the case? A few moments' consideration will show that the 4-volter has very little to offer in advantages over the 2-volter, while the 6 has advantages over the 2 and 4 which really only come into operation, as it were, when real power is required. Let us consider the point a moment.

Useful Two-Volters

With recent developments the 2-volter has become every whit as useful for the average man as the 4- or 6-volter in H.F., detecting, and first-stage L.F. work; even the screened-grid valve in the 2-volt class can be quite as good as the 6-volt; the 2-volt ordinary H.F. valve may not neutralise quite so easily as the 6-volt, but it can be neutralised with good results, while as detector there is very little difference.

Question of Cost

The first L.F. stage shows us no very great difference, certainly not enough to warrant the use of a 6-volt accumulator as against the 2. When it comes to power L.F. amplification the 6-volter certainly does score, but the average man does not need power L.F. amplification. He uses a two or three-valve set, and all the signal strength he requires can be obtained without distortion from 2-volt valves, or certainly without such distortion that will be apparent from the loud speaker that he usually uses.

So far the coil-driven loud speaker has not come into popular use, and until this does a slight amount of distortion in a receiver will not be noticeable; such slight distortion as a little bit of overloading here and there is usually smothered by the

The radio equipment of the Croydon air station is one of the most efficient in the world. Our photograph shows the control tower, where the direction-finding and light signalling gear is housed.

loud speaker, and the signal strength is such that the average man does not need power amplification.

In many cases he cannot have it; he cannot afford it; it takes a tremendous amount of H.T. voltage and current, and unless he runs his set from the mains it is almost hopeless to expect to do it successfully at a reasonable cost. It is a very expensive business to run 6-volt valves, and to have real power amplification. Still further, the average room does not warrant it; it will not stand it. People require a certain amount of signal strength, and much above that the whole of the broadcasting becomes unbearable, while that "certain" signal strength can be obtained with good 2-volt valves.

Between Two Stools

So you see there appears to be no real need for a 6-volter unless you want real power work. Therefore, if that is the case, what happens when we consider the 4-volter? Unfortunately the 4-volter really falls between two stools. In efficiency it is very little better than the 2-volter; in fact, in the majority of cases, one can detect no difference by ear, and, after all, it is the ear which is doing the comparing in all these cases.

Give the average man 2-volt valves, let him get his set going, and let him listen to the programme. Then change his valves for 4-volters of suitable types and switch him over to the continued programme, and I'll warrant he will notice no difference, or, if he does, not enough to make him want to use the higher voltage with the more expensive L.T. supply, and therefore greater initial and running costs.

And why should he buy an accumulator that will cost him more to charge, besides twice the initial cost, if he is not going to get any better results on his set? The 4-volt valve has certainly fallen between two stools. It served at a time when filament consumption was a vital point, and when accumulators could not be charged easily, and dry cells had to be used. It gave us very low filament consumption, was horribly microphonic, but it had certain advantages over the other valves, which were in most cases rather insensitive pieces of mechanism.

Now, however, it has no advantages, or such slight ones that they make little or no difference, to offer over the 2-volt class, though it costs more to run and entails a greater initial cost for batteries.

If we want super-power results, real super-power valves, suitable for carrying as large an amount of grid voltage swing as possible on their grids, we must use 6-volt valves. If we do not want quite so much, and can carry the voltage swing on 4-volt valves, we shall find we can carry it just as well on 2 volts. Why, therefore, should we use 4-volt valves?

Why Now Scrap It?

The experimenter who wants power, and wishes to make sure that he is getting the utmost out of the set, will use 6-volters. They are better than 2 or 4—much better in some cases, on the low-frequency side. But the *average* man, as I said before, will notice very little difference between 2- and 4-volt valves. Therefore, he will use 2 volts.

So we see it all boils down to the fact that the 4-volter has had its day. It is time it was scrapped, taken right off the market. I do not think anyone would miss it; and, with a little more experiment, a little more trouble, the 2-volters could be brought up to such a pitch that they would far exceed the present 4-volters in their efficiency.

(*Continued on page* 322.)

FROM OUR READERS

The "Viking IV"

SIR,—I feel I must write and thank you for a set anyone can be proud of; it is well named the "Viking." It does more than you claim. As I could not get the formers or wire in Guildford for the transformer or coil I used Lewcos split-primary and split-aerial. Saturday evening I switched on, getting 5 G B at once. We had an hour's fine music.

I thought to try for another station, and station after station came along, it was the surprise of my life. No interference from one another; it was simply grand.

Good luck to your journal, MODERN WIRELESS, and the construction department.

Yours respectfully,
W. JUDD.

Chiddingfold.

Solodyne Success

SIR,—I want to thank you for the 1928 Solodyne circuit, and to congratulate you.

I finished the set on Saturday last, and have been enjoying it during the week-end. What I particularly notice is the improvement in *quality of reception.*

My old set—a neut. 5-valver—was good, and listeners admired its quality, but your new Solodyne is a vast improvement even on it. By the way, I cannot call mine a Solodyne. I used three Ormond ·0005 condensers. I have tuned-in about fifteen stations on broadcasting band already, and I am by no means an expert. My bother here is fading. Can anyone recommend any cure?

Yours very sincerely,
Rev.——

Co. Cork., Ireland.

The "Selective" Three

SIR,—In your issue of December, 1927, you gave a "Selective" Three, by Mr. L. H. Thomas.

I have made up this set three times, and have found it selective (extremely so), and it produces excellent volume both in tone and loudness.

The stations heard on an Amplion cone speaker are Bradford, Leeds, Newcastle, Manchester, 5 G B, and numerous foreign stations in between these wave-lengths.

The reaction is extremely smooth, and I have found that the position of the plug-in coils different to your layout illustrated, and have closed the coupling.

The results are on a very poor aerial.

I have found that there is some coupling between the wire coil on the former and the aerial plug-in coil when placed as illustrated

The condenser used for the aerial tuning requires to be geared extremely low, as the selectivity is wonderful. I find, also, the volume to be obtained without trace of reaction distortion.

Yours truly,
H. B.

Bradford.

NEXT MONTH

SPECIAL SOLODYNE NUMBER

RADIO NOTES AND NEWS OF THE MONTH

A feature in which our Contributor brings to your notice some of the more interesting and important Radio news items.

Conducted by "G. B."

CAPTAIN ECKERSLEY has been emphatic on the point that the B.B.C. is not disappointed with 5 G B. Well, the B.B.C. may not be, but there seems plenty of evidence that listeners are. Listeners are not so unreasonable as some people make out, and they do understand the fact that a medium high-power station like 5 G B cannnot possibly have such a big service area as 5 X X; but, for all that, many listeners, particularly in London, who thought they were going to get an alternative programme from 5 G B, are not getting it, and no one can blame them if they start making a row and want to know why.

Restricted Range

5 G B has undoubtedly got a restricted range, and in all probability the masts at 5 X X are responsible for causing shielding, which has been put down as the chief source of trouble. Birmingham, of course, is still complaining about the reception of 5 G B; but, then, Birmingham has found it efficacious to make a row, long and rowdy, about anything it doesn't like, especially in wireless matters, and there is no doubt the B.B.C. has been particularly ready to fall in with the wishes of the Midlands as far as possible.

5 G B should really be a contrast programme altogether, with a much wider range than covers the Birmingham district, and it is suggested that the best thing the B.B.C. can do is to move 5 G B well away from 5 X X. But the answer for the B.B.C. is, of course, that the station is experimental, and how long it will be termed that probably depends on how long the plans for the Regional Scheme are held up.

A Terrible Thought

The Bell Telephone Company of America announces that it has successfully commercialised a new loud speaker which has been designed so that people within a mile radius may hear public addresses or musical items. It is said that a million people can thus be reached by the same loud speaker.

If this sort of thing goes on in proportion, no doubt some of our radio prophets will be visualising the day when New York fixes up a loud speaker to broadcast news direct to London. Let us hope we shall all be dead before that happens!

A.D. or B.C.?

In the "Passing Show" recently there was an interesting and amusing cartoon of Sir J. C. W. Reith, with the following caption underneath it:

"To you, Sir J., our debt we owe
is high, and wide, and deep;
You soothe our early morning
nerves, your wave-lengths waft
us sleep.
Culture on easy terms consoles;
but from the 'phones we flee
When humour passed as up-to-date
turns out to B-B.C."

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Invaluable to every Amateur and Constructor

The "POPULAR WIRELESS"

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5. H.F. (Tuned Anode) AND CRYSTAL WITH REACTION.
6. H.F. AND CRYSTAL (Transformer Coupled, without Reaction).
7. 1-VALVE REFLEX WITH CRYSTAL DETECTOR (Tuned Anode).
8. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Employing H.F. Transformer, without Reaction).
9. H.F. AND DETECTOR (Tuned Anode Coupling, with Reaction on Anode).
10. H.F AND DETECTOR (Transformer Coupled, with Reaction).
11. DETECTOR AND L.F. (With Switch to Cut Out L.F. Valve).
13. 2-VALVE REFLEX (Employing Valve Detector).
14. 2-VALVE L.F. AMPLIFIER (Transformer Coupled, with Switch to Cut Out Last Valve).
15. 2-VALVE L.F. AMPLIFIER (Transformer-Resistance Coupled, with Switch for Cutting Out Last Valve).
16. H.F. (Tuned Anode), CRYSTAL DETECTOR AND L.F. (With Switch for Last Valve).

P.W. BLUE PRINT Number

17. CRYSTAL DETECTOR WITH TWO L.F. AMPLIFIERS (With Switching).
18. 1-VALVE REFLEX AND CRYSTAL DETECTOR, with 1-VALVE L.F. AMPLIFIER, Controlled by Switch.
21. THE 2-VALVE LODGE "N."
22. "THE GUARANTEED REFLEX."
23. THE 1-VALVE "CHITOS."
24. THE "SPANSPACE THREE." Three-Valve Receiver employing 1 Neutralised H.F. Valve, Detector with Non-Radiating Reaction Control, and 1 L.F. Valve.
26. A "STRAIGHT" 4-VALVER (H.F., Det., and 2 L.F. with Switching).
28. A "MODERN WIRELESS" 5-VALVER (H.F., Det., and 3 L.F.).
29. AN H.T. UNIT FOR DIRECT-CURRENT MAINS.
30. A REINARTZ ONE-VALVER.
31. A STANDARD TWO-VALVER (Detector and L.F.).
32. The "CUBE SCREEN" THREE (H.F., Det. and L.F.).
33. A "KNIFE EDGE" CRYSTAL SET.
34. AN H.F. AND DETECTOR TWO-VALVER.
35. THE "UNIVERSAL THREE" (Det. and 2 L.F. stages resistance-coupled).
36. The "SPANSPACE FOUR" (H.F., Det. and 2 L.F.).

ALL "POPULAR WIRELESS" BLUE PRINTS 6d. EACH

All orders for these Blue Prints should be sent direct to the "Popular Wireless" Queries Department, Fleetway House, Farringdon Street, London, E.C.4, enclosing a stamped addressed envelope and a postal order for 6d. for each Blue Print ordered.

RADIO NOTES AND NEWS OF THE MONTH

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Berlin's Broadcaster

Germany is working, on lines different from the B.B.C.'s, in the matter of providing alternative programmes. Instead of having a Regional Scheme worked out, that is to say, a scheme which allows for the installation of a number of high-power stations transmitting two different programmes, the German plan is to use a super high-power station for transmitting one programme with a number of minor stations for providing the alternative programme. Germany's super station is now in operation, although working on much smaller power than it is capable of using. Zeesen, the new station, is very close to Konigswusterhausen, in the Berlin neighbourhood, and undoubtedly at the moment it is the most powerful broadcasting station in the world. It is capable of operating with 120 kilowatts, while the maximum power of 5 X X is 25 kilowatts, and that of 5 G B 30 kilowatts.

Zeesen has been built with the idea of covering the whole of Germany, so that people in the most distant parts of the country can receive the programmes on a simple crystal set.

Chelmsford Calling

A Cape Town amateur, who was listening-in to Chelmsford the other evening, reports that for the first time reception from 5 S W was almost perfect. This amateur, a Mr. Slingsby, said that the address of Captain Eckersley was heard without a single word being lost, but reception from America was not so good.

Very good reports seem to be appearing about 5 S W, and if this paragraph meets the eye of any of our readers in distant parts of the world, we should be glad to hear from them as to how 5 S W is being received.

A Wave-length Rumour

The news that the new Croydon Aerodrome transmitter was to use a wave-length of 1,550 metres is not true. This rumour put the wind up quite a lot of people because it was naturally anticipated that on such a wave-length Croydon would greatly interfere with reception from 5 X X.

But the Air Ministry have announced that two wave-lengths have been used—900 and 1,400 metres—both pretty well clear of any broadcasting station's wave-lengths. The 1,400-metre wave-length will be used for communication between Croydon and other ground stations, and for exchange of traffic news and weather reports. The old Aircraft wave-length of 900 metres will be used for all communications with aircraft.

An Italian Invention

I saw the other day that the Italian Government announced it had acquired in the interests of National Defence an invention covering "a system of telegraph and radio telegraph combined with a method of typewriting adjusted to guarantee security of communications."

According to the "Morning Post," the apparatus consists of a special typewriter with which the sender can transmit to whatever locality desired, and to that only. Messages can be sent of any length with the absolute certainty of secrecy, or at least such is the claim made.

The inventor is a Leghorn engineer who for some years has been experimenting with ordinary and beam wireless in Italy, Berlin and London. It appears that, like many other

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inventors, he found little encouragement in London, and so made known his experiments to a scientific congress in Germany, and it was there that the Italian Government arranged for tests, which certainly seem to have been successful from the inventor's point of view.

Popular Broadcasters

An interesting letter appeared in the "Daily Mail" the other day, as follows: "Many of us sincerely hope that the B.B.C.'s scientific talks will not be cut in any way. We would rather go without a dinner than lose a talk from Sir Oliver Lodge, Professor Huxley, or some others. We don't all want silly songs, silly talks and silly nonsense all the time."

This reminds me that it was suggested the other day that the two most popular broadcasters in the country were Sir Oliver Lodge and Sir Walford Davies, with Mr. A. J. Allan coming a very good third.

Future of Set Design

Professor Hazeltine, chiefly known as the sponsor of the neutrodyne method of stabilisation in high-frequency amplifiers, gave some interesting views on the future of radio design in a recent address to an American electrical association. According to a report in the "New York Times," he said that advances in radio have lessened the difficulties in receiving sets which now lie in the details of design and construction.

Interference and Distortion

Sensitivity, according to Professor Hazeltine, in a wireless receiving set is limited by disturbing noises, partly in the valves and power supply, but in a large measure external in the form of natural or man-made strays. Selectivity is limited by the fidelity required in broadcast reception. A certain band of frequencies must be covered at each tuning adjustment, corresponding in width to the frequency band present in speech or music. To-day it is possible to bring each radio stage close to this limit. Increased selectivity then is a matter of a correct number of tuned circuits, and therefore of greater cost.

Fool-proof Receivers

The future of listening, according to Captain Eckersley, is in terms of foolproof sets. It should be the aim of those responsible for distribution, he said, at a recent lecture before the Institution of Electrical Engineers, in London, to make the problem of reception as simple as possible. And in order to do this and to make selection between two alternative programmes as simple as possible, the two transmission strengths must be equal. This once achieved there was a maximum opportunity for the receiver to obtain one or the other programme without initial interference and possible interference from outside sources.

The Parrot Competition

The B.B.C.'s idea of adopting a parrot was rather novel. It appears that they made a search throughout London, and in the end found a very handsome and sprightly looking bird in Tottenham Court Road. It was stated that this parrot had a vocabulary of twenty words, and on the strength of this vocabulary was promptly purchased and carted to 2 L O in a new cage. But the parrot, like a good many other broadcasters first going to Savoy Hill, was seized with microphone fright and sulked in his cage, refusing to admit even the most vulgar of the words in his vocabulary. It appears that anybody who approached the cage was treated with suspicion, a ruffling of feathers and a scratching noise similar to a bad form of oscillation.

The Parrot Competition, which is just announced as these Notes are written, seems rather dangerous. One can never censor a parrot's vocabulary, and just out of sheer cussedness and to back up Mr. Bernard Shaw, Mr. Chesterton and others who have been so annoying over the talks controversy, it is quite possible that listeners will be badly shocked before the end of this competition for broadcasting chats by parrots.

No Welsh Station

A wireless station for Wales was one of the many questions discussed by the National Union of Welsh Societies recently. Alderman William George said he had been in touch with the B.B.C. with the result that progress could be expected in the number and standard of Welsh programmes; but the idea of a station for Wales, we are afraid, is not likely to come to anything for some time yet.

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Wireless and Weather

Mr. A. M. Low, the motor engineer, has been saying that no scientist has the right to dismiss the question of wireless interference with climatic conditions as of no consequence. In fact, it is ridiculous to say that the suggestion is ridiculous.

But writing in the "Daily Express" recently, Sir Napier Shaw said the control of weather is a good deal for wireless to manage. Whoever undertakes to provide a tenth of an inch of rain over a ten miles square—a poor allowance for a rainy afternoon—must arrange to dispose of half a billion foot tons, four hundred and fifty million kilowatt hours, six hundred million horse-power hours!

In fact, it is ridiculous for Mr. Low to say that it is ridiculous to say that the suggestion is ridiculous!

"Seeing Across the Atlantic"

Mr. Baird's spectacular experiment in televising a crude image across the Atlantic has probably made many people think that progress in television has been accelerated tremendously, but, experts have agreed that the question of *distance* in television is not a very great problem.

The Real Problem

What is the great problem, however, is the question of detail, and it is not much good Mr. Baird saying that with greater power he can get greater detail. That is beside the point. He has made many experiments during the last two years, since the Baird Development Company was formed, but so far, from the evidence he has offered, we cannot see any indication of an improvement in the detail of the crude images he televises, and certainly no indication that he has a system worthy of being offered to the public in the form of a service. The day of the thirty pound televisor receiver from the real utility point of view is indeed a long, long way off. What is wanted is a new scientific system, and of that, we are afraid, there are no signs as yet.

A CORRECTION.

"In the R.I. & Varley advertisement on the back cover, the distributed capacity of the R.I. & Varley H.F. Choke is given as 25 mfds.; this of course should read 25 micro-micro-farads."

ALL ABOUT THE "MASTER THREE," ETC.

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to the second valve, as it were, and as one end or terminal of this goes to the maximum H.T. plus, this point is also used as one of the loud-speaker terminals. The other loud-speaker connection is in the form of one of the pins of this third unit which, were it acting as an "inter-valve" unit, would be the pin which carried the energy over to a subsequent unit with its anode resistance and grid condenser.

It is a remarkably well-thought-out scheme. If one so desired, one could go on plugging these units in, and with equal facility one could pull one or two out. However, the three used in the Threesome are all that are required for ordinary purposes.

Grid Bias Values

The detector stage is given an H.T. plus terminal to itself, the other two valves sharing one common tapping. Each of the three valves has its separate grid-bias tapping, although it should be noted that the detector valve is given a positive bias, whereas the other two grids are made negative. The arrangement of the grid-bias plugs in the "R.C. Threesome" is a vital point in its design, and constructors should make sure that they have them right.

Almost as important, or I should say equally important, are the values of the coupling components and the types of valves. It is necessary, to the proper working of the set, that there should be an Ediswan white label resistance in all the units with the exception of the centre unit. This latter should have a green label resistance shunted by a ·0005-mfd. tubular condenser, as mentioned above. The use of a green label resistance in any other position will cause a very considerable drop in volume.

The Valves

These resistances and condensers were chosen to work with certain definite types of valves, and one must use these valves if one wants the best results. In the first stage an Ediswan H.F. 210 type is specified. This valve has a fairly high-amplification factor and impedance, but not as high as those peculiar to the special R.C.C. type of valve recommended for the second stage of the set. In the last

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stage it is necessary to use a power valve of the P.V.2, 4 or 6 type.

The constructor must see that he inserts these valves in their right order. He should also ascertain that the pins of the valves are making good contact with their various sockets.

I do not think that I can see any snags in the construction of this Ediswan set. The constructor should, of course, note that the pins of the various units are making good contact with their sockets before the assembly of units is screwed to the baseboard. If necessary, the sockets can be opened slightly with a pocket-knife.

The Plug-In Coils

You should obtain tuning coils of one make; do not mix them. It is an unfortunate fact that some makes of coils are wound in different directions from others. If, perchance, you happen to hit on a pair that are out of sympathy in this respect, you will be unable to get reaction effects with your "R.C. Threesome" until you reverse the two connections which go to the fixed block of the two-way coil holder.

By the way, you bring the "R.C. Threesome" nearer to its point of greatest sensitivity as you bring the two coils in their holders nearer together by means of the coil-holder control knob. The farther the coils are parted the farther the set is away from that point and the less sensitive it becomes.

A "Hand-Capacity" Tip

If you find that hand-capacity effects are pronounced when receiving distant stations and that as you take your hand away from the set stations vanish, this can probably very easily be overcome by reversing the connections to the variable condenser; that is, take leads Nos. 1 and 2 to the moving plates and leads Nos. 3 and 4 to the fixed plates.

I expect you will find the "R.C. Threesome" sufficiently selective for all ordinary purposes, but if you happen to be situated very close to a transmitter and experience jamming or desire to separate two stations which tend to merge, I would advise you to try using an "X" coil. This is a plug-in coil made by Messrs. Lissens, having two tappings on it

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ALL ABOUT THE "MASTER THREE," ETC.

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which give alternative degrees of selectivity. This tapped coil of appropriate size for the wave-band you wish to cover should be plugged into the moving block of the coil holder instead of the usual aerial coil. The aerial lead should then be taken to one or other of the tappings on this coil instead of to the terminal to which it normally goes on the "A" unit. Still greater selectivity can be obtained by placing a ·0002-mfd. in series with the aerial as well as using the "X" coil.

The way you use this extra component is as follows: You connect the aerial lead direct to the ·0002-mfd. fixed condenser. The other terminal of this you then connect by means of a short length of wire to the tapping on the coil.

Where the set is used right in the shadow of a transmitting station's aerial it will be necessary to employ a wave-trap. A very simple and easily built variety is the "M.W." Standard Wave-trap designed by Mr. G. P. Kendall. It can be used with this "R.C. Threesome" without altering any of the existing connections.

Future Articles

In conclusion, just a few words of general interest to those who possess one or other of the three sets I have dealt with in this article. The last paragraph dealing with the Ediswan "R.C. Threesome" applies equally well to all three receivers, and arrangements have been made to reprint the specification of the "M.W." Standard Wave-trap in either this or the next issue of MODERN WIRELESS. Mr. K. D. Rogers is going to have something to say about the use of gramophone pick-ups with these three popular sets in either the next or at least a very early issue of "M.W."

And should any reader wish still further to extend the loud-speaker range of any one of these three sets, he can build and use the easy-to-make, easy-to-operate and inexpensive H.F. unit which Mr. Johnson-Randall will deal with in full in next month's MODERN WIRELESS. If you have purchased this issue of MODERN WIRELESS specially to read about one of the "star" Valve-maker Sets and you are in truth A New Reader, place a regular order for the journal at once for we have many articles in preparation which you will find of great interest and value.

THOSE UNNECESSARY FOUR-VOLTERS

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Eventually the 4-electrode valve will solve the H.T. voltage problem, and I hope within a very, very short time we shall be having super-power valves capable of being operated on 80 volts H.T., or perhaps even less, and giving a voltage swing sufficient to operate a medium-sized cone loud speaker with good volume.

Development on the H.F. side has been extremely rapid, and I feel sure that within a comparatively short time we shall find that development on the L.F. side has been nearly, if not quite, as rapid.

Readers' Views Invited

The 4-volt valve can surely be taken off the market without anybody being worried. It is a good valve, but the 2-volter is also a good valve—just as efficient. Therefore, why keep two classes? Why keep a valve which is obviously not popular, and which means a greater expense and merely litters up the manufacturers' and dealers' shelves, taking space which might be occupied in a much better way?

It would be interesting to have readers' opinions on this point, and I should be glad if any of you would find time to drop me a line, and give me your opinions on the question of 4- or 2-volters.

I referred just now to the probability that in a short time we shall be seeing a series of 4-electrode valves designed specially for L.F. amplification with low H.T. voltages. As a matter of fact, I have just had several L.F. valves of this description sent in for test by Messrs. Analoy Products, Ltd., who are manufacturing a series of 4-electrode valves.

Satisfactory 4-Electrode Valve

These valves have very good characteristics, and are capable of carrying a considerable voltage swing without overloading, and using only 40 to 100 volts H.T. Without going into details, I must say that these valves are eminently satisfactory, and, though these are not super-power valves, I believe that special super-powers will be available before very long.

It is to be hoped that other manufacturers will give their attention to the question of producing 2-volt power valves of the 4-electrode type, as well as 6-volt super-power valves.

THE "SOLODYNE" ON LONG WAVES

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obtain more magnification, but only at the risk of losing quality of reproduction or selectivity.

A little experimenting soon cleared up such points as these, and the first really great difficulty was encountered when the question of accurate ganging was tackled. Much time and trouble were expended on this point, and a design finally decided upon which can fairly readily be matched up to a standard and does not then involve any readjustment of the gang condenser.

The basis of the final coil is a six-ribbed former such as the Becol No. 5A, roughly 3 in. in diameter over the ribs and 3½ in. long. This is supported on the usual five-pin base ("Special Five" type) by means of two short pieces of threaded brass rod and nuts.

Section Winding

The windings are of the sectionalised type, arranged by making a series of saw-cuts along the ribs and winding these full with wire in a manner the photograph of a complete coil unit will make quite clear. The windings (both primary and secondary on the H.F. transformers and secondary only on the aerial unit) are wound in two halves in opposite directions as before. The actual spacing of the saw-cuts is marked on the diagram, and it should be noted that they are taken down to the full depth of the ribs.

The secondary consists of 29 turns of No. 32 D.S.C. wire in each of 12 slots, 6 being wound in one direction and 6 in the other. Total number of turns, 348. The 13th slot (we are not superstitious!) carries the reaction winding of 80 turns of No. 36 D.S.C. in the same direction as the section of secondary nearest to it. This slot is against the I.S. end.

Over the top of the secondary is wound a few layers of silk or cotton thread, and then the primary is wound on, consisting of 15 turns per slot of No. 36 D.S.C. wire, in the same direction as the sections of secondary beneath.

The aerial unit has only 12 slots (see photo), since there is no reaction winding. The secondary is as before, but the primary (80 turns, taps at 40 and 60 of No. 32) is all wound in the first four slots from the I.P. end.

THE "RADIO-GRAM" FOUR

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Burndept do not market a three-point switch, and I preferred to employ this type of well-made anti-capacity switch since it makes a better job than does an ordinary stud-type switch. Constructors who do not agree with this can use the latter type of switch if they prefer to. The hole for the milliammeter is not quite so simple as the remainder of the panel holes, but the fretsaw will enable the necessary circle to be cut if this is first marked out with a pair of dividers. Incidentally the set as described will fit into the standard 1928 "Solodyne" cabinet, since there is only a slight difference in the baseboard size, the "Solodyne" baseboard being 12 ins. deep.

Wiring Up

The wiring is not difficult. For the H.T. and L.T. leads it is advisable to use Systoflex covering in case one of the wires happens to touch the metal floor or screening. Make the holes through the screens large enough to permit the Systoflex covering to be pulled through freely in case the sharp edge of the copper pierces the insulation covering.

Now for details of the operation of the receiver. Assuming that the coils described in my December article will be employed, place these in position, i.e. the 75-turn inductance in the aerial socket and the 80-turn coil in the anode socket.

The valves I have been using in the tests are as follow: In the H.F. valve holder a Marconi S.625; detector, Marconi or Osram D.E.L.610; 1st L.F., D.E.5; last stage, two D.E.5A's.

These are not the only suitable valves, and except in the case of the H.F. stage considerable variation is possible. Unfortunately, I have as yet had no opportunity of testing other makes of screened valves, but with regard to the remaining sockets I suggest:

Detector.—Any good H.F. valve having a resistance of 20,000–30,000 ohms and a magnification of 20, such as the Mullard P.M.5X, Cossor 610 H.F., etc.

1st L.F.—A valve with a resistance of 6,000–8,000 ohms, such as the P.M.6, Cossor 610 L.F., B.T.H., B.4, D.E.5, etc.

Last Stage.—If signals are strong, two super-power valves having a resistance each of 3,000–4,000 ohms.

In some cases readers may be situated in districts where reception from any station is poor. In these circumstances signal strength can be improved by using a 250,000-ohm resistance instead of the 100,000-ohm anode resistance, and a valve having a magnification of 20 and a resistance of 20,000–30,000 ohms instead of the 6,000–8,000-ohm valve suggested. In the last stage valves having a resistance of 6,000–8,000 ohms each could then be employed, but not if signals are strong, otherwise overloading will occur.

Now connect up the L.T. and H.T. batteries. The H.T. voltages may be as follow:

H.T.+. 80 volts.
H.T.+1. 120 volts.
H.T.+2. Same as H.T.+3, or, in any case, 120 volts or more.
H.T.+3. The highest possible voltage, depending upon the valves and volume handled. If available, 200–300 volts is advisable for moving-coil instruments. For moderate volume on ordinary loud speakers, 150 volts.

The grid bias to the detector valve should be about 3–4½ volts, and 1½ for the grid bias when the valve is used for the gramophone pick-up.

The grid bias for the L.F. valves should be adjusted in accordance with the maker's instructions for the particular H.T. voltage employed.

Coil Details

Regarding the small coils which I usually use for local reception, these are made to exactly the same dimensions as were given in the December issue. The formers, however, are 2 in. in diameter instead of 3 in., and the turns are as follow:

Aerial Coil.—70 turns of No. 30 D.S.C. wire wound in two halves of 35 turns each, the second half being in the opposite direction to the first half winding, and a centre tapping being taken to the centre of the winding at the point where the reversal in direction occurs.

Anode Coil.—90 turns of No. 30 D.S.C. wound in two halves of 45 turns each, the second half being in a reverse direction to the first half.

Paxolin or Pirtoid formers are satisfactory, and are 3½ in. long. The distance between the centres of the outside valve pins is 3 in. Further details will appear next month.

RADIO ABROAD

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immense distances beyond the "dead" area.

Consequently, every high-frequency station really requires an exclusive channel, thus placing a definite limit upon the number which may be accommodated throughout the world.

The radiation or interference problem with regard to short-wave transmission and reception will no doubt be overcome very soon, but fading and other transmission irregularities may prevent the use of short waves in the essential local and regional broadcast services.

Allotting Wave-lengths

Since short-wave stations practically cover the earth with their signals, it is desirable, so far as possible, to assign only one powerful short-wave broadcast to any particular frequency. Consequently, it is important to select a short-wave broadcasting band at once and allot frequencies so as to meet the needs of all countries.

Radio in the Near East

Oil prospectors in the Red Sea are the latest of the world's isolated communities to adopt wireless as a means of communication with the nearest centres of civilisation. Islands in the Farsan group are being prospected by the Red Sea Petroleum Company, and are being equipped with transmitting (spark) and receiving apparatus of the type used on board ships.

Radio Position in Australia

With the rapidly increasing interest in broadcast reception, and in wireless generally, in Australia—which is probably at the present time one of the best overseas markets for British wireless goods—it has been found necessary to appoint a Royal Commission to investigate and consider the wireless patent situation, so as to enable manufacturers, traders, and the public generally to understand clearly the position.

The Royal Commission has now received an exhaustive report on the patent situation from a well-known firm of Sydney patent attorneys and some of the findings in this report are very interesting.

The opinion is expressed that, with the possible exception of the well-known Meissner patent of 1914,

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RADIO ABROAD

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and the Schloemilch patent of 1913, there is no patent which can be successfully propounded to interfere with the activities of broadcasting transmitters in Australia.

With regard to receiving sets, the report expresses the view that no patent applies to crystal sets and that a plain valve detector (without feed-back) is not of itself subject to any patent. Where the reaction principle is used, however, this brings in the Meissner patent, and the low-frequency feature brings in the Schloemilch patent referred to.

With regard to the neutrodyne, it is pointed out that the Hazeltine patents, which are five in number, obtained in 1924 and 1925, were applied for in Australia when the neutrodyne system was known and in use there. These patents, it was stated, cover a particular form of neutrodyne circuit, but do not cover the whole of the principle.

Tuned R.F. Amplification

One of the most important decisions in the radio business in the United States was recently given in favour of the Radio Corporation of America against a prominent firm of traders. The decision established the validity and scope of the well-known patent of Dr. Alexanderson, which deals with tuned radio-frequency amplification.

IS 5GB WORTH WHILE?

SIR,—With reference to the article "Is 5 G B Worth While?" in the February number of MODERN WIRELESS, I am wholly at a loss to reconcile the statements:

(*a*) That the new London transmitter is to be situated to the north of the Metropolis, so that it may serve both London *and* the Midlands.

(*b*) That this transmitter will give the Home Counties and the South an adequate service.

If the new 2 L O is to cater for both the South and the Midlands it will presumably be placed midway between these two areas, say, fifty miles north of London.

Now, Londoners know by bitter experience that, with the poor aerials they necessarily have to use, four or five valves are required to bring in either of the Daventry stations at speaker strength. The B.B.C.'s "anti-oscillation" pamphlet lays down that four valves are needed to get 5 G B through the speaker at fifty miles distance when working off a 100-ft. aerial. 5 G B is only thirty miles from Birmingham, yet listeners in that city cannot get this 25-kw. station at good strength.

Too Well Behaved?

Now, we do *not* want, as a result of the Regional Scheme, programmes which can be heard only with a neutrodyne or super-het. These are of no use to the average listener, who simply cannot afford to run such expensive instruments. What we *do* want is a transmitter sited sufficiently near to give loud-speaker results with, at the most, three valves, and it is up to us to show the B.B.C. that we intend to have it.

The danger is very real, because it has been obvious for some time past that B.B.C. policy has been dictated by the Midlands.

5 X X, which was to have provided alternative programmes, was converted into a relay of 2 L O solely because the Midlands insisted (!) upon London programmes; then 5 G B was made directional because Birmingham screamed when their local station was closed; now the new 2 L O is to be transferred to the North, again by order of the Midlands.

Our interests have been ignored in the past because we have been too quiet and well behaved; the Midlands, by making themselves a general nuisance to the B.B.C., have been given everything they have asked for. And if a chorus of screams and whines is the only argument the B.B.C. can understand, then for heaven's sake let us create an uproar before it is too late.

The Midlands are fully entitled to their fair share of the good things, but they cannot have preferential treatment every time and all the time.

A Possible Danger

I trust, Sir, that you will exercise your influence to ensure that, when the new London station is eventually erected, we shall not find—too late—that its programmes can be heard only on receiving apparatus we cannot afford to use.

Yours faithfully,
C. P. BROWN.

37, Alfriston Road,
Clapham Common, S.W.11.

IN OUR TEST ROOM

—*continued from page 308*

hesitation in saying that in our opinion the Columbia is as good an H.T. battery as it is possible to purchase.

A Lotus List

Messrs. Garnett, Whiteley & Co., Ltd., have sent us one of their revised illustrated lists of Lotus wireless components. We notice that their well-known Lotus remote control is now available in three types, and that this enables them to supply remote controls for every type of receiving set, whether working from L.T. accumulators and H.T. battery, L.T. accumulator and H.T. eliminator, or "all from the mains."

A Useful Booklet

The T.C.C. people have sent us a copy of the second edition of their booklet, "How to Build Your Own High-Tension Eliminator for A.C. or D.C. Mains." Very well illustrated with photographs and diagrams this booklet should prove of considerable interest to the practical constructor. Although these booklets are marked on the cover "price 3d." the T.C.C. people inform us that they have decided to distribute them free of charge with the exception of collecting a penny per booklet to cover the cost of postage.

A Resistor Chart

The Dubilier Condenser Co., Ltd., have issued a chart which enables one to select the correct resistor to use with a certain valve and accumulator. This ingenious and useful chart is available free to applicants.

THE ROMANCE OF THE COIL

—continued from page 266

The speaker at, say, Langenberg is probably only vaguely conscious of the fact that somehow harnessed to his voice is an electro-magnetic force representing many horse-power.

But your tuning coil is conscious of it. Though hundreds of miles away from that scene of electro-magnetic action, yet the current in that coil leaps to life and flows in perfect step with the giant impulses that inspired it.

Perhaps the distant speaker, faced by an unblinking microphone—that, like Brer Rabbit, "lies low and says 'nuffin"—has a moment's subconscious twinge of anxiety as to whether his voice is "getting out all right." And his wife, good, easy Frau, listening in the studio, is aware of a trace of nervousness in her husband's voice. She knows the speaker through and through, and thinks that nobody else notices it! But Langenberg's aerial, towering above the tree tops, flung from it at that second a current that bore the impress not only of the speaker's words, his earnestness, and his message, but also that strange little hesitancy. Every faint suggestive inflection, tone and timbre is taken up and transmitted.

A Corresponding Commotion

All that is happening hundreds of miles away. But across your tuning coil there is an exactly corresponding commotion. A rushing back and forth, an ebb and flow, that is an exact duplicate of Langenberg's transmission. And that tiny current in your coil, so small that it is almost immeasurable, ceaselessly rises and falls *in exact accordance* with the speaker's words. So that, suitably translated by a good set, the very words are repeated at the instant they are uttered.

The Invisible Duplication

What is more, the intonation, the voice, is exactly the same; and so close is that parallel that if Frau What's-her-name were sitting near your loud speaker instead of in the distant studio, she could recognise her husband's voice among a million. Not only his words and his meaning, but his almost unconscious feeling at the moment of uttering them is picked up, and passed on. Your coil receives, perhaps, one-billionth of the energy let loose, and along your coil the currents flow, and around it the magnetic field appears, with instantaneous, sympathetic and almost unbelievable reincarnation. No sign, no sound, no tiny tremor will pass into that distant microphone without causing a corresponding electro-magnetic fluctuation. And coursing invisibly and intangibly around your tuning coil is a current that speaks and whispers and sighs in sympathy.

Unbelievable Activity

Between the turns of that coil, where you might fondly imagine there is only insulation, there leaps and falls a magnetic field never still, never steady, the strength and the size and the form of which are unbelievably made and moulded by that distant transmitting station! And so unpretentious is a coil, so damp-proof, so turn-numbered, so pile-wound, basket-wound, or solenoid-wound, so inductive, so tapped—in fact, so utterly misunderstood and under-valued—that in this article there is only space to deal with one of the properties of the tuning coil—i.e. the magical, marvellous, magnetic mystery of the thing.

INDEX TO ADVERTISERS

All communications concerning advertising in "Modern Wireless" must be made to John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. Telephone: City 7261.

D/R

Your duty towards your neighbour!

ONE H.F. STAGE

There is a large Public who are content with reception from the local Station and Daventry, whose requirements can be met by the ordinary 3 Valve re-acted Detector Set of which there are so many varieties advertised with fanciful names. To get more than this inevitably means "oscillation" with consequent howling and annoyance to your neighbours.

The B.B.C. definitely state that one H.F. stage is essential at the following ranges, if loud speaker reproduction is to be anything but "indifferent":—

100-150 miles from Daventry.	5XX.	4 Valves.	1 H.F. stage.
50-100 „ „ „	5GB.	„	1 H.F. stage.
Over 15 „ „ Main Station.		„	1 H.F. stage.

These figures obviously allow for that factor of safety which is so necessary if consistently pleasing reception is to be obtained under all conditions.

One neutrodyned stage of H.F. will give that additional sensitivity necessary for more distant reception, with radiation reduced to a minimum.

The Met-Vick 4 Valve A.N.P. Constructor's Set is the ideal solution. With the additional H.F. stage, there is no need to force the set. Using A.N.P. coils the set is stabilised, screening is unnecessary and high voltage factor Valves can be used. Additional selectivity is provided by a Tuned loose coupled aerial circuit, brought into action when required. Delightful to operate and cheap to build, the parts with two sets of coils costing only £9.

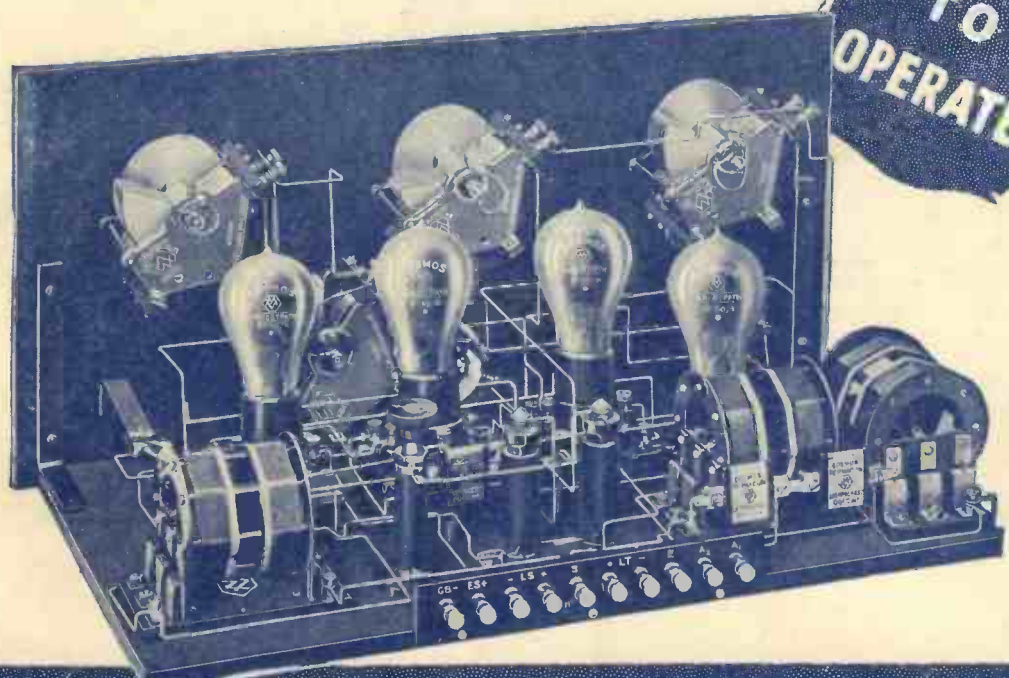
The Met-Vick A.N.P. 4 is pre-eminently the 4 Valve Set of the Day.

If unable to obtain instruction book from your dealer, write for Publication No. 7117/5 or 7117/4 (the A.C. Valve Model) free on request.

MET-VICK

CHEAP TO BUILD

EASY TO OPERATE



RP 104

METRO VICK SUPPLIES LTD 155, CHARING CROSS RD. LONDON. W.C.2.

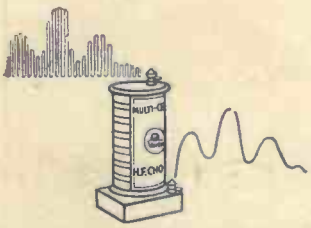
SPECIALISTS IN LOW FREQUENCY AMPLIFICATION

YOU—one of thousands—are satisfied *only* with real QUALITY in wireless reproduction. In the past, tens of thousands were content with very poor reception provided they could tune in a few stations at audible loud-speaker strength. But the time is coming when the public as a whole will insist on really good reproduction, and, what's more, many already know they can get it by using R.I. & Varley components. We have made a special study of all forms of L.F. Intervalve Coupling, because we realise the necessity for QUALITY if radio is to be really worth while.

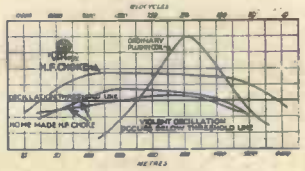
The famous Bi-duplex winding, developed and perfected after years of research, has been incorporated in our Resistance Capacity Couplers, and has resulted in a degree of real tonal purity hitherto undreamt of. The National Physical Laboratory Curves of our R.C. Couplers and Straight Line Transformer show that a wonderful degree of amplification has been attained, together with remarkable uniformity at all audible frequencies. That explains why you can hear the deepest bass notes and yet lose none of the high frequencies when using the R.I. & Varley Transformers or R.C. Couplers.

In this connection it must be remembered that no matter how good an L.F. Transformer or R.C. Coupler may be, distortion is bound to result if the H.F. Choke fails to choke back the H.F. currents efficiently.

Here again our Bi-duplex winding has enabled us to produce a component which for negligible self-capacity, minimum external field, extremely small dielectric hysteresis, and maximum choking efficiency over a very wide range, has no equal on the market to-day.



This diagrammatic sketch illustrates the effective way in which the R.I. & Varley Bi-duplex wire-wound H.F. Choke (9/6) deals with H.F. currents.



Comparative curves showing relative choking efficiencies. It will be seen that the R.I. & Varley H.F. Choke—distributed capacity 25 microfarads—chokes efficiently over a range of from 30–4,000 metres (10,000 to 75 kilocycles).

General Purpose Transformer
15/-

Bi-duplex Wire-wound Resistance Capacity Coupler.
Type A. ..... 20/-.
Type B. ..... 22/6.

"Popular Wireless" writes—"It must have been very skilfully designed for it gave results far superior to those its price would lead one to anticipate. We must admit it falls very little short of transformers in the one pound class."

Straight Line Super Transformer
25/-

THE MARK OF RI AND Varley LTD. **BETTER RADIO**

Kingsway House, 103, Kingsway, London, W.C.2. *Telephone: Holborn 5303.*

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