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Popular Wireless

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No. 379. Vol. XV.

INCORPORATING "WIRELESS"

September 7th, 1929.

IN THIS ISSUE

THE "PRESTO" THREE

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FINDING FAULTS.
RADIO CELEBRATIONS.
BOOTLEG BROADCASTING.
TATSFIELD STATION.

RADIO NOTES & NEWS

ZEESEN CALLING.
HAD THE BYRD.
AMERICA CATCHES IT.
WHO IS G. B. S. ?

A Largish Loud Speaker.

IF you're looking for a largish loud speaker (no good for putting in a portable set), you might cast your eye into the Science Museum at South Kensington. They've got a nice little chap there, with a horn *nine yards long!* They say it gives remarkable purity, and personally I admit that I sincerely hope it does, because if not somebody must be horribly disappointed. (Fancy whispering down one end and having to run along to the other to see if it came out undistorted !)

Was It a Relay ?

I HEAR that Marconi's are very bucked about their new portable, for not only does a chap down in Aden regularly receive 5 X X over a distance of 3,000 miles on this receiver, but now a laddie up in Liverpool has actually picked up America direct upon it. At least, that is what he thinks, but having read the letter describing this interesting feat it looks to me as though what was actually picked up was a German relay of the American station describing the "Graf Zeppelin's" landing. By the way, did any of you try to keep in touch with her when the flying liner was out east ?

Rumania's Radio.

YOU know that when in Rome you should do as the Rumanians do ?

Well, this year all the Rumanians are going to hold a wireless exhibition from the 1st to the 20th September, right slap in the middle of Bukarest. This is the first exhibition of its kind to be held in Rumania, so I am sure all "P.W." readers will join with me in wishing them a jolly good show.

Radio Celebrations.

ACCORDING to the "Morning Post" the radio telegraphists of the French Navy at Toulon have just been celebrating the memory of their patron saint, Joan of Arc. Always celebrating, those fellows. But I must admit that the last time I had the privilege of celebrating a bit with them (after a spot of submarining), the whole colour and complexion of the universe took on novel and roseate hues, that made up for a lot of life's sadder moments.

5 S W in Assam.

REFERRING to my recent paragraph about Assam (17/8/29), I have received a curt p.c. saying "Assam (or at least B.J.M.P. of that place) 'lics' when he states they want the 5 S W programme extended.

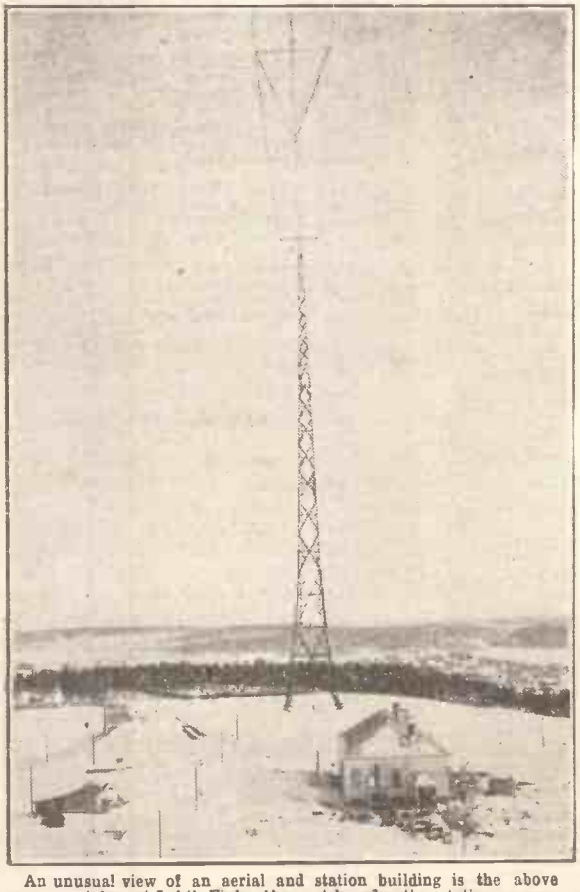
"(P.S.—10*s. a year for other countries' programmes.*)"

So now you know ! But it *is* a fact that most well-informed people really and truly haven't more than a foggy notion of where Assam does lie. (And that foggy notion is nearly always wrong !)

Finding Funny Faults.

HOW many of us, I wonder, would have spotted this one, related by a Norbury reader. "On a set I built recently" he says, "I struck a simple fault, quite new to me. After spending four or five hours tracing it I found that the trouble was caused by the rods holding the fixed vanes of the tuning condenser extending past the end-plates and making contact with the metal panel." This is the kind of fault that makes life in the "P.W." Query Department a bed of roses.

LAHTI'S LONG LEAD-IN.



An unusual view of an aerial and station building is the above taken at Lahti, Finland's great broadcasting station.

Bootleg Broadcasting.

HEARD about the latest row in the States ? Wall, Kid, listen ! Some guy who runs a radio station had a lot of letters from various ginks complaining of the programmes he put out to them, so he thought to himself "I'm a mutt ! Why not pinch a good programme from another station ? "

So one dark night he tunes in and picks up a good programme from Oshkosh-Wis. or Gee-Wiz-Cal. or somewhere, and then re-broadcasts it, to the great delight of all the local listeners ! The real owners of that programme objected strongly, but apparently they couldn't do anything, so bootlegged programmes are now "all the go" in the Land of the Free.

Tatsfield Receiving Station.

THE B.B.C.'s new receiving station at Tatsfield, which is to take over the work of the Keston Station seems to be causing quite a flutter for some reason, and I have received several letters about the work that the B.B.C. is going to do there.

So far as I can nose out the truth the present idea is simply to carry out the work now done by Keston (wavelength checking, etc.) under better conditions at Tatsfield, and no startling future developments lie behind the change-over. Tatsfield should be ready about September 15th. If, however, there are going to be exciting consequences you can bet the first hint of them will appear in our "Latest Broadcasting News" page.

(*Continued on next page.*)

NOTES AND NEWS.

(*Continued from previous page.*)

Zeesen Calling!

"IS Königswusterhausen (1,600 metres) the same as Zeesen (1,630 metres)?" is the rather puzzling question I'm asked on mauve paper with a violet scent, by Miss G. E., Portsmouth.

I kiss your little hand, madame, and beg to state that Zeesen is a village (just near Königswusterhausen) with a new station working on 1,635 metres, and handling the broadcasting previously done by Königswusterhausen.

High Power for Spain.

SPAIN is the latest convert to high power, and 'tis being whispered on the plazas that Barcelona is shortly to begin broadcasting upon ten kilowatts, "whilst Madrid, my dear Senor, is to work on *twenty* kilowatts." (*Si Senor*, no less!)

Another Radio Holiday.

IF you like listening to Ljubljana—and there's no accounting for tastes, so perhaps you do—don't worry because he has been un-gettable lately. As a matter of fact this station has been off the air for its "annual," but is due back again by the time these words are in print.

The Rescue of the Spanish Airmen.

YOU remember that not long ago H.M.S. "Eagle" was able to rescue the airmen on the Spanish Dornier flying-boat, down in the Atlantic. The Admiralty has disclosed that the good old Johnny-on-the-Spot in this instance was the s.s. "Greldon" (Derwent Shipping Co), who heard the engines of the aeroplane during the night and immediately reported the fact by radio. It was as a direct result of this that the "Eagle's" swoop was so effective. Good old "Greldon," what?

"Have You Had the Byrd?"

SOME time ago, under the above heading, I referred to the wireless on Commander Byrd's exploration ship, the "City of New York," ploughing the Frozen South. At the time I wondered if anybody in this country would pick up signals, and sure enough a South Bermondsey reader has done the trick. He tells me that signals were easily readable on a Det.-L.F., the wave-length at the time being 21 metres, though several different wave-lengths are used by the expedition.

Radio in the Antarctic.

THIS seems to me to be a most interesting piece of work, and readers interested should watch the "Correspondence" pages for more details.

What strikes me about these long-distance feats is the hour at which some of them happen—this one was *seven a.m.!* Ye gods! I've heard of seven-o'clock-in-the-morning courage, but personally I'm never anywhere near 21 metres at seven a.m., are you?

This Bulgin coil incorporates its own wave-change switch which is of push-pull form, changing instantly from short to long waves.

America Catches It!

I HEAR that a lot of American sobersides and killjoys have been tickled to death by the idea of educating people in their own homes and have persuaded President Hoover that here is a great chance for some real good uplift. You can tell the sort of people they are by the snappy title they have taken for themselves, namely, "The National Committee on Radiated Instruction."

Highbrow committees are already at work collecting solid facts fit to flood the country with, but there is one fact that they will never get over, and that is as soon as they start their talk the listener will merely switch off, or turn to a station with some red-hot mommas going strong, or a couple o' guys back-chatting a lot of rot at one another. Uplift indeed!

Reception Without a Set.

SEVERAL people have recently asked me what I think about that strange affair in New Jersey where a lady receives broadcasting nearly every night, although the nearest broadcasting station is about 40 miles away, and there is no receiver of any kind in the vicinity of the house. All sorts of ingenious theories have been advanced as to how this could possibly happen, but I am inclined to put it all down to a super-active imagination.

Nerves play a part, too, and well I know it, for during the War as a result of long periods of listening I could not only receive complete messages in my dreams, but I could actually read every word *through bad jamming!*

The Great Plays.

A SHROPSHIRE Lad has written me a very cheery (and sarcastic withal) letter in praise of the fact that during August the B.B.C. gave us the last of the great plays. "I used to wonder" he says, "how people managed to live through the great fire of London, and the great Plague. But now I know we are the same hardy race, for if we can go on listening after those great plays, we must be descendants of a super race—capable of anything."

Cross Canada Chain.

THIS coming winter is going to see a big step forward in the history of broadcasting in Canada, for arrangements are now being made by the Canadian National Railways to regularly relay weekly programmes from the Atlantic to the Pacific coast, a distance of 3,500 miles. No less than sixteen broadcasting stations will be linked in this colossal chain, and the company will use about 15,000 miles of telegraph and telephone wires to get the Atlantic programmes over to the Pacific listener.

Should Pos. or Neg. Go To Earth?

THE interesting remarks which have been made in "P.W." lately upon the subject of earthing negative L.T., or positive, for best results, have brought me a sheaf of letters. Some are full of well-reasoned technicalities, some of ripe experience, and some—even from well-known people—say that the subject is a difficult one. But the queerest one of all was one from Tilbury, which simply said:

"Dear 'Ariel'—Only a *fool* earths his L.T. negative." I don't know who sent it, but he seems mighty *positive*, doesn't he?

Who is G.B.S.?

HOW horrified Mr. George Bernard Shaw would be if he could see the letter which I have just received. It touches on heterodyning, DX, backlash and harmonics, and concludes with the simple query, "Who is G.B.S.?"

Unbelievable as it may appear to Mr. Shaw, this has nothing whatever to do with him, but is merely a reference to the call sign of the Post Office station at Rugby.

ARIEL.

SHORT WAVES.

One way to find out what you can get on your wireless set is to take it round to the pawn-shop.—"Cincinnati Enquirer."

* * *

TOO TECHNICAL.

Mabel: "I just love to sit with Jim in a darkened room with the radio playing soft music."

Marjorie: "Oh, I might with some boys, but Freddy will keep both hands busy on the dials."—"Radio News."

* * *

"Apparently the B.B.C. broadcasts of fishing news are helping the fishermen at sea to make for those areas in which herring shoals are moving," we read in the "Bulletin and Scots Pictorial."

It is to be hoped the B.B.C. won't mislead the poor fishermen by exercising their own tendency to exaggerate their hauls!

* * *

A correspondent in a Scotch newspaper states that wireless and music are two tastes which do not always go together.

That's just as well!

* * *

It appears that one of Mr. Charlot's first moves (if he were to run the B.B.C.) would be to have a station broadcasting dance music from noon to midnight. That would give every dance enthusiast the chance of arranging his radio party whenever he wanted to.

I should also think it would be a perfect boon to shoe repairers!—"The Wireless Constructor."

* * *

ETHER—THE DRUG.

As is well known, most hospitals have now been fitted with wireless sets. A caustic writer in the "Sporting Times" suggests that, judging by the dullness of some of the B.B.C. programmes, they might almost be used instead of an anæsthetic.

* * *

It is claimed that Hilversum is the most musical broadcasting centre in the world.

But there's a very charming Ayr in Scotland!

* * *

Tommy owned a radio,
And grumbled every day:
"I want to get America
And hear Paul Whiteman play."

But now he's over in the States,
He does the self-same thing:
He tries to tune in 2 L O,
And thus hear Jack Payne sing.

Representative "Becol" formers for the man who "rolls his own."

COUPLING H.F. CIRCUITS

A very illuminating chat on a subject which the home constructor is apt to regard as rather too abstruse for him.

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

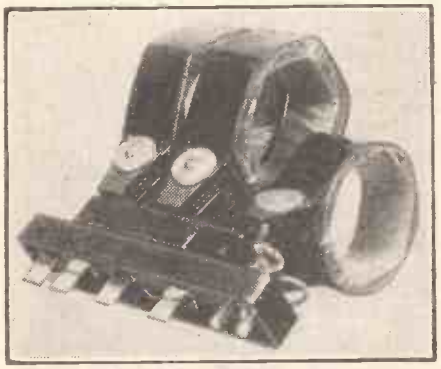
ACCUSTOMED as we are to using three or more valves in a wireless receiver without any special difficulty, it may come as a surprise to many readers to know that when the three-electrode valve was first invented, the use of several valves "in cascade" as it was then called, presented enormous difficulties. One of the chief troubles was that no two valves were alike.

We have still a long way to go yet before we get the same efficiency of energy in the high-frequency stages as we now get at the low-frequency end. In high-frequency coupling the two things aimed at are the greatest possible magnification per stage with the highest practical selectivity.

Selectivity Not Always Important.

In some cases where it is only desired to listen to one station selectivity is not important, as it is unlikely that any other station will compare in strength with that—the local—to which we desire to listen.

The reason why a circuit must not be made too selective in the high-frequency end is that in broadcasting we are not dealing with one definite frequency per station, but with a band of frequencies each side of that carrier-wave. For proper broadcasting all musical frequencies between

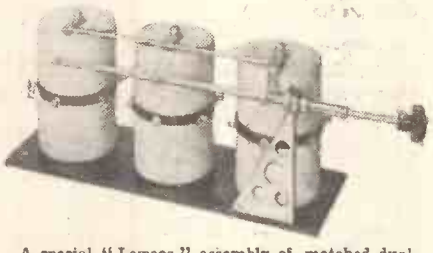


The complete broadcast adapter used in Marconiphone short-wave sets. The coils seen here are of Lissen make.

about 50 cycles and 5,000 must be transmitted (although it is better if certain frequencies above this upper limit are also sent out), and if proper transmission of frequencies between these two limits is made, then we shall get exceedingly good reproduction with a properly designed set.

If our set is so sharply tuned that there is an appreciable falling off in magnification of frequencies on either side of the carrier, then we shall get distortion.

The two leading forms of high-frequency coupling are the tuned anode and the tuned transformer. Modification of these are the untuned anode impedance, coupling



A special "Lewcos" assembly of matched dual-wave coil units for the 1926 "Solodyne."

where the high impedance of a good radio-frequency choke is used and the untuned transformer which transmits all frequencies fairly uniformly but with very little "step-up."

In the tuned-anode scheme we can use ordinary plug-in coils, which I would like to emphasise are still a very highly efficient component when properly used, particularly as the leading makers now sell plug-in coils of far much improved efficiency.

A Popular Type of Coil.

We can also use the very popular six-pin variety of interchangeable coil, in which single layer or slot windings are used. As reaction is often a very desirable feature reaction windings are fitted to the tuned-anode coils of the six-pin variety.

The efficiency of a single-layer six-pin tuned-anode coil is slightly higher than that obtainable with most plug-in coils, but there is not the difference between them that some writers seem to suggest.

The efficiency of modern valves is so high, and the magnification obtainable with well-designed circuits so good, that it is becoming more and more essential to use some form of screening between stages to prevent interaction between coil fields, wiring, etc.

For this reason it is essential that those readers who build their sets from published designs should follow the layout with great accuracy.

The binocular or "fieldless" type of coil is of considerable use in all forms of high-frequency coupling, as the field of the coil instead of straying all around is very closely confined owing to the particular form of winding. Tuned-anode coils of the binocular form are obtainable from the leading makers, and cut down considerably the amount of screening required in a set.

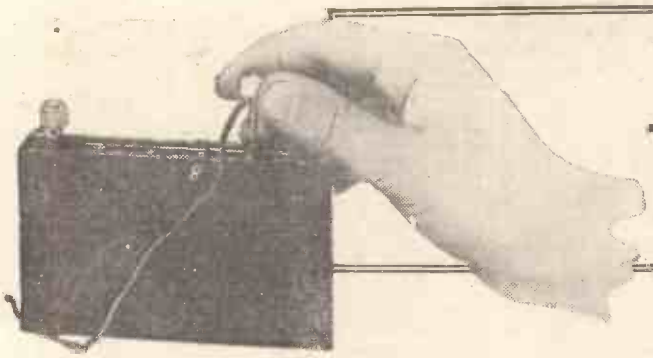
In high-frequency transformers the actual make-up is slightly more complicated, for we have to have both primary and secondary windings instead of one winding.

Useful in Portables.

The untuned anode coupling, as exemplified by the radio-frequency choke, has gained considerable popularity in the last year or two owing to its suitability for portable sets where the selectivity is mainly obtained by the frame aerial, and simplicity of control is a highly desirable feature.

Resistance coupling has been and can be used for coupling ordinary types of high-frequency valves, and has the merits of cheapness and simplicity. When used in conjunction with reaction excellent results can be obtained, but here, of course, we have to sacrifice some amount of selectivity and sensitivity in order to obtain simplicity and cheapness.

This special type of binocular coil was developed for use in their own sets by Messrs. Radio Instruments.



G.B. and YOUR UNIT

A simple scheme for deriving Grid Bias from A.C. and D.C. Mains is described in this very interesting article.

By F. A. TURNBULL.

HAVING disposed of the H.T. battery by using an "H.T. eliminator," which can be a completely satisfactory source of supply, there still remains the G.B. battery. And when 20, 30 or even more volts are required to serve a super-power valve in regard to grid bias, the G.B. battery is liable to assume the dimensions of a small H.T. battery.

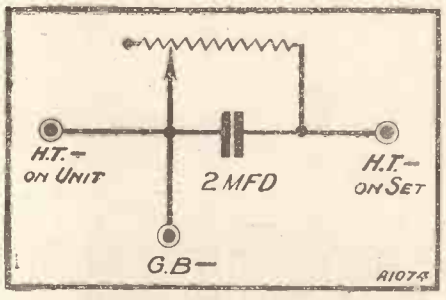
There are, of course, units available which will give H.T. and G.B. from the mains and others from which L.T. also is available, but it is quite a simple matter to take a little voltage away from an H.T. unit for grid-bias purposes.

All you have to do is to connect a resistance in series between the negative terminal of the mains unit and the H.T. — terminal of the set. A lead taken from the unit's minus terminal then can be used as a grid-bias connection.

The Variable Resistance.

Tappings at different points on the resistance can be taken to provide other grid-bias voltages of smaller orders. It is necessary to by-pass the resistance with a large fixed condenser.

You will see the simple connections in the accompanying diagrams which show them both in theoretical and pictorial forms. The variable resistance will have to



The simple circuit of the auxiliary connections.

be one capable of carrying the total current flowing through the eliminator and must provide a smooth and reliable variation.

A Clarostat can be employed for the purpose or a high resistance potentiometer. If you use a potentiometer only two of its terminals will be in service. A connection is taken from the one which is joined to the slider and from either of the other two.

Two Variable Tappings.

With a four point potentiometer (I believe there is one in the Centralab range) you can take out two variable grid-bias tappings. In this case the other slider terminal is run out direct to a grid-bias point.

The fixed condenser used should be of at least 2-mfd. capacity or 4-mfd. if possible, and while it need not be of the very high voltage variety, it must be able to withstand the pressure occurring across the resistance (this will be the grid-bias voltage arranged for).

It is important to remember that the voltage taken for grid bias in this way must be subtracted from the H.T. voltage and it follows from this that as you adjust the G.B. so you vary the H.T.

Unfortunately, the variation is not in such a way that the H.T. automatically follows the G.B. In fact, the more G.B. you bring out the less H.T. is available.

With a 5,000-ohm resistance I have taken 40-volts grid bias by this means. For ordinary purposes, that is for obtaining grid bias up to about 25-volts, a resistance having a maximum value of 1,000 ohms will be adequate.

It is impossible to give definite figures for the simple reason that the resistances of mains units and the circuits with which they are used, vary considerably. If you know these factors, it is, of course, possible to work out a fixed resistance to place in series, which will give you a definite grid-bias voltage.

Calculating Voltage Drops.

As you will see, by referring to the accompanying diagrams the resistance is directly in series with the eliminator (and all its internal resistance), and the set with its internal resistance. The voltage drop across the added resistance will be equal to the total resistance in the whole of the circuit divided into the added resistance multiplied by the voltage available (in the case of a D.C. mains unit across the input terminals).

The extra components which figure in this grid-bias circuit, viz—a fixed condenser and a resistance—can be mounted in the set, or in the mains unit if this is home-made. Additionally, they can be built up as a separate small unit having on it the three necessary terminals for the external connections.

If you know the current that is flowing through your eliminator and G.B. resistance circuit and the resistance of the G.B. component, then Ohms Law quickly tells you the voltage drop created for G.B. purposes.

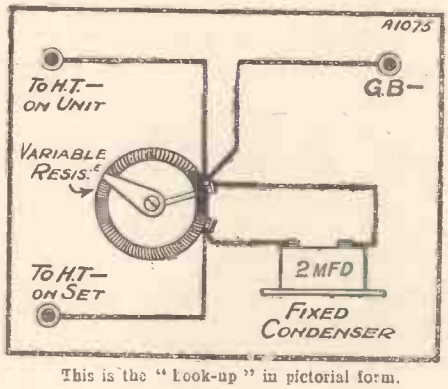
You take the current in amperes and multiply it by the resistance in ohms, and the answer is the voltage drop in volts. Supposing the current were 10 milliamperes (·01 amperes) and the resistance 1,000 ohms, then the potential drop is 10 volts.

If you happen to be using an L.T. eliminator, the G.B. resistance will have to figure in the circuit of this. Your H.T. unit will be finding its minus connection via the L.T. minus, so it is obvious that we can ignore that.

With An L.T. Unit.

You will need to use a power resistance capable of handling all the "juice" which passes through the L.T. eliminator. The connections are as follows. The G.B. resistance should be placed directly in series with the negative input from the mains to the unit, the mains end being the G.B. minus "tapping." By-passing will have to be by electrolytic condensers in this case, and choke smoothing arranged with the L.T. unit to cover the G.B. Altogether rather more complicated than when only an H.T. unit is used!

However, should you be employing



This is the "look-up" in pictorial form.

separate units both for H.T. and L.T. then complete rebuilding is advisable.

Combined Supply Units.

A separate G.B. device might prove quite practical, but where mains are concerned one is wise to avoid any possibility of "cross-connections."

The next step from having eliminated H.T. and L.T. batteries is either a combined unit giving H.T., L.T. and G.B. or a mains set. And of the two alternatives the latter is to be recommended, not so much on technical considerations as those of compactness and neatness.

The "PRESTO" THREE

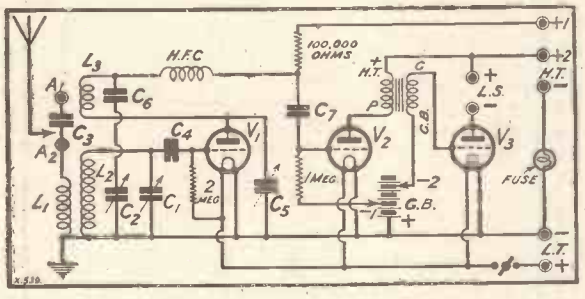
An extremely simple but highly efficient three-valver capable of giving the greatest satisfaction with the minimum of expense and trouble.

Described by the "P.W." RESEARCH AND CONSTRUCTION DEPARTMENT.

IN the August 24th issue of POPULAR WIRELESS we described a straightforward two-valve set specially designed by the "P.W." Research and Construction Department for readers requiring a perfectly standard well-tried circuit of conventional type. The receiver was, as a matter of fact, produced at the request of the Queries Department, in response to numerous applications for such a set.

Practical experience has taught us that sooner or later those who have two-valve receivers require an additional L.F. stage to get that extra "punch" which naturally two valves cannot give.

For instance, when one is situated over 15 or 16 miles from a main station, or is only able to erect an indoor aerial owing to local conditions, the extra valve becomes very necessary.



Then, again, distant stations can be brought in at full loud-speaker strength on three valves, whereas on two good 'phone strength only is possible.

In fact, the additional amplifying stage will improve the volume enormously on both local and distant stations.

Easy to Operate.

Of course, the great advantage of a simple straightforward set is that first, it is extremely easy to operate; secondly, it is cheaper to construct than a more complicated receiver employing the same number of valves; thirdly, there is little likelihood of any mistakes occurring in the construction—an important point in the case of the beginner.

Now, a three-valver such as the "Presto" Three will bring in distant stations every bit as well as a similar set having more refinements.

For instance, wave-change switching could have been incorporated; but this, while it is beneficial in many ways, would have detracted to some extent from the simplicity of the design.

Probably the reader will desire to have some idea of the results he is likely to obtain. Well, the "Presto" Three first of all received the standard "P.W." Research Department test on the laboratory aerial in London.

Having passed this successfully it was then taken to another aerial 15½ miles S.E. from 2 L O and tried on the medium and long waves every day for a week. This aerial was not a good one. It consisted of a length of 7/22-gauge copper wire stretching from the house to a tree trunk in the garden. At the house end the height was 28 ft. and at the tree end about 6 ft. The length, including the lead-in, was 90 ft., and owing to the small average height the aerial can really be termed poor. In these conditions the set brought in 2 L O, 5 G B and 5 X X at full loud-speaker strength at all times. In addition, at least ten Continental stations were received at *good* volume on the speaker on the medium waveband, while on the long waves such stations as Hilversum, Radio-Paris, Berlin, etc., could quite easily be brought in.

These stations all came in after dark consistently, but there were other Continentals which could be brought up to loud-speaker strength on certain nights, and, taken over a reasonable period, the "log" would be a very satisfactory one. If the set can do things like this on a poor type of aerial, it should be capable of greater achievements with a good aerial. Two-volt valves were employed in the tests, dry cell H.T. batteries, and standard plug-in coils.

The Circuit.

Now for a brief description of the circuit. It is very similar to the "Presto" Two. The detector is what is termed the leaky-grid condenser type, this having been proved to be the most sensitive and satisfactory scheme for all-round work. The tuning and reaction circuit consists of a plug-in aerial coil of the semi-aperiodic type. That is to say, it is not tuned with a condenser, but one coil is employed to cover a certain band of wave-lengths.

The chief advantage of this method is selectivity, since the coil size can be changed to suit any particular set of conditions. A small coil will give greater selectivity than a large coil, but the latter will give better signal strength. It is, therefore, usual to

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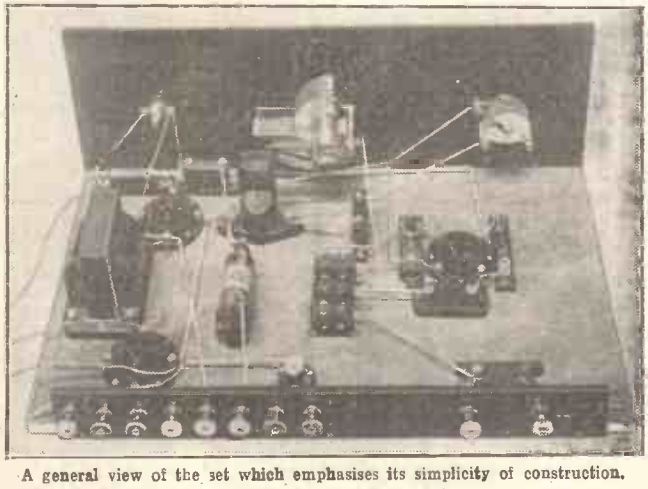

A general view of the set which emphasises its simplicity of construction.

THE "PRESTO" THREE.

(Continued from previous page.)

effect a compromise. The coil can also be suited to the aerial—i.e. with a small aerial a large coil can be used and vice versa. Those who have a set of plug-in coils will find it beneficial to experiment with various sizes in the aerial coil holder.

The secondary coil is tuned and placed next to it is the reaction coil L_3. As in the "Presto" Two the well-tried "throttle" reaction scheme has been employed, but in order to increase the efficiency of the design still further a semi-variable by-pass condenser has been connected between the plate of the detector valve and L.T. negative.

This scheme was introduced by Mr. G. P. Kendall, the chief of the "P.W." Research Department, and has been found to improve signal strength appreciably.

It has been proved in practice that the use of an auxiliary condenser of this type gives a marked advantage on the lower reaction condenser adjustments. This semi-variable condenser is shown as C_5 in the wiring diagram.

The L.F. Side.

Turning to the L.F. side it will be seen that the excellent resistance-capacity-transformer combination has been employed. This combination does not tend to give trouble and it is extremely unlikely that "motor-boating" or howling will occur in normal circumstances.

The value of the anode resistance is 100,000 ohms and it has been chosen because a low value is better from the point of view of obtaining reaction on moderate anode voltages. Although greater amplification could be obtained by using a higher value, the actual increase with a detector valve of the "H.F." type would be very small.

It is therefore better to concentrate on the question of smooth and efficient reaction control than to endeavour to obtain an extra five per cent amplification by using a higher value anode resistance.

In a receiver of this type, which has no H.F. stage, it is important to pay attention to the reaction control.

Next we come to the L.F. transformer. Any good make can be used, but a low-ratio type should be chosen. By low-ratio type an instrument having a turns ratio of $2\frac{1}{2}$–$3\frac{1}{2}$–1 is implied. This is the best type from the point of view of quality and amplification. In fact, the majority of transformer manufacturers nowadays specialise in low-ratio instruments, and only recommend higher ratios for special purposes.

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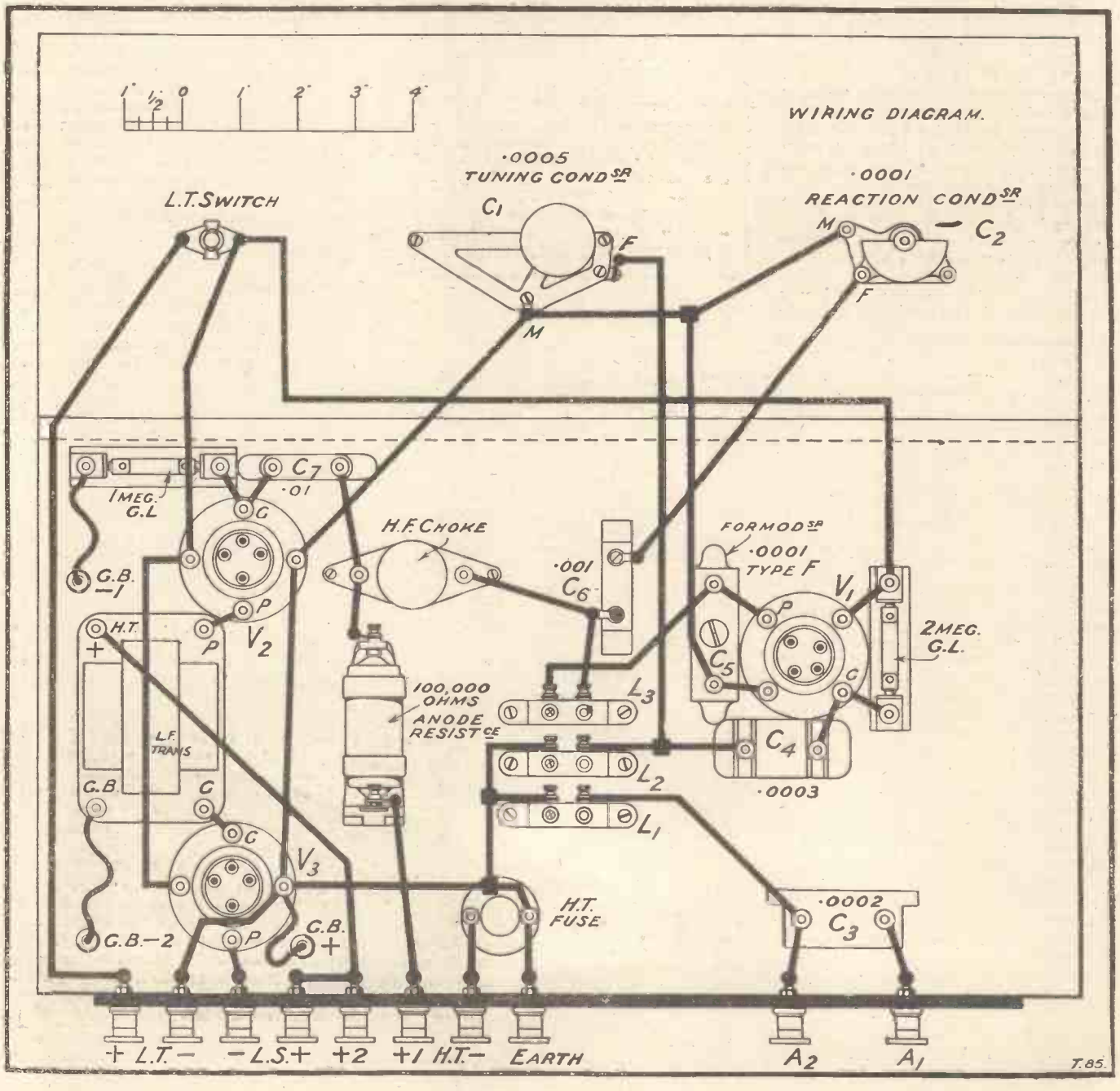
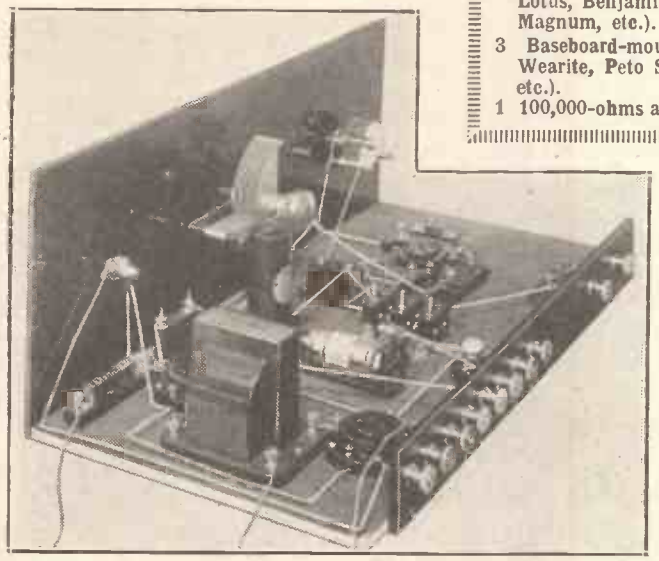


THE "PRESTO" THREE.

(Continued from previous page.)

The construction of the set is made easy by the well-spaced layout. You will notice that the components have been arranged to give conveniently short wiring. The three coil sockets have been placed nearer the centre of the baseboard than is usual. By so doing, the length of certain vital leads can be reduced. It is unnecessary to describe the construction of the set in detail.

All the dimensions are given on the panel layout diagram, and the positions for the various components can be followed clearly by reference to the wiring diagram. It is important to place the coil holders the correct distance apart. This is best carried out by inserting the coils actually in the coil holders and then placing them in position on the baseboard, allowing about $\frac{1}{8}$ in. between each coil. They should in fact practically touch.



Careful spacing of components and neat wiring go a long way towards ensuring an efficient receiver.

It is a matter of individual taste whether bare or insulated wire is used for wiring up. Bare tinned copper wire looks very neat, but the leads have to be well-spaced, whereas with Systoflex covering there is no risk of accidental damage if two of the leads should touch.

When you have completed the wiring you will be ready to carry out the preliminary tests.

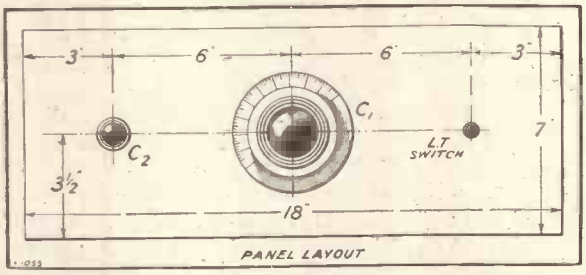
The Valves.

You will need three valves, two of the "H.F." type for the detector, and first L.F. stages, and one of the power or super-power type for the last stage. Whether you use a power or super-power valve depends entirely upon your nearness to the local station and the volume you require. If you wish to fill a large room with undistorted music a super-power valve is advisable. Now just a word of warning. A super-power valve requires a fairly heavy anode current, and it is impossible to take this current from small dry H.T. batteries, unless you are prepared to renew them at very short intervals. Therefore, if you do decide to purchase a super-power valve, remember that it is highly advisable to employ batteries of the triple-capacity type, unless of course you are in a position to make use of H.T. accumulators or a mains unit.

The coils you will require are as follows:

For B.B.C. wave-band, 200-550 metres: Aerial Coil L_1, a No. 35 or 25; Secondary Coil L_2, a No. 60; Reaction Coil L_3, a No. 40 or 50.

For 5XX and the other long-wave stations:



Aerial Coil, a No. 100 or 150; Secondary Coil, a No. 200; Reaction Coil, a No. 100.

Join up your L.T. and H.T. batteries to the terminals marked, and also the aerial, earth and loud speaker.

The aerial should be joined to A2 to commence with. A1 is an alternative position, to be used where greater selectivity is desired, and should always be tried. It is very useful in cases where two stations tend to interfere with each other.

The H.T. voltages which may be employed are H.T. + 1, 80 volts, and H.T. + 2, 100-120 volts. H.T. + 1 should be varied until the best reaction effects are obtained. Before switching on the valves you must make sure that your grid-bias battery is properly connected up.

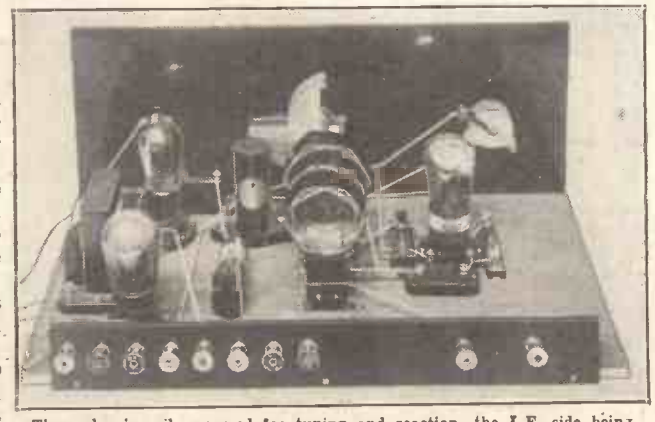
When all is ready, switch on the valves and rotate the tuning condenser dial until you hear signals. Then increase the value of the reaction condenser, noting whether the volume increases. Carry out this operation with the adjusting knob of the semi-variable condenser unscrewed.

Adjusting Reaction.

You will reach a point on the reaction condenser where signals begin to distort, and finally the set bursts into oscillation. You must always keep the reaction condenser adjusted below this position, otherwise you will interfere with your neighbours and at the same time spoil your own reception. Tune in several stations until you are quite used to the reaction control, and then proceed to adjust the condenser C_5.

Screw down the knob a little and note the effect. You will find that you have to employ more of the reaction control C_2.

Well then, you should try to obtain an adjustment on C_5 such that full reaction can just be produced with the moving vanes of C_2 fully in mesh and the ·0005 tuning condenser set to the reading for the highest wave-length you wish to receive.



Three plug-in coils are used for tuning and reaction, the L.F. side being resistance-transformer coupled.

COMPONENTS REQUIRED.

1 Insulating panel, size 18 in. × 7 in. × $\frac{3}{16}$ in. or $\frac{1}{4}$ in. Becol, Paxolin, Resiston, Ebonart, Trelleborg, "Kay Ray," Ripault, etc.).
1 Cabinet to suit with baseboard, 9 in. or 10 in. deep (Raymond, Camco, Pickett, etc.).
1 ·0005-mfd. variable condenser, with vernier dial (J.B., Lissen, Lotus, Igranic, Gecophone, Utility, Colvern, Raymond, Dubilier, Formo, etc.).
1 ·0001-mfd. reaction condenser (Lissen, Lotus, Raymond, Dubilier, J.B., Utility, Peto Scott, Cyldon, Burton, etc.).
1 L.F. transformer low-ratio type (Brown, Varley, Cossor, Ferranti, Philips, Lissen, Mullard, R.I., Igranic, Marconiphone).
3 Valve holders, sprung type (W.B., Igranic, Lotus, Benjamin, Pye, Precision, Wearite, Magnum, etc.).
3 Baseboard-mounting coil holders (Lotus, Wearite, Peto Scott, Raymond, Magnum, etc.).
1 100,000-ohms anode resistance and holder (Varley, Cosmos, Igranic, R.I., Dubilier, Mullard, Ediswan, Precision, etc.).
1 H.F. choke (Lissen, R.I., Lewcos, Dubilier, Varley, Wearite, Raymond, Climax, Magnum, Igranic, Cosmos, Colvern, etc.).
1 ·001-mfd. fixed condenser (Dubilier, Lissen, T.C.C., Clarke, Goltone, Mullard, etc.).
1 Formodensor, Type "F" (Formo Co.).
1 ·0003-mfd. fixed condenser (Dubilier, etc.).
1 ·0002-mfd. fixed condenser (Lissen, etc.).
1 ·01-mfd. fixed condenser (T.C.C., etc.).
1 2-meg. grid leak and holder (Cosmos, Lissen, Dubilier, Ediswan, Mullard, etc.).
1 1-meg. grid leak and holder (Cosmos, Lissen, Dubilier, Ediswan, Mullard, etc.).
1 L.T. switch (Benjamin, Lotus, Lissen, Igranic, Wearite, Bulgin, Magnum, etc.).
1 H.T. fuse (Magnum, Ready Radio, etc.).
10 Terminals (Eelex, Belling & Lee, Igranic, Clix, Burton, etc.).
1 Terminal strip, 16 in. × 2 in. × $\frac{3}{16}$ in. or $\frac{1}{4}$ in.
Quantity of tinned copper wire, Systoflex or Glazite, etc.

LATEST BROADCASTING NEWS.

NEW STATION FOR THE NORTH.

SIR JOHN REITH IN ITALY—THE ST. LEGER—CLAPHAM AND DWYER—MORE HOUSEHOLD TALKS, Etc.

THE new twin-wave transmitter for the North of England which will be erected near Slaithwaite will be called Moorside Edge, the other name presenting difficulties rather more pronounced than Daventry. The contracts are now being signed, and work should begin before the end of September. The B.B.C. expects that the new transmitter will be ready by September next year. Mr. Noel Ashbridge, the new Chief Engineer of the B.B.C., still fortunately possessed of the active cooperation of his old chief and lifelong friend, Captain Eckersley, is pressing forward the North of England transmitter in every possible way.

Sir John Reith in Italy.

For the first time since he joined the B.B.C., seven years ago, Sir John Reith is taking a holiday completely detached from his work. No one at Savoy Hill appears to know anything of his whereabouts beyond that he went first to the South of France and then to Italy, where he proposes to remain until the end of September.

The St. Leger.

Listeners throughout the country will be pleased to learn that a running commentary on the St. Leger will be broadcast from London and 5 X X on Wednesday, September 11th. The commentators will be Mr. R. C. Lyle and Mr. Alan Howland, and their description of this famous race will be relayed from Town Moor Racecourse, Doncaster, between 2.50 and 3.15 p.m. Another sporting event on which a running commentary has been fixed is the water polo match between England and Germany at the Pitfield Street Baths, Hoxton, on Saturday, September 28th, the first occasion, we believe, on which such an event has been broadcast.

Clapham and Dwyer.

Clapham and Dwyer, whose "arguments" have not taken place before the microphone for some months past, are to visit the London Studio on Wednesday, September 25th, to begin what all listeners hope will be an intensive series of autumn and winter broadcasts.

More Household Talks.

We hesitate to express an opinion on how our womenfolk will accept a new series of talks entitled "Commonsense in Household Work," which are to form part of the morning transmissions for the next few weeks from the London station. Altogether there will be nine talks, four by Miss Sydney M. Bushnell, and the remainder by Mrs. R. O. Raphael (Miss Spielman), director of the Household Section of the Institute of Industrial Psychology. The first talk is down for Monday, September 9th, when Miss Bushnell, who is a graduate of the London School of Economics, and has had considerable experience in connection with all types of housing schemes, house and estate management, will discuss that age-old problem of "Choosing a Home."

National Orchestra of Wales Again.

Although concerts at the City Hall, Cardiff, do not begin again until October 3rd, listeners will hear the National Orchestra of Wales play in the Assembly Rooms on Monday, September 16th, at 9 p.m. The occasion will be a civic reception by the Lord Mayor. The Lord Mayor of Cardiff must feel specially proud of his city when it falls to his lot to entertain visitors to the city, for the civic buildings are admittedly unique. A special request was made for vocalists at this concert, and the ever-popular Mountain Ash Girls' Choir, conducted by Miss E. Thomas, will sing, and Owen Bryngwyn, the Welsh baritone, will give a group of Welsh songs.

Talks on Migration and Children.

The next in the series of talks on migration, mention of which has already been made in our columns, will be given in the London studio at 7.25 p.m. on Tuesday, September 10th, by Commissioner David C. Lamb, migration officer for the Salvation Army. As most listeners are aware, the migration and emigration schemes of the Salvation Army have been working successfully for many years, and Commissioner Lamb will, no doubt, be able to give much useful information in the course of his talk, which he has titled "Our Imperial Heritage."

At 10.45 on the following morning, Mrs. Susan Isaacs will be heard in the second of the series of talks on "Parents and Children." The title of the talk is "The Trials of the Parent," and Mrs. Isaacs will follow it later with another talk, entitled "The Trial of the Children," and, subsequently, by a third which will be devoted to answering questions submitted by listeners as the outcome of the first two talks. Mrs. Isaacs, by the way, was formerly Principal of the Malting House School, Cambridge, and is the author of an important little work known as "The Nursery Years."

This variable condenser is an example of Ediswan design, particular attention having been paid to facilitate easy and accurate operation. It will be seen that the control "knob" is divided into sections, one for making fine and the other for coarse tuning adjustments.

A People's Service From Liverpool.

The Sunday evening "People's Services" at Liverpool Cathedral have become, since their institution, one of the best appreciated among the forms in which the cathedral authorities seek to present opportunities for Divine worship suited to twentieth century needs. The broadcasting of one of these services on September 15th will enable the greater congregation for the first time to share in their message.

It is characteristic of the People's Services that the singing is entirely congregational, and that each service—hymns, prayers, and address—forms a coherent whole, built round some central theme. The Service on September 15th will be conducted by the Rev. Canon C. E. Raven, D.D., who will also give the address. Canon Raven is already well known to Northern listeners, both for his religious addresses and for his studies of British wild birds. The service will be preceded by a short recital on the great organ of the cathedral by Mr. Edgar Robinson, the Choral Conductor.

TECHNICAL NOTES. By Dr. J. H. T. ROBERTS, F.Inst.P.

CONDENSER DISCHARGE

DECAY OF OSCILLATIONS—PRODUCTION OF WAVES, Etc.

THE science of radio owes its existence to the discovery—generally credited to Sir Oliver Lodge—that an electrical condenser will, under certain conditions, discharge itself with an oscillatory discharge. I mention this because I want to say a few words about coils and condensers and it is interesting to note that the very existence of wireless as we know it to-day is based upon certain properties of a condenser.

Decay of Oscillations.

The discharge of the condenser is not always of an oscillatory character; questions of inductance and resistance enter into consideration, as well, of course, as the relation of these to the actual electrostatic capacity of the condenser itself.

It is sufficient, however, to say that with proper conditions in the discharge circuit the electric charge will flow from one plate of the condenser through the external circuit to the other plate and will over-shoot the mark, storing itself up to some extent in the opposite plate until this is raised to a certain potential and then returning and flowing backwards, and so on. These oscillations are conveniently compared to the oscillations of a pendulum, and like the latter they gradually diminish in amplitude until finally they die out altogether.

Production of Waves.

Whilst the electricity is rushing to and fro in alternately opposite directions in the condenser circuit it is setting up disturbances in the ether which travel out in

(*Continued on page* 824.)

MAKING YOUR SET SELECTIVE

Do you know what makes your set selective, why it gives different selectivity on different aerials, and how selectivity can be estimated? In this article you will find that the answers to these questions and many others are given

By GEOFFREY ELTRINGHAM.

I BELIEVE the real inwardness of selectivity is less clearly understood by most people than almost any part of radio, partly because it is really rather an involved subject and partly because it is not one of those things you need to know to build a set and operate it successfully.

All the same, it is worth understanding something about selectivity, because one is then much better able to choose the right set for a given purpose, and to supply the necessary grain of salt when confronted by the extraordinary claims to selectivity one sometimes sees made on behalf of some device which cannot in actual fact affect selectivity in the least.

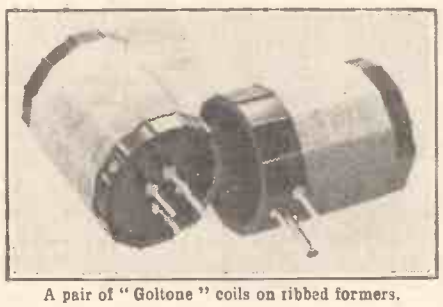
For example, if you know what really governs selectivity you are in a position to make a suitable reply to the man who tells you that your set will become far more selective if you do as he has done, and replace your ·0005-mfd. tuning condenser with one of ·001 mfd! That particular fallacy is pretty completely killed by now, I think, but there remain a number of others well-nigh as glaring which keep cropping up again and again.

Some Test Questions.

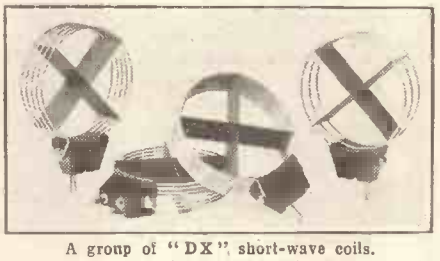
Just ask yourself these questions, and see whether you can give a confident answer to all of them: What *is* selectivity? How can it be measured or estimated? What decides the selectivity of a set? Is the same set equally selective on different aerials? Has the type of variable condenser anything to do with selectivity? If you feel a little doubtful about any of the answers let me suggest you read the rest of this article, in which I have tried to present you with the gist of the matter as briefly as possible.

Selectivity is the power of a set to respond to the signals of just the station to which it is tuned and to exclude all others. It is nothing to do with SENSITIVITY, which relates to the necessary initial strength of the incoming signal for it to be heard properly with a given set. (Other things being equal, this means the distance over which the set will bring in a station.) The essence of selectivity, you will see, is to be found in the power of the set to EXCLUDE signals, not to bring them in.

You will find that the real nature of sensitivity becomes clearer when we consider how it may be measured or estimated. Actual measurement is rather too advanced a subject to deal with here, and we must confine ourselves to what I have called "estimation," which only calls for quite simple methods.



A pair of "Goltone" coils on ribbed formers.



A group of "DX" short-wave coils.

Now let me say right away that the common method of noting the number of degrees through which the dials must be turned before the local station disappears is *not* a good method of estimation. If it could always be carried out under identical conditions it would serve, but it is almost impossible to comply with this requirement. Such matters as differences in shape of condenser plates (i.e. whether square law or S.L.F.), the actual wave-length of the local station, coil sizes, and a number of other factors, can make it completely misleading.

Measuring The Detuning.

What we want to know is the true amount of detuning necessary to cause a given interfering station to become inaudible, and dial readings are not a safe guide to this. What we must do is to find out what actual change of wave-length is necessary to tune out our local station. For a true comparison this ought really to be expressed as a difference of frequency. However, so long as we always use the same interfering station for our tests we shall get quite a useful indication if we adopt the simpler plan of working in metres.

This, then, is what we must do to estimate the selectivity of a given set; tune in the local station, then gradually de-tune until it just disappears. Next, we must determine the wave-length to which we are now tuned, and the number of metres separation from the wave-length of the local can be taken as a measure of the selectivity of the set.

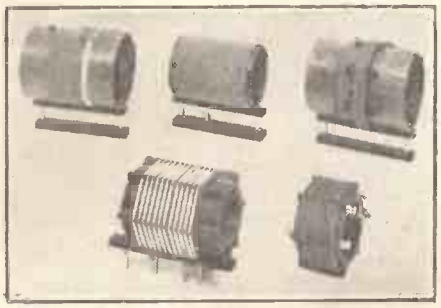
This figure will then give us a basis of comparison if we take care always to make the test on the same interfering station, the same aerial and earth, and the same loud speaker or 'phones.

A practical point concerns the method of determining the wave to which the set has to be de-tuned to make the local station disappear. If you possess a wave-meter the matter is simple, but you can still make the test without one, in this way: find out by trial which foreign station close to the wave of the local you can just manage to hear without interference from the latter, look up its wave-length, and there you have your data.

The Deciding Factors.

Now let us see what the selectivity of a set depends upon. Here are the main factors which govern it: the number of tuned circuits in the set (selectivity goes up rapidly with an increase in the number of tuned circuits), the effective damping (i.e. the equivalent H.F. resistance) of each circuit, and the coupling between them (the weaker the coupling the greater the selectivity as a general rule).

The method of coupling the aerial to the set has also a considerable influence on selectivity, more than one would expect merely from a consideration of its effect in varying the effective damping of the circuit to which it is coupled. Since it does definitely produce such a variation in damping it is at once obvious that different aerials will be likely to affect the selectivity of a given receiver considerably. As a matter of fact, the same set may give very different degrees of selectivity on different aerials, hence the need for the use of the same aerial and earth system for all tests.



This group of coils of "Parex" make provides some good examples of the types with which modern selective receivers are assembled.

CORRESPONDENCE.

B.B.C. AND PRONUNCIATION.

THE "ANTIPODES ADAPTOR"—A SUCCESSFUL SHORT-WAVE CIRCUIT —THE NEW 2 L O?, ETC.

Letters from readers discussing interesting and topical wireless events or recording unusual experiences are always welcomed; but it must be clearly understood that the publication of such does in no way indicate that we associate ourselves with the views expressed by our correspondents, and we cannot accept any responsibility for information given.—EDITOR.

B.B.C. AND PRONUNCIATION.

The Editor, POPULAR WIRELESS.

Dear Sir,—Looking over the bookstall recently, I saw your article "The B.B.C. and Pronunciation," and purchased my first copy of "P.W." in consequence.

The pronunciation of our own language raises so many people to wrath that it is refreshing to come across a really sane article on the subject.

I quite agree with the opinion expressed in your article that the B.B.C. need, and must, not be accepted as the final arbitrator. To give another example, in addition to those quoted, let us take "idyll." It is entirely due to that "one hundred per cent Irishman," G. B. Shaw, as he called himself last week at Malvern, that the pronunciation of this word is given as "iddil." I maintain that an Englishman who cannot pronounce "idyll" so that the listener does not imagine it to be "ideal" (the reason given for this weird "iddil") is semi-illiterate. In the first place, "idyll" has but two syllables, with the accent on the first; "ideal" has three, with the accent on the second.

You mention, too, Mr. Eric Dunstan's criticisms of announcers' pronunciation. A day or two ago he went out of his way to compliment an announcer on his improved pronunciation of French, as evidenced by his rendition of an S O S in that language. Either Mr. Dunstan was pulling that gentleman's leg or—well, Mr. Editor, his knowledge of that language must be less than one imagined. Announcers should bear well in mind that, although one may swallow up to half a word when speaking English and yet remain entirely intelligible—and, maybe, cultured—in other languages, more especially French and Italian, each syllable must be properly sounded and the lips used vigorously.

I am one of the people mentioned in your interesting article who "find these pronunciation problems a spark of gaiety."

The last two reverend gentlemen who gave us talks, one on stamps, the other on language in Central Africa, have given me an instance each. The former mispronounced "mulcted" as "mulshed" (should be "mulk-ted"); the latter gave us "recalcitrant" with a hard second "c," instead of a soft. They were extremely interesting talks, though.

May we have another interesting article soon?

Faithfully yours,
"LINGUIST."

S. Woodford, Essex.

THE "ANTIPODES ADAPTOR."

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to the "1929 Antipodes Adaptor" and the list of stations that are receivable on same, I herewith wish to enclose you an extract from a letter I received dated June 19th, 1929, from Messrs. Dominion Broadcasting Proprietary, Ltd., Melbourne, which may help to clear up any difficulty in being unable to hear them at the time stated. Extract as follows:

"We regret to have to advise that, owing to alterations having been made by the Postmaster-General's department for broadcasting in the Commonwealth of Australia, we have been reluctantly compelled to cancel our short-wave session each Sunday 19.00 to 20.00 G.M.T."

I was one of the first to build the original "Antipodes Adaptor," and have had the pleasure of hearing 3 L O several times, sometimes even on the loud speaker, using only three valves (Mullard). Strange to say, I have been unable to receive P C J (Hilversum) since February last, it may even be before that, and have often wondered whether any other readers have had a similar experience, as I used to hear him as loud as Daventry 5 X X. With best wishes.

I remain an old reader,
R. W. FELLENDER.

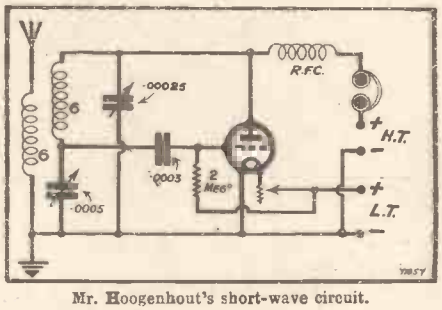
Bristol.

A SUCCESSFUL SHORT-WAVE CIRCUIT.

The Editor, POPULAR WIRELESS.

Dear Sir,—In nearly every issue of your paper I see readers' letters about results obtained with short-wave sets, many of them of latest and so-called supers.

Now I am enclosing a circuit that I have been using for some years. On one valve I have received American stations and numerous amateurs, and on two valves Chelmsford has been received at about the same strength as a 500-watt broadcasting station comes in on one valve.



Mr. Hoogenhout's short-wave circuit.

Of all the short-wave circuits I've tried I found this one the easiest to work and to control. The reaction control especially is very smooth.

The aerial I have used is of the ordinary 100 feet type, without any condensers in series; the "earth" is a piece of galvanised iron buried under the ground, with a lead to the second story of the house.

Wishing you and the "P.W." the best of luck.

I am,
Yours faithfully,
G. F. M. HOOGENHOUT.

Pretoria, South Africa.

THE NEW 2 L O?

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to your request for reports on the test transmissions from Brookman's Park, I picked up one of these to-day (Friday) at 3.30 p.m. and held it till 3.50 p.m. Presumably it was Brookman's Park, but, naturally enough, there was no announcement of locality, as it was purely an engineer's test.

The wave-length was the same as the present 2 L O's; the carrier and modulation were very strong. The beginning and end of each separate test were announced and the speaker frequently besought an unknown gentleman of the name MacLaren to remember the special test to follow No. 4.

There was no signal of any kind during each test but announcements, as was to be expected, were slightly louder than those received from the present 2 L O. Owing to the absence of a prolonged signal, I was unable to notice the "wipe out" effect, but formed the opinion that this station would not "interfere" with the reception of distant stations any more than 2 L O does at the present time. However, my set (1-v-1) is fairly selective as I can receive Toulouse (54 kc. from 2 L O) and Gleiwitz (81 kc.) entirely free from London.

I did not hear the beginning of the transmission but picked it up halfway through test No. 2. At 3.50 the end of the test was announced, and the next test was fixed for to-morrow (Saturday) morning at 5.30 a.m.

Hoping this will be of interest,
Yours truly,
N. H. BLUNDELL.

London, S.E.27.
August 23, 1929.

"BREMEN'S" RADIO.

The Editor, POPULAR WIRELESS.

Dear Sir,—I see by a recent "P.W." that you mention the "Bremen's" wireless apparatus.

I have just received a QSL card from the "Bremen," giving me a report on my signals (R 5) when the ship was in position 42° 40′ North 54° 17′ West.

The receiver he was using was a Schnell 0-v-0, and the aerial was laid on the deck.

Apart from the equipment you mention, he says he has a 50-watt crystal-controlled transmitter, but this, I believe, is owned by the operator "Franz Noether," who uses the call sign X D 4 A B N.

The call sign on the card is K Q 5.

Hoping this may be of interest to you.

Yours sincerely,
S. F. HARRIS.
G 5 S H.

Battersea, S.W.11.

SHORT-WAVE NOTES.

By W. L. S.

I AM writing these notes immediately after listening to an excellent running commentary on the arrival of the "Graf Zeppelin" at Los Angeles, relayed by all the American stations, and on short waves by W 2 X A D on 19·56 metres. This is the first time I have received an important broadcast via this station during the afternoon in this country, and I am inclined to think that the strength of signals was better than it is during the late evening.

The exact times were from 2 p.m. till 3.30 p.m., B.S.T., corresponding to about 6 a.m. at Los Angeles and 9 a.m. at the actual transmitting station. The comments from the flying field were followed by a commentary from an aeroplane over the field, by Herbert Hoover, Jun., son of the U.S. President.

A Pentode Change-over.

I find it rather convenient in the case of my detector and pentode short-waver to be able to use the pentode roughly so that its characteristics approximate to those of an ordinary power valve, rather than changing over the valve in the last socket. I have therefore arranged a change-over switch which disconnects the priming-grid terminal of the pentode from the H.T. + and connects it instead directly to the anode.

There is not much sense in using the pentode with the volume control half-in, so when noises are bad or signals extra strong I just switch over and put the volume control "all-in" again.

I have an interesting letter from "R. I.," of Ilkley, describing his receiver, which consists of an aperiodic S.G. stage (aerial being connected to earth through an H.F. choke), detector, and *four* note-mags.! The first is choke-coupled and the other three R.C., with 100,000-ohm resistances and low-mag. valves.

Needless to say, he receives the high-power broadcast stations quite loudly, to put it mildly, and he qualifies for membership of "H.A.C." I have often thought that a really big set like this would be ideal for short-wave broadcast reception, although naturally it would merely be a nuisance for hunting faint Morse signals over the amateur bands, for which purpose a single-valver, with its absence of annoying background, would be far more ideal.

I rather longed for an extra note-mag. myself while listening to the broadcast I mentioned at the beginning of these notes, as, with plenty of amplification available, and a good volume control, one can eliminate fading almost completely.

A Complete Re-build.

"R. I." finds conditions very variable at this time of year, and says that 5 S W, usually a still small voice, has suddenly started roaring in for no apparent reason.

As I had all my gear to pieces just recently before taking a week's holiday, and carefully repainted and cleaned everything before filling up the benches again, I am in the throes of a complete re-build of everything except my standard short-waver, which is, of course, used as the principle source of information in compiling these notes. The transmitter has to be built right up from a heap of components, so that when it *does* arrive ultimately it will be perfectly new once more.

SLOW-MOTION DIALS

A practical article for the constructor.

By G. V. DOWDING, Grad.I.E.E.

SLOW-MOTION dials do not directly affect the electrical qualities of a set; their purpose is to make it easy to get very close adjustments with variable condensers. Some variable condensers have slow-motion movements incorporated in them and others have not, but there is little practical difference between a slow-motion variable and an ordinary variable that has a slow-motion dial fixed to it. Indeed, the result is almost identically the same.

Now a reaction condenser does not want a slow-motion dial. The set need never be operated so close to oscillation that gearing is needed to give you a minute approach, and there is not so much to be gained by having slow-motion dials even on the tuning variable condensers of some sets.

For instance, slow motion will not be needed if you merely want 5 G B, 5 X X and 2 L O on a local station loud-speaker outfit, but if you have a set capable of running round the Continental stations, then geared variables become very useful.

There are a large number of slow-motion dials available, although it is to be feared that quite a few of these are not so satisfactory as they might be. On the other hand, there are many that are excellent.

Points To Be Watched.

There are a number of points that must be examined in a slow-motion dial. In my opinion, the first thing is its appearance. Apart from a switch knob or two, the condenser dials are the only things that one sees on a radio receiver. It is all very well for the baseboard components to be beautifully finished and the whole "innards" of the set spick and span, but it is the cabinet, panel and condenser dials that have to appeal to the eye. And we have long since passed the day when appearance was a secondary consideration.

The Lotus dial has a very neat "cursor" device for reading the scale.

The movement of a slow-motion dial must be smooth and free from backlash. Let me explain what backlash is, as there may be some readers who, although they have probably seen the word a good many times, are not quite clear as to its meaning.

Backlash is a mechanical defect, and these are its symptoms. You turn the dial slowly round until a certain reading is reached, and then stop at that point. When you try to move back again to a lower reading you have to rotate the adjustment knob a tiny way before the vanes of the variable condenser are set in motion. In short, there is "play" between the adjustment knob or dial and the spindle carrying the moving vanes. This is a very serious defect in a slow-motion dial, because it is essential for precise and easy manipulation that there should be a corresponding movement of the vanes with every microscopic adjustment of the controlling knob or dial.

Smooth Action Essential.

There should be a uniform resistance in the movement. You do not want the gearing to be too loose and you do not want it to be stiff; the ideal drive provides you with a compromise between the two and, obviously, there should not be a patchy motion, the control knob rotating smoothly at first and then striking a hard or sloppy patch. I am saying nothing about the kind of gearing incorporated in the device, for this really does not matter providing the result is a smooth action. Some manufacturers achieve satisfactory operation with carefully cut cog-wheels, while others employ friction drives. Even worm gears and epicyclic arrangements are to be found.

The Burton dial combines a direct and a slow-motion dial.

Now you do not want the gearing to be of too high a ratio unless you have a direct drive as well as the geared drive. And, by the way, if you have a direct drive, see that this, too, is smooth and that its action has not been sacrificed in order to achieve a smooth "vernier" drive.

Ratios of Gearing.

With a gearing of anything between 4 to 1 and 6 to 1, a direct drive is not essential, and very close adjustment at any point of the scale can very rapidly be made. Microscopic settings are possible with condensers with gearings of 10 to 1 and 12 to 1, and higher, although if you have no direct drive it takes a long while to get around the dial.

A high ratio slow-motion dial fitted with a small adjustment knob is more of a nuisance than an asset, and here is a very important factor and one I want you particularly to take note of. To get the best out of a geared condenser drive a finely engraved scale with a sharp indicator or "hair line" are quite vital.

In the case of the "hair line" indicator, this should come closely up against the scale, as otherwise it is liable to cast a confusing shadow. Some types of slow-motion dials are provided with almost completely concealed scales; you note the settings and make calibrations through an aperture. Personally, I prefer to see the whole scale, which is in effect one's radio operations map, but this may be an old-fashioned view.

One thing is certain, and that is that the aperture idea is a failure unless the figures on the scale are bold and easy to see without having to crouch down in front of the panel.

Concerning Drum Drives.

One of the great advantages of the old plain dial was that almost invariably it had a scale engraved on a bevelled edge. You nearly always look down at the panel of a receiver, and the bevelling brought the scale at about the right angle.

I suppose drum drives could hardly be placed in the category of slow-motion dials. They are a class of their own, but a few words about them are necessary. Most of the above remarks apply to these devices. Practically every drum drive I have examined has answered to all the above requirements.

I am, of course, referring to geared drum drives. They are harder to mount on a panel than ordinary slow-motion dials because they necessitate the cutting of a large hole. Nevertheless, they are of handsome appearance and are very nice to handle. Also they tend to make the operation of sets having several tuned circuits a much easier matter.

The latest Formo dial is arranged with the scale on an inclined surface for ease of reading.

Ganging can be accomplished without the necessity of precise circuit balancing. You can have two or three drum drives all in close juxtaposition so that they can be adjusted either individually or collectively.

This makes station searching an easier business with sets having two or three H.F. stages.

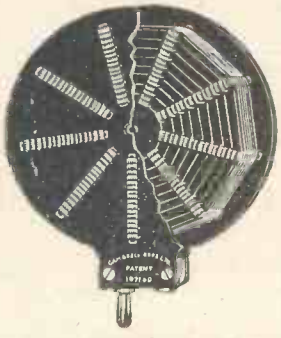
COILS and CONDENSERS

A comprehensive review from the practical point of view of all the principal types of coils and condensers used in radio circuits, with a helpful discussion of their special adaptations.

By G. P. KENDALL, B.Sc.

SOMEHOW, I do not think the readers of "P.W." would wish me to devote this article to explanations of the theory of tuning coils and condensers, how they work, who invented the different types, and so on.

I believe they would be much better pleased if I used the space allotted to me in trying to give them some more practical information about the whys and wherefores of these matters, so that they may gain a clearer insight into the *reasons* for such things as the customary use of a ·0005-mfd. condenser for tuning, a ·0001 for reaction, and so forth. I trust I am guessing correctly, and that the essentially practical notes which follow will prove helpful.



A part-sectioned view of the Gambrell type of plug-in coil.

Capacity Questions.

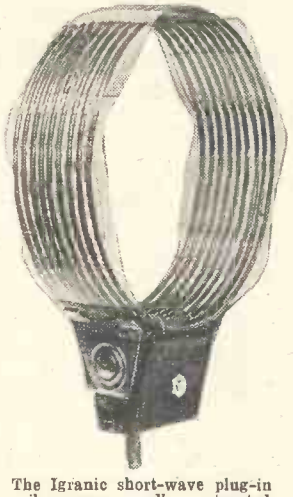
Since we are not going to make any attempt to go into theory, we need not worry unduly about the order in which we tackle the different parts of the subject, so we may as well get down to business at once. First of all, let us take the question of the capacities of the different variable condensers used in a set, and see what they should be, getting an idea of the reasons therefore as we go.

For a start, there is the reaction condenser. Have you ever wondered why it is in practically all modern designs the capacity of this unit is about ·0001 mfd.? (Sometimes given as ·00015 mfd., but that is too small a difference to be worth counting, and merely arises from the fact that in some makes only a ·00015 is available, and no ·0001 mfd.) Well, the main reasons are these: In most modern circuits things are so arranged that full reaction—i.e. the just-short-of-oscillation point—is reached with quite a small reaction capacity, usually about ·00005 to ·000075 mfd.

The Raymond miniature type of reaction condenser—a very neat little component.

Reaction Requirements.

Since we only want this quite small capacity it is obviously desirable to get it with a correspondingly small condenser, since in this way we shall get easier and more gradual adjustment. Moreover, such a small condenser is cheaper, and as a result of its compactness it requires less panel space and so can be fitted into a layout more easily.



The Igranic short-wave plug-in coils are very soundly constructed.

Of course, one *could* use an ordinary type of condenser of, say, ·0003 mfd., but it would always be working near its minimum setting, and so would be more or less wasted. Also, it would give a rather coarse and abrupt control which would be far from pleasant in use.

Things would be worse still with one of ·0005 mfd., because control would be so sudden as to require a good deal of skill, and in some cases the set might even oscillate with the reaction condenser at zero,

(*Continued on next page.*)

FIVE FINE SPECIMENS OF BRITISH RADIO PRODUCTS

Reading from left to right: The Wearite version of the "Titan" coil unit, the J.B. neutralising condenser, a Lewcos standard plug-in coil, a T.C.C. large fixed condenser, and finally a Dubilier "Toroid" coil.

DETAILS OF A SELECTION OF FIRST-CLASS

as a consequence of the comparatively large "minimum" value of such a component.

Another point about the reaction condenser which readers sometimes raise is the effect of the fixed condenser practically always placed in series with it in "P.W." sets. They may be interested, therefore, if I explain why I always include this device

A component with many applications—the Lotus differential reaction condenser.

in the "P.W." Research Department designs. This condenser does not affect in any appreciable degree the functioning of the reaction circuit, but is purely a safety device intended to prevent H.T. short-circuits.

Preventing H.T. Short Circuits.

The point is this: If this fixed condenser were not provided and the fixed and moving plates of the reaction condenser chanced to touch, there would result in most circuits a short-circuit of the H.T. battery. This would very possibly have disastrous consequences for the first L.F. transformer primary winding, 'phones, or whatever is included in the detector anode circuit.

Such a fault ought not to occur with a good make of reaction condenser, but there is always the possibility of the plates being bent accidentally, and I have found in practice that the risk is quite a real one. My own experience convinced me that something definite should be done to safeguard against it, and hence when I took charge of the "P.W." Research and Construction Department, some two years ago, I decided that this safety condenser should be incorporated as an invariable rule in all our sets except those in which some special circumstances made it unnecessary.

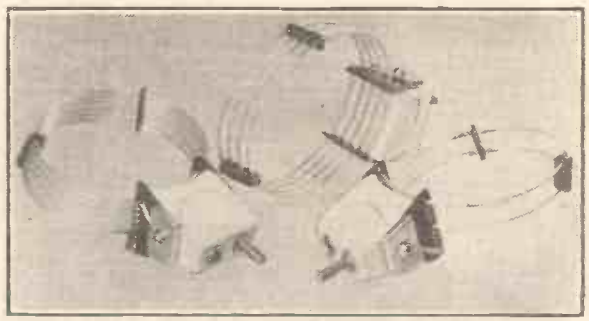
No Operating Effect.

The reason why this "stopping" condenser has no effect upon the behaviour of the reaction circuit is quite simple. It is usually of much larger capacity than the reaction condenser, and so its electrical "resistance" to H.F. currents is negligibly small in comparison. Hence, variations in the capacity of the reaction condenser have just the usual effect, the presence of the large capacity of the fixed condenser in series not altering matters to any degree you can discover.

The Peto Scott miniature type reaction condenser.

To give you an idea of the relative capacities of these two condensers, I may mention that it is usual in sets of my design for the fixed condenser to be about ten times the capacity of the reaction condenser. Thus, in the majority of sets, the variable is of ·0001 or ·00015 mfd., and the "stopping" condenser is of ·001 mfd.

This value (·001 mfd.) will serve in practically all cases, but in some sets where a specially small capacity-reaction condenser is used it is permissible to reduce the stopping condenser in roughly the same proportion. The point is that any fixed condenser of about seven to ten times the capacity of the reaction will serve, or any large size available. For example, in designing the "Titan" Three I found that the best capacity for the reaction condenser was round about ·00005 mfd., hence there was no need to place so large a condenser as a ·001 in series with it. Instead I used one of ·0003 mfd., which was amply large enough and was a size which I thought it probable most constructors would have at hand.

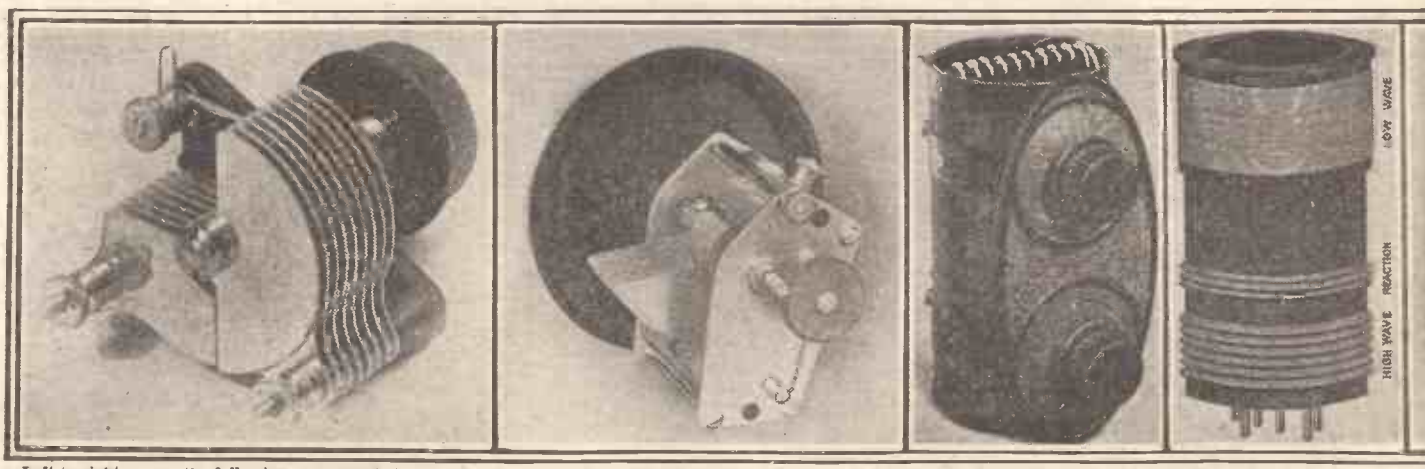


The "Atlas" range of short-wave coils is mounted on special porcelain plugs.

The Type for Reaction.

The point is really this: The fixed stopping condenser should be *not less* than about seven times the capacity of the reaction condenser if it is not to have any appreciable effect on the adjustment of the latter. A larger capacity still could be used if it happened to be available, although it is not necessary nor of any advantage. You could use one of 2 mfd. if you liked!

The type of condenser to use for reaction purposes is a point on which many people



Left to right we see the following components here: The Lissen reaction condenser, a Brandes slow-motion tuning condenser, the Chakophone dual-wave range tuner, and a sp
and a pair of Colvern 6-pin coils on special ribbed for

H.F. COMPONENTS FOR WIRELESS RECEIVERS.

do not seem to be quite clear. Really, all that one wants is a condenser giving a variation of capacity proportional to the dial reading, i.e. one with plain semi-circular plates. There is little point in using fancy-shaped plates, such as the square law and S.L.F. in a reaction condenser, because we are not concerned here with a tuning effect. It is arguable, however, that these special shaped plates may, in some cases, give a slightly more gradual control of reaction; it all depends on the particular point on the condenser scale at which the adjustment is being made.

A high-voltage Ferranti reservoir condenser of 2 mfd. capacity.

A Special Type.

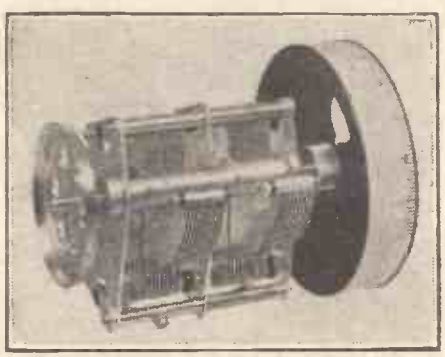
Reaction condensers of the ordinary miniature sort are available nowadays in a great variety of types and makes, but we must not forget that there is another form just achieving popularity which is only produced as yet by a comparatively small number of makers. This is the so-called "differential" condenser, which although by no means new, has not been used to any great extent until comparatively recently.

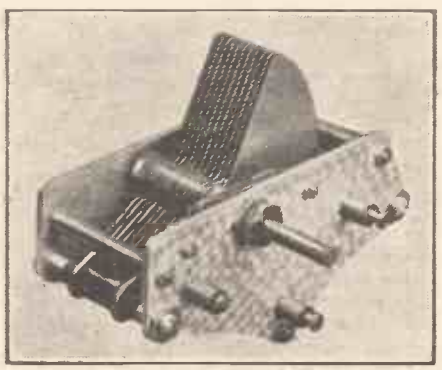
This type has two sets of fixed plates and one set of moving. They are arranged so that the moving plates can engage wholly with either set of fixed ones, or partly with either, and this component has some quite valuable applications. For example, it can be adapted to the ordinary Reinartz circuit in such a way that the adjustment of the reaction condenser no longer upsets the tuning nearly so much as in the normal scheme.

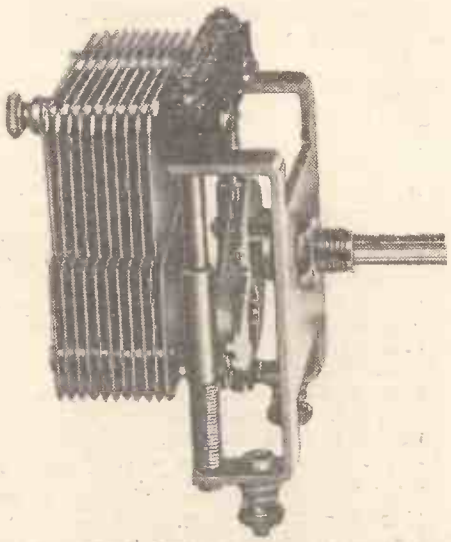
Tuning Capacity Considerations.

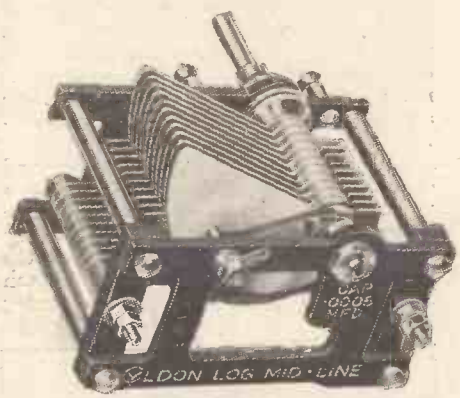
Now for some practical points about tuning condensers for different purposes. Now, the standard capacity for the tuning condenser in a receiver for the ordinary medium and long broadcast waves is ·0005 mfd., and the reader of an inquiring turn of mind may have wondered why this should be. Well, there is nothing magical about this figure of ·0005. It simply happens to be about the smallest capacity which will cover comfortably the lower broadcast band of waves with ordinary coils.

It is sometimes argued that better results can be obtained by using a smaller condenser (·0003 mfd.), and a larger coil in each circuit, since by so doing we obtain a higher ratio of inductance to capacity in the circuit. Under favourable conditions this means a greater H.F. voltage across the circuit, and should result in stronger signals.


The special Gecophone double slow-motion tuning condenser used in the "Music Magnet" receiver.


One of the Igranic range of tuning condensers of the square-law variety.


The Ripault condenser operates on a special "lateral action" principle.



A Cyldon variable condenser of the "log-mid-line" type.

(*Continued on next page.*)


pecial Formo 6-pin dual range coil unit. The tuning components on the right hand page are, left to right, the Bowyer-Lowe reaction condenser, an Ormond slow-motion tuning condenser, rmers. (The one to the right is a slot-wound long-wave coil.)

COILS AND CONDENSERS.

(*Continued from previous page.*)

This improvement, however, is rather difficult to realise in practice, and means a very special and somewhat expensive coil. Now that the lower broadcast band is so wide (practically 200 to 550 metres), moreover, the problem has become more difficult still, and so the ·0005 value is practically always used.

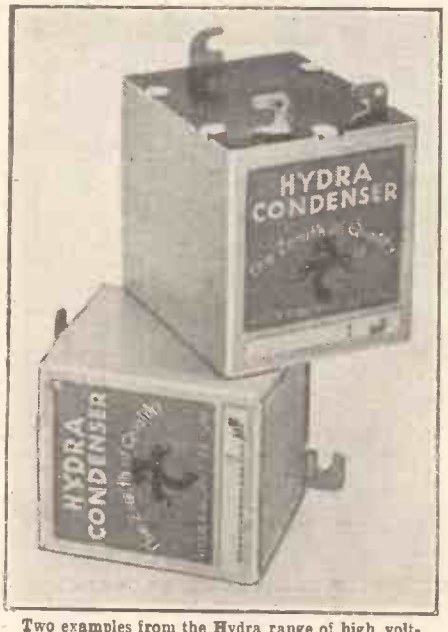
On the short waves things are rather different, and special short-wave receivers usually employ considerably smaller capacity tuning condensers. Here we do not as a rule require to cover such a wide range of waves, and so a lower capacity is adequate. For example, one interesting band of waves is from 20 to about 35 metres, and this only involves a comparatively small alteration of capacity.

Short-Wave Requirements.

Consequently, we can quite well use a condenser of only perhaps ·0002 or ·0003 mfd., or even a little less, and still have an ample range of tuning. For the next wave-range above we change the coils, and so cover the whole band in time.

It might be thought at first glance that although a ·0005-mfd. condenser is larger than necessary for short-wave tuning it might yet be employed and so render the set equally suitable for broadcast reception without other modification than the changing of the coils. This, however, is not as a rule the case, because so large a condenser is apt to make tuning exceedingly difficult on the short waves.

Hence, in sets intended for both low and ordinary waves it is usual to provide a ·0005-mfd. tuning condenser, with a device for cutting down its capacity when working on short waves. This generally takes the form of a small fixed condenser which can be connected in series with the tuning condenser for low waves, and cut out for the broadcast band.



Two examples from the Hydra range of high voltage reservoir condensers in metal cases.

Now, what about the type of condenser to use? There is first the question of the shape of the plates, and it can be assumed that the old semi-circular straight-line-capacity condenser is dead so far as tuning purposes are concerned. The choice now is really between the straight-line-wave-length condenser (two forms, square law and log-mid-line) and the straight-line-frequency (S.L.F.), and it is really a matter of taste which you use.

The Tunewell Dual-Range coil is a single-hole mounting component with integral wave-change switch.

Just one point here: don't let anybody tell you that different types alter the selectivity of the set. All they do is to affect the convenience of working and the positions at which the stations come in.

Then there is the question of a slow-motion or a plain condenser, and this requires a little consideration to make a correct decision. By slow-motion, by the way, I mean either a condenser with an integral slow drive, or else a plain type fitted with a so-called "vernier" dial.

Now let me see if I can give you some general rules which will help you in making a choice. First, there is the simple case of the crystal set. Here a plain condenser is definitely indicated, for I have never yet found a crystal circuit in which tuning was sufficiently sharp to make slow-motion either necessary or desirable.

Very similar is the purely "local" set, usually a detector and one or two L.F., where the tuning is again comparatively flat. So long as such a set is intended only for the local and 5 G B a plain condenser can be taken as quite adequate, but if it is to be used for long-distance work as well then a slow-motion control will be very desirable.

A Useful Rule.

Here, then, we can decide upon a general rule; the great majority of sets intended for long-distance work call for slow-motion tuning condensers.

Now we come to the question of the coils used in a radio receiver, and here we reach so large a subject that we must make up our minds to try to deal only with some particular aspect of it. I rather think it will be of the most practical value if I confine myself to questions of the applications of the various coil types.

Our obvious first example is the standard plug-in coil, and here we can quickly arrive at a useful generalisation: wherever we are aiming at simplicity and flexibility we shall do well to consider the plug-in type.

Their flexibility is particularly valuable in experimental work, since in most makes we have available a range of sizes from 25 to 300 turns or thereabouts, with the intermediate sizes very closely graded.

For the simpler types of sets, therefore, such as single-valvers and "Det.-L.F." receivers, the plug-in coil makes a very strong claim.

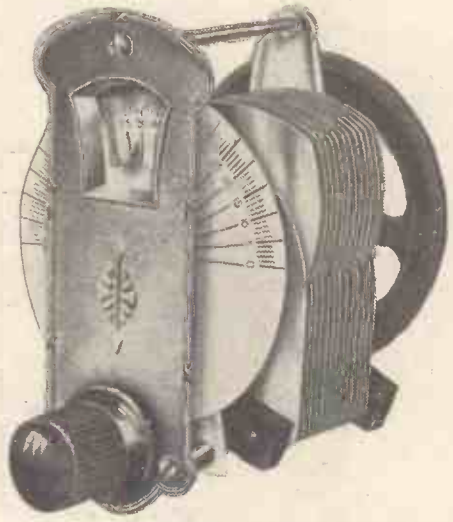
For wave-change circuits this type of coil is not quite so convenient, on account of its rather large size. True, it is quite possible to arrange our low-wave coils in one group and the long-wave ones in another, with a suitable switching arrangement, but it generally results in a fairly bulky set.

I have produced a number of designs for such sets in the past which have appeared in the pages of "P.W.," and while they have given good results I have always felt that their inevitable size was a point against them. All the same, they represent a very economical way of constructing an up-to-date set for the man who already possesses a range of plug-in coils.

Where to Use Plug-ins.

To sum up, it seems that the type of set in which the plug-in coil is the obvious form of inductance is the comparatively simple one without wave-change switching. As regards efficiency, it should perhaps be pointed out that the more modern types of plug-in coils give quite creditably low figures of H.F. resistance.

An advantage of the plug-in coil which must be mentioned in justice to this type concerns the use of the simpler kinds of sets on short waves. Most receivers of the detector and L.F. type can quite well be used on the really short waves if they are fitted with this kind of coil, because special short-wave specimens can now be obtained.



The Lamplugh variable condenser is of decidedly original design and construction.

Now we come to the limitations of the plug-in type. We have already seen that it is not too well adapted to wave-change switching circuits, and the modern tendency here is to use combined-wave coil units in which both medium and high-wave windings are built into a single component. Our "Titan" unit, with its well-known efficiency and adaptability to different circuits, is a good example of this class of coil.

Another position in which the plug-in coil is not often used is in sets with one or more stages of H.F. Here we usually require too many different windings for the plug-in type to be convenient or very efficient.

In these larger sets it is therefore usually preferable to use some of the complete H.F. transformer units, of which the standard six-pin coil is a good example. These coils have been very widely used in all sorts of sets for some years, and they are available in an extraordinary number of different types.

FROM THE TECHNICAL EDITOR'S NOTE BOOK

Tested and Found—?

S. G. BROWN'S NEW ACTIVITIES.

THE copy of the "Brown Budget" we recently received is the annual catalogue number, and we note that S. G. Brown, Ltd., have some interesting new productions for the coming season. For instance, there are screened-grid receivers for home assembly, the kits for these handsome-looking outfits being available at very reasonable prices.

A great radio factory which proudly advertises itself to the world.

Then there are the Brown Duplex loud speakers which are stated to give exceptionally good results. The new Brown Vee Unit is prominently figured, and we note that there is now available a handsome fire-screen specially designed for use with the Vee Unit chassis. This stands 2 ft. 7 in. high, and is made of fine quality Honduras mahogany. The price of this most artistic "baffle" is two guineas.

LEWCOS TRIPLE-TAPPED COILS.

There is a new range of Lewcos plug-in coils which should prove of exceptional interest to builders of new sets, and those who desire to make old sets more selective. They are known as the Lewcos X inductance coils, type 7B. They are similar in appearance to Lewcos centre-tapped coils, and are enclosed in beautifully moulded insulating cases.

In addition to the normal plug connections in the ordinary plug-in base, corresponding with the two ends of the windings, there are three terminals which are taken to three tappings. These enable any one of three alternative aerial connections to be made.

The 60X, which covers the range of from 180 to 540 metres, using the normal ·0005-mfd. variable, is tapped at 15, 25 and 50 turns. These tappings are very well placed, and are most suitable for "P.W." sets where coils of the tapped variety are specified in various positions.

It is interesting to note that the N.P.L. gives 3·2 ohms as the H.F. resistance of the 60X tuned by a ·0005-mfd. variable. This is, of course, exceptionally low, and is a good indication of the coil's very high efficiency. The 75X is tapped similarly, and the 250X and 300X are each tapped at 15, 30 and 50.

HOME-ASSEMBLED H.T. BATTERIES.

The Leyton Battery Co. is now selling the component parts of H.T. batteries so that amateurs can themselves assemble these accessories. The main element is, in effect, a complete dry cell of the triple-capacity type. These can be purchased for 3s. 6d. per dozen. All you have to do is to dip each cell in hot wax (the wax is available at 1s. per pound), put them in a cardboard box and solder or screw the cells into a complete electrical chain.

The full details are, of course, supplied when you buy the parts. It is a very economical way to obtain the type of battery needed to operate a multi-valver. The work of assembly is not at all a tedious or difficult operation, and necessitates no particular skill.

Another attractive Leyton Battery Co. innovation is the Leyton Dual Battery. This is again of interest to the home assembler. In this case the cells are fitted with interchangeable terminals, and have to be placed in small glass jars as though a wet H.T. battery were being assembled. But you do not put anything into the jars until the cells begin to run down. As each cell starts to give out, water is poured into its jar and this has the effect of revivifying it. Used on an average of four hours a day it is claimed that the possible life of the Leyton Dual Battery is anything from one year to eighteen months.

A FERRANTI ANNOUNCEMENT.

Ferranti Ltd., makers of the well-known components bearing their name, announce that Mr. M. R. Carlisle, one of their Sales Engineers, has taken over their representation in the Midlands for the sale of their Radio products. Mr. Carlisle will reside in Birmingham and will take an early opportunity of making contact with the many clients of Ferranti Ltd. in the Midlands. This appointment follows the resignation of Mr. H. S. Cooke, who has been well known as the Ferranti agent in the Midlands for several years.

NEW MAIN SETS.

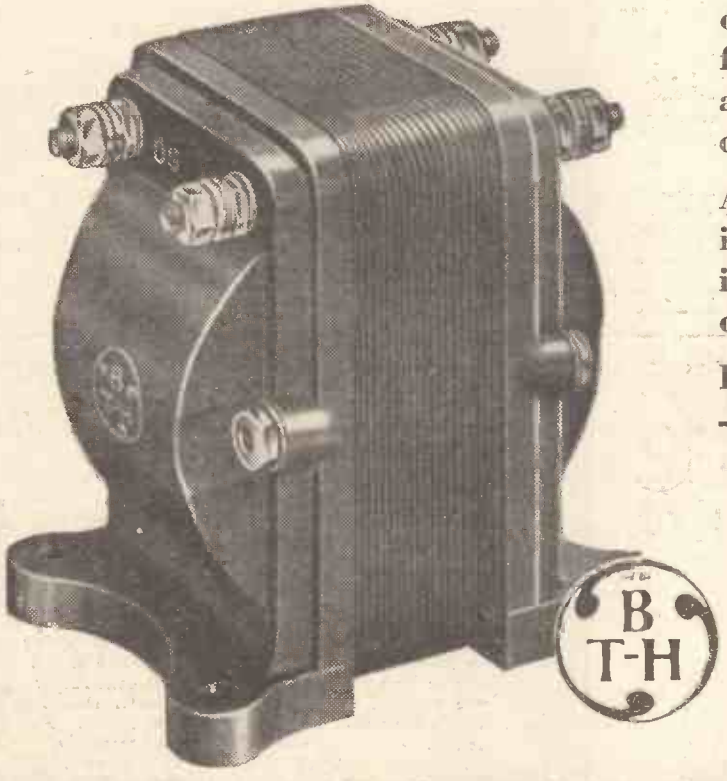
We have had the opportunity of examining the full and complete specifications of two new mains sets that the R.I. people are now in the process of introducing to the listening public.

The one that particularly appeals to us is a three-valver which requires no aerial or earth. This set employs mains valves and, of course, needs no batteries at all. You just plug it in a light or power socket like an electric wire. It appears that this R.I. receiver gives an astonishing performance and, in due course, we hope to be able to make a detailed report on it.

Traders and manufacturers are invited to submit radio sets, components, and accessories to the "P.W." Technical Department for test. All tests are carried out with strict impartiality under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended as a reliable and unbiased guide as to what to buy and what to avoid.

A photometer for measuring the performance of electric lamps and radio valves in which a photo-electric cell takes the place of the human element.

NEVER A BREAKDOWN



Meticulous care in manufacture and in choice of raw materials has ensured that even with the most prolonged usage, this transformer will not break down. A product of resources of the famous B.T.H. Radio Laboratories at Rugby, it has exceedingly good characteristics.

A feature of this wonderfully designed instrument is the fact that screening is rendered unnecessary, as the whole of the magnetic field is utilised.

It is made in a variety of useful ratios —your dealer can supply you.

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W.12

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The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts or photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4.

The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS.

A DOUBLE WAVE-TRAP.

T. C. F. (Enfield).—"Whilst staying with friends for the August holiday I saw the set of one of their neighbours (called The 'Dwarf' Three.) What interested me especially was a sort of double wave-trap, which he explained to me would cut out two stations (either one at a time) by means of a switch (usual type L.T. switch).

"It appeared to consist of an ordinary centre-tapped coil and two of the little variable condensers of the type which you adjust with a screwdriver. Can you give me the directions for making one of these wave-traps?"

Either an X coil or a centre-tapped coil can be used for the trap, and in addition to this you will require one compression type semi-variable condenser having a maximum of ·0003 mfd., and another of ·001 mfd.

To insert the trap into the set all that is necessary is to mount the coil well away from all other coils, etc., with the two condensers close to it, and also to the switch, the leads to the latter being as short as possible, as it is important to run these leads direct to avoid losses. In addition, a new aerial terminal will be required which we will call A1, calling the ordinary aerial terminal on the set A.

The first thing to do is to wire this latter (A termina on the set) to one side of each of the new variable condensers and to one end of the new coil holder. The other end of the coil holder goes to one side of the ·001-mfd. variable condenser and to one side of the switch. The remaining side of the switch goes to the other side of the other variable condenser (·0003 mfd.).

Now all that remains is to take a flexible lead from the new A1 terminal to either the centre tap on the centre-tapped coil or to one of the tappings on the X coil, whichever may be in use. The operation of the trap is simplicity itself, and it can be cut right out of circuit if the aerial lead is placed on the old aerial terminal. If it is placed on the new aerial terminal the best position for the flexible lead should be found on the coil by trial and error, and then the switch should be thrown open, and the lower wave-lengths on the two stations which it is desired to cut out should be tuned in on the set, and reduced by the wave-trap in the ordinary way.

After this has been done the switch is closed and the set is tuned to the higher wave-length, finally tuning the wave-trap to cut out the second interfering station on the longer waves, in the same manner as with the former station. The great advantage of the scheme is that once the wave-trap condenser has been adjusted, either the lower or the upper wave-length station can be cut out by the wave-trap merely at the touch of the switch.

VOLUME CONTROL BY MEANS OF RHEOSTAT.

"SORBO" (Warrington).—"The circuit is H.F.-Det.-2 L.F., the H.F. being screened grid with tuned anode, detector on the ordinary grid-leak condenser principle (with Reinartz reaction), first L.F. resistance and second L.F. transformer coupled.

"All the best components have been chosen and all the values have been carefully picked from advice given from time to time in 'P.W.,' so the rest of the set is of really high quality. As the cost has been rather high I do not want to fit an ordinary volume control, and I am wondering if I could use the H.F. filament method instead. The only objection that I can see is that this may spoil the quality, and this is the very thing I wish to avoid. Is this so, or do you think it would be O.K. to

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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 818.)

insert a 30-ohm resistance and adjust the volume according to whether this was in or all out of circuit on the H.F. filament?"

You should have no serious distortion if this method is employed on the H.F. valve. Distortion arises when volume control is affected by means of dimming the filament of one of the low-frequency amplifiers, thus causing the valve to work on the wrong part of its characteristic curve. The H.F. valve, however, handles so small an input that the same effect does not arise, and consequently we think you will find it perfectly satisfactory to use a variable resistance of the value mentioned, controlling the volume with this as suggested.

Before mounting we should take care to see that it works very smoothly, as placed in the H.F. position a filament rheostat which has any tendency to noisy results would be a tremendous drawback, especially if the quality of the set is otherwise excellent.

Adjusting H.T.

R. D. A. (Bewdley, Worcs.).—"I was reading in 'P.W.' about these stabilising resistances for anti-motor-boating units, and it seems to be the very thing I require for my set, which is pretty good except that it distorts on great volume.

"One point I am not clear on, and that is does an anti-motor-boating device need any other alterations after it is fitted, or is this the only thing you have to do in putting it in the set?"

The anti-motor-boating unit is very easily wired into the set according to the directions which the makers issue with the component when purchased. Once fitted, there is nothing to do at all in the way of adjustment, for if suitable values are chosen the action of the instrument is completely automatic, and all that happens is that the distortion which was previously troublesome is now removed.

There is, however, just one little item which you might find a difference in, and that is the position of the H.T. positive supplying the valve in the plate circuit of which the anti-motor-boating device is connected. Owing to the fact that an extra resistance has been placed in circuit it is sometimes necessary to move this plug up a little higher on the H.T. battery than was previously the case, in order to compensate for the added resistance in circuit.

Too Many Terminals?

F. J. T. (Manor Park, London, E.12).—"Why are practically all sets of two valves or more fitted with more than one high-tension tapping. Would it not be much simpler to insert resistances to reduce the full voltage to that required by a screened-grid valve or the detector as the case may be? Also as mains units are getting more universal would it not be simpler to have one positive terminal to supply the high voltage? I understand that only the fairly expensive units are reasonably accurate on the lower voltage tappings."

The reason that two tappings are provided is that modern valves, although much superior to the valves of a few years ago, are inclined to be rather critical about their anode voltages (especially if of the special type such as the screened-grid valve), and consequently the sets which have these mixed up with other valves, make it necessary when full efficiency is to be obtained to apply exactly the right voltage to each particular part of the circuit.

It would certainly be *simpler* to insert resistances to reduce the full voltage of the mains or of the battery, to that required by the screened valve or detector, but these resistances would have to be bought, and would certainly cost a good deal more than the extra terminal and the extra wander plug which is all that is required to tap an H.T. battery. It is this question of cost which really governs the fact that more than one terminal is used, especially when it is remembered that such resistances are liable to deteriorate.

This is not true of the wander plug, so that trouble might arise owing to the resistance which would not be there if the two-terminal method were employed. Nevertheless, as you suspect there are certain advantages in the simplification by means of resistances, and you will probably have noticed that several "P.W." sets of the more ambitious type have been designed with resistances inserted in the plates of separate H.T. circuits. (Please note:—Your letter had been passed to "Ariel" for attention, but unfortunately we have had so many requests of this kind that we are afraid that he will be unable to comply with your request.)

INDOOR AERIAL'S POSITION.

M. J. (Goodmayes, Essex).—"We have only just moved in, but my neighbours tell me that we can get good results with indoor aerials they believe, as the man who was here before me had one. I cannot quite make out where it was placed for there appears to be no trace of it left behind (worse luck!). What is the best place for this type of aerial?"

If you can get into the space underneath the roof the best plan is to run three long wires across this at a distance of, say, two or three feet from each other. At the far end, each of these wires can be affixed to separate insulators suspended from the wall or rafter. At the near end the three wires are joined together

(Continued on page 822.)

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good"?

Perhaps some mysterious noise has appeared and is spoiling your radio reception?—Or one of the batteries seems to run down much faster than formerly?—Or you want a Blue Print?

Whatever your radio problem may be, remember that the Technical Query Department is thoroughly equipped to assist our readers, and offers an *unrivalled* service.

Full details, including scale of charges, can be obtained direct from the Technical Query Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

A postcard will do: On receipt of this an Application Form will be sent to you free and post free immediately. This application will place you under no obligation whatever, but having the form you will know exactly what information we require to have before us in order to solve your problems.

LONDON READERS PLEASE NOTE: Applications should NOT be made in person at Fleetway House or Tallis House.

RADIOTORIAL QUESTIONS AND ANSWERS

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and taken down to the set in as direct a line as possible. It is important to keep the aerial wires themselves and the down lead as far away from the walls, etc., as possible.

Where they have to pass through a wall they should pass *straight through* it, and should not be run against a wall or ceiling for a greater distance than is absolutely necessary. Failing the space under the roof (which is generally the largest), a passage or hall should be tried. If these are not available and the aerial must be placed in a small room it is sometimes advisable to try the effect of different *shapes* of indoor aerial.

In some places the best aerial is that wound round and round a picture rail, whilst in other locations a zig-zag from one side of the ceiling to the other gives better results. Much depends upon the situation of the house and that of the surrounding buildings, etc., so that the only way of determining the most satisfactory method of arranging an indoor aerial in your own case is to experiment with different forms until the best position is found.

HEATING VALVES FROM THE MAINS.

F. T. L. (Cleckheaton).—"I am interested in the valves which run direct from A.C. mains. What is the difference between directly heated and indirectly heated valves of this type and do both types need a transformer?"

Both directly heated and indirectly heated valves are used in conjunction with a low-frequency transformer to step-down the voltage of the alternating-current supply (which is usually much too high) to the required figure. A directly heated valve is of the type with very thick filament specially designed so that fluctuations of the A.C. input at the end of the filament cause it to heat up to a more or less steady temperature.

An ordinary thin filament valve is very sensitive to the exact voltage which is applied to the filament, and its emission would alter considerably with variations in the voltage across the filament. Even if such a valve could stand up to the fluctuations impressed upon it, the variations in emission would give rise to a strong howl in the receiver which the use of a thick filament would entirely obviate.

The indirectly heated valves are entirely different, for in this case the fluctuations in voltage supplied by the transformer are not applied to the filament itself but are used to heat up a special heater element which, being in close proximity to the cathode, raises the temperature of this and so releases the electrons just as effectively as a special filament would do. Full details of the various types and of the circuit connections, etc., can be obtained from the valve makers.

THE "P.W." "ELECTRO" UNIT.

Apparently a great deal of interest is being taken in this unit for providing low-tension current from D.C. mains, but a great number of the queries which have been sent in have already been answered in the article describing the unit.

It is obvious, too, that some would-be constructors are entirely inexperienced in handling high-tension wiring, so we would call attention to our oft-repeated warning that alterations to house mains and similar wiring should not be undertaken except by a qualified electrician, or by experienced persons who know exactly what precautions should be taken to prevent all possibility of danger.

All the wiring of the unit should be covered to prevent the possibility of shock, and the terminals should be of the type designed for mains units. As stated, great care must be taken not to alter or "open" the L.T. circuit by removing one or more valves, as this adversely affects the eletrolytic condenser (and remaining filaments, if any), and may result in damage to them. (This, by the way, is a precaution that should be taken in all cases where an L.T. mains unit is being employed.)

No earth lead or connection should be used for the set or unit, as this part of the aerial-earth circuit is made via the mains connection, and need not be duplicated.

If for any reason the constructor particularly requires an additional earth connection, it must not be made direct (as in certain cases this may short the mains), but through a large fixed condenser (say, 1 mfd. or more) of really good make.

Regarding cost of running, although this is very low in cases where electricity is laid on at power rates, the device can simultaneously operate as a battery charger, if desired, and in this case the running cost will be much less than that of a simple trickle-charger. Details of this scheme are to be given in full in a further article that is to appear shortly.

TESTING H.F. CHOKES.

E. M. (Manningtree, Essex).—"What were the circuit connections given in 'P.W.' for testing by oscillation whether an H.F. choke was suitable for a reaction circuit, using a tuning condenser and 250-turn plug-in coil?"

In addition to the 250 coil and ·0005-mfd. condenser you must wire up a valve holder, a ·001 condenser, a pair of 'phone terminals, and an on-off switch as well as the H.F. choke under test. The connections are as follows. H.T.— and L.T.— joined together and to one of the filament terminals

(*Continued on page* 824.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 822.)

on the valve holder, to one side of the ·001 condenser, to one side of the ·0005-mfd. variable tuning condenser, and to one side of the 250-turn plug-in coil.

The remaining side of the plug-in coil and ·0005-mfd. condenser are joined together and to the grid terminal of the valve holder. The remaining filament terminal of the valve holder is joined to the switch, the other side of which goes to L.T. positive. Next join the plate terminal of the valve holder to one side of the choke under test, the remaining side of this going to the remaining side of the ·001 fixed condenser and to one 'phone terminal.

The final connection is from the other telephone terminal to H.T. positive. If oscillation is obtained at any point on the tuning range, the choke is definitely unsuitable for ordinary reaction purposes.

THE VENT PLUGS OF AN ACCUMULATOR.

J. M. (Leamington).—"At some time or another we have mislaid the little plugs made of celluloid which are fitted into the top of the accumulator, and in order to prevent spilling, or anything getting in, I hammered a cork in in place of this. But a friend told me that this is wrong and might cause an explosion. If that is a fact, what shall I do if I cannot get another plug?"

The vent plugs of an accumulator are an important part of it, and if they are lost or mislaid the holes should not be left open. Unless the hole is covered, metallic impurities may find their way inside and set up local action. Your idea of the cork was quite a good one except for the fact that it did not allow the gases to escape, as there was no hole in the cork like there was in the original plug.

Probably the makers can fix you up with a vent plug at a nominal cost if the dealer cannot do so on request, or you can make quite a satisfactory job of a cork if you drill a small hole or two right through it to permit of the escape of any gas which may be formed.

TECHNICAL NOTES.

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the form of what are now called electro-magnetic or wireless waves and this, as you know, is the basis of all radio communication.

Continuous Waves.

I said that the oscillations would die down but this is on the assumption that no steps are taken to maintain the oscillations in the circuit. Since the introduction of the 3-electrode valve it is a very simple matter to arrange a circuit including valves which will maintain itself in oscillation, the energy which is dissipated in the form of radiated electro-magnetic waves being made up by energy drawn from the batteries which are to operate the oscillating circuit.

Frequency.

The rapidity of the oscillations depends upon the total inductance in the circuit and the total capacity. If either of these quantities is varied the rapidity or frequency of the oscillations will be varied accordingly, and this provides a very simple means of regulating the frequency of the oscillations which are sent out by a transmitting circuit or the frequency of the oscillations to which a receiving circuit will be most responsive.

In other words, variation of the inductance or the capacity gives us a means of "tuning" the circuit and this discovery which, of course, is of paramount importance in the operation of all radio apparatus, is also due to Sir Oliver Lodge.

Inductance or Capacity.

In some cases it is simpler to tune a circuit by means of a variable inductance but in the majority of cases the tuning is done by means of a variable condenser.

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TECHNICAL NOTES.

(*Continued from page* 824.)

Design of Coils.

Although theoretically any coil may be tuned for a given wave-length by means of a condenser of suitable capacity, this arrangement may in practice be inefficient, and it is better to employ a coil of an inductance within certain limits. There are various reasons for this, which it would take rather a long time to go into, but one of them is connected with the self-capacity of the coil.

You have to bear in mind that although the coil (in the aerial circuit, for example) is placed there primarily to provide the main inductance of the circuit, it has nevertheless a certain amount of electrostatic capacity and therefore acts as a condenser.

Self-Capacity.

If the coil is unduly large or badly designed its electrostatic capacity may be quite considerable and this, as I mentioned above, interferes with the efficient distribution of capacity in the circuit. For this reason coils have been, since the earliest days of radio, designed specially—in the majority of cases—to have a small self-capacity.

Various Uses of Condensers.

Before leaving the subject of condensers I would like to refer to one or two special uses of condensers, quite apart from what may be called their fundamental function in the oscillatory circuit.

As you know, condensers are used at a variety of points in a receiving circuit and they serve various different purposes. The leaky condenser which is inserted in the grid leak, for instance, of the detector serves to carry high-frequency impulses whilst the space charge which would accumulate on the grid is allowed to escape by the grid leak bridged across the condenser.

By-Pass Condensers.

A condenser of quite large capacity may be shunted across the high-tension battery, and in some cases this will prove to be a great advantage. With a low-resistance high-tension source of supply, such as a high-tension accumulator battery, this shunting condenser is unnecessary, but with an H.T. dry battery, especially if this is getting old and out of condition, a fairly large capacity condenser shunted across the terminals of the battery will often make a great improvement in the reproduction. This is because the condenser provides a by-pass for the impulses, which are thus enabled to avoid the resistance of the battery itself.

Smoothing Condensers.

Condensers also play a highly important part in the construction of the smoothing circuit in a mains unit, where their effectiveness again depends upon their ability to transmit impulses whilst offering practically an infinite resistance to steady current. Large-capacity condensers are usually bridged across the D.C. output leads and thus provide a very easy short-circuit for any ripple or other irregularity in the D.C. output, whilst they do not provide an alternative path for the steady rectified current.

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TECHNICAL NOTES.

(*Continued from page 826.*)

Neutralising.

The neutralising condenser is another example of the extreme utility of this component and, as you know, is used for balancing-out the grid-plate capacity of a valve employed as a high-frequency amplifier. As a matter of fact, a neutralising condenser may be used in many other ways as well. Such a small variable condenser is often one of the quickest means of providing a variable coupling between one tuned circuit and another.

The plug-in coil and the three-way coil holder are not so popular as formerly and consequently the coupling of circuits in this way is usually not particularly convenient; the neutralising condenser, however, which is easily variable and can be used even unmounted, is sometimes very convenient where experiments are being made in a hurry.

Astatic Coils.

Referring to the coils used in the receiving circuit, there are so many varieties of coils that it would take very much more space than I have available even to say a few words about each. I would like to refer, however, to a point with regard to the so-called astatic coils which are increasingly used to prevent interaction and to reduce eddy current losses where screening is employed.

In some cases the grid coil of the detector valve is of this type, and where it is desired to use reaction, difficulty may arise since the two halves of the coil are wound in opposite directions. The effect of the reaction coil, therefore, is sympathetic to one half of the coil and adverse to the other, and experimenters are often puzzled by curious effects which are obtained in these circumstances.

Reaction.

However, the problem need not present any serious difficulty if you remember that the half of the grid coil which is adjacent to the reaction coil should be wound in the same direction as the reaction coil; in other words, the reaction coil and the part of the grid coil which is nearest to it should be sympathetic to one another, the other half of the grid coil being, of course, in the opposite direction.

The result will be that the reaction between the reaction coil and the near part of the grid coil will be much stronger than the opposite reaction between the reaction coil and the remote part of the grid coil. If the grid coil is the wrong way round, all kinds of curious effects will be obtained and the result will generally be unsatisfactory. A capacity control should be used, and with this it is a comparatively simple matter to find the best position of the reaction coil and grid coil in relation to one another.

S.G. and Selectivity.

When screen-grid H.F. amplifiers are used, you will sometimes find that the operation of the volume control—if of a certain type—has the effect of interfering with the selectivity; if the volume is turned down very much, the selectivity practically disappears.

Where the volume control consists of a variable resistance in the anode circuit of the screen-grid H.F. valves, this effect will generally be found to be due to the value of the resistance being too high. As a result, the whole of the volume control range is comprised within a very small part of the total actual range of the resistance. If a smaller resistance is used, something approximating to a vernier effect is obtained and the control of the volume is much more effective.

If you already have a fixed resistor you can reduce its effective value by connecting another one in shunt with it, of about the same value, which will make the total resistance roughly half.

Why Selectivity Falls Off.

The loss of selectivity is due to the reduced effective voltage on the anodes of the screen-grid valves, while the positive voltage on the screen grids themselves remains unchanged. In some cases, the effect of the resistance is to leave the anodes at a lower voltage than that actually applied to the screen grids. In these conditions the anode cannot operate properly, since the current is diverted to the screen grids, and thus stray coupling with the detector may be set up.

Often it is found that whilst the selectivity of the screen-grid H.F. amplifiers may be interfered with by the operation of the volume control, the selectivity of the detector is unaffected. It is easy to see why this should be the case, since the anode

voltage of the detector is unaffected, the volume control not being in that circuit.

You will generally find it more satisfactory to introduce the variable resistance in the common H.T. positive lead to the screen grids.

Aerial Dangers.

Does an outside aerial act in the same way as a lightning conductor, and is it therefore likely to be struck in a lightning storm? These are questions which naturally arise in the minds of radio listeners and experimenters during the summer season. Popular belief has it that the outside antenna acts as a lightning conductor, but the U.S. Bureau of Standards have made a thorough study of this subject, in order to satisfy the Fire Insurance people, and the results of these tests seem to show that there is really little to worry about.

Nevertheless, listeners are advised not to tune in stations or to keep their sets tuned on during a thunderstorm and the fire insurance companies have adopted a rule requiring that all receiving sets be equipped with lightning arresters at the point where the lead-in enters the house.

A Simple Rule.

According to Dr. J. H. Dellinger, the outside antenna has about the same attraction for lightning as the metal drainpipes or the gutters on the roof, and consequently, in case of a severe storm very close at hand, there is always a certain amount of danger which, of course, is increased if there is a large amount of metal within the house or in close proximity to the aerial or lead-in.

As the result of these elaborate tests it seems that we are just about back to the old advice to disconnect the set during a thunderstorm (certainly not to use it) and to connect the aerial to earth.

Printed and published every Thursday by the Proprietors, The Amalgamated Press, Ltd., The Fleetway House, Farringdon Street, London, E.C.4. Advertisement Offices: Messrs. John H. Lile, Ltd., Ludgate Circus, London, E.C.4. (Telephone: City 7261). Registered as a newspaper for transmission by Canadian Magazine Post. Subscription Rates: Inland and Canada, 17/4 per annum; 8/8 for six months. Abroad (excepting Canada), 19/6 per annum; 9/9 for six months. Sole Agents for South Africa: Central News Agency, Ltd. Sole Agents for Australia and New Zealand: Messrs. Gordon & Gotch, Ltd. Saturday, September 7th, 1929.
-R/R