

MORE ABOUT THE "EVERYBODY'S" THREE

Popular Wireless

Every Thursday
PRICE
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No. 357. Vol. XV.

INCORPORATING "WIRELESS"

April 6th, 1929.

The "TITAN" ONE



**FULL
DETAILS
INSIDE**

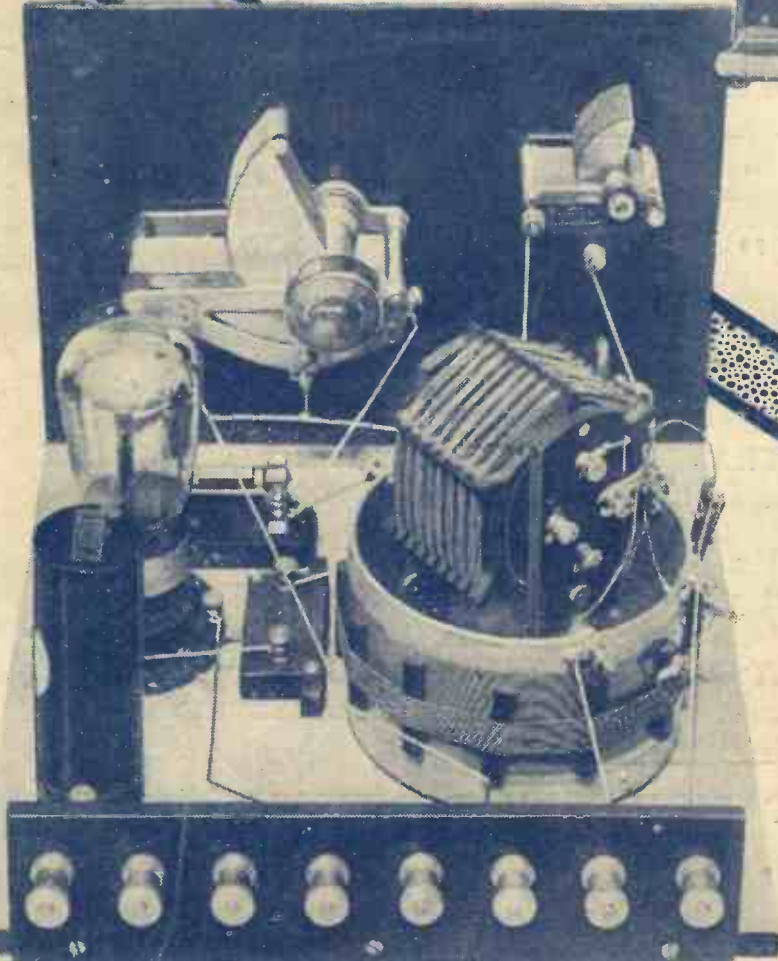
SPECIAL FEATURES

Metal Panel Troubles
The Cold Valve
YOUR "TITAN" SET

Making Your Own
Components—2. Coil Holders
Random Radio

The
Latest Broadcasting News

WHITE PRINT No. 18





Invaluable to
THE HOME CONSTRUCTOR

Two New
"BEST WAY" WIRELESS BOOKS

"Best Way" No. 328.—Modern Valve Sets. Contains full constructional details of four receivers. A "WAVE-CHANGE ONE-VALVER" to cover long and short waves by the operation of a switch, a "TWO-VALVE AMPLIFIER," the "'BEST WAY' WAVE-CHANGE THREE" and "THE HOME CIRCLE FOUR," a set specially designed for family use.

"Best Way" No. 329.—This Year's Star Sets. Tells you how to build another four specially-designed receivers. "AN ALL-WAVE TWO-VALVER" which covers all wave-lengths from 2,000 to 20 metres, "A ONE-VALVE AMPLIFIER," "A REGIONAL CRYSTAL SET," and the "S.G. AND PENTODE THREE"—a receiver of the most up-to-date type, capable of remarkable results.

EVERY SET MINUTELY DESCRIBED

On Sale Everywhere.

PRICE 6d. EACH.

MARCONI

2 VOLT

SCREENED

GRID



TESTED *once*

TESTED *twice*

TESTED *3 times*

Not only are all components of Marconi Valves tested at every stage of manufacture, but before they can get into the purple box bearing the name Marconi, the completed valves have to pass the following triple test.

- (1) The "qualifying" or Factory Test.
- (2) The "passing out" or Stock Test.
- (3) The "third degree" or Headquarters Test.

Marconi Valves are consistently good because they are triple tested.

Write for Marconi Valve Catalogue No. 520, giving particulars and characteristic curves of all types, mentioning "Popular Wireless."

For greater selectivity and long-distance reception Marconi S215 2-volt screened grid valve is unexcelled. It is manufactured with the latest Marconi filament giving copious emission and very high magnification.

Type S215 22/6

TRIPLE TESTED

SHOCK-PROOF!

When you buy your Screened Grid Valve insist on the one which will give you the longest service—choose Cossor. These illustrations show *why* the Cossor Screened Grid Valve is the most robust—the most dependable—and the most uniform Screened Grid Valve made in Great Britain. Remember that this wonderful new system of **interlocked** construction is to be found only in the Cossor Screened Grid Valve. No other make of Valve has these outstanding features of design.

NOISE-PROOF!

Noises are generally due to loose elements in a valve. In the Cossor Screened Grid Valve the elements are **interlocked**. Even under the hardest blow individual movement is impossible. The Cossor Screened Grid Valve is built like a bridge. Every joint is scientifically welded to ensure long life and complete rigidity.

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Never before has such a wonderful system of construction been used in any Screened Grid Valve. Even the hardest blow cannot disturb the perfect alignment of the elements which are rigidly held at top and bottom. As a result every Cossor Screened Grid Valve retains its characteristics throughout its abnormally long life. For any Screened Grid Receiver choose Cossor. Accept no substitute—for there is no adequate substitute for the Cossor system of **interlocked** construction.

Technical Data.

Cossor 220 S.G. (2 volts, .2 amps.) and 415 S.G. (4 volts, .15 amps.)
 Max Anode Volts 150, Impedance 200,000, Amplification Factor 200, Grid Bias 1.5 volts at max. anode Volts. Price (each)

22/6

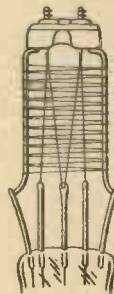
Demand the

Cossor S.G. Valve

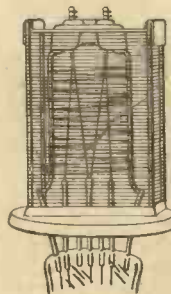
The only Screened Grid Valve with INTERLOCKED construction



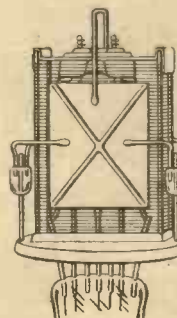
Here you see the double length of Cossor filament famed for its colossal emission. Note the seonite bridge holding it rigidly in position.



Around the two stout grid supports is wound the first grid, electrically welded at twenty-five points.

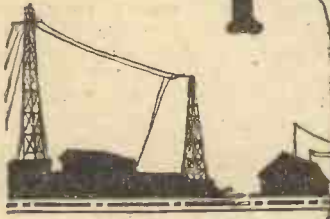


Note the enormous strength and rigidity of the screen. See how it is built on four stout supports and capped by a metal bridge-piece anchored to seonite insulator.

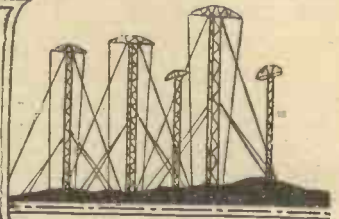


Finally, observe the construction of the anode. Actually two rectangular nickel plates are used and for greater rigidity each is diagonally ribbed.

Popular Wireless



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RADIO NOTES AND NEWS.

The New B.B.C. Orchestra—Birth of a Giant—The Home Theatre—Readers' Reports—Radio and Fog—Charging with a Bell Battery—Pirates in Canada.

Solid Listening.

"SAINT JOAN," by George Bernard Shaw, is to be cut into two slabs and broadcast half on April 25th and half on the day following. Each broadcast will occupy about two hours. This is the kind of item to please people who like to let the dials alone and sit back in their chairs. Jolly good stuff, too!

The New B.B.C. Orchestra.

THE great new orchestra which the B.B.C. has promised London, and which will be conducted by Sir T. Beecham, is already in course of formation. Auditions for admission to its ranks are to be held during this month. Curious applications are being received, one being from a lady who admitted that she gave up the violin three years ago and was not much good at it, but it might be worth her while to practise again.

The Set is Furniture.

MR. JUSTICE CLAUSON recently decided that a wireless set legally falls within the category of furniture. I am afraid that my people do not share that opinion concerning my set. However, now we know. We know that our pets are liable to be spring-cleaned, and that when we move them we ought to wear green baize aprons.

Meet Mister Malko!

MR. NIKOLAI MALKO, who is director of the Leningrad State Academy of Music, has been let out of Russia to come here and conduct a concert of Russian music. He introduced a symphony based on "Tea for Two." He says that jazz has colour. He says that people listen to radio with half an ear.

As to that, it may be true of Russia, where, I presume, the other one and half ears are commandeered by Comrade Stalin for "talks."

The Birth of a Giant.

I DOUBT that when Edison produced his first phonograph he foresaw that it was the ancestor of something which would create a huge new industry and interest. And, of course, the pioneers of photography did not dream of Kodaks.

That is no reason why we, the heirs of a scientific era, should not think more prophetically, and so I venture to suggest that in Mr. G. V. Dowding's "Radioscope" we see a baby which will grow into a giant.

The Home Theatre.

THERE appears to be in Mr. Dowding's invention the possibility of the home theatre on a scale and of a quality which poor R. L. Stevenson would have loved, though he loved the crude old puppets and blood-and-thunder plays well enough to enshrine them in one of his most fascinating essays. Well, as Mr. Dowding unfolds his story and develops his apparatus,

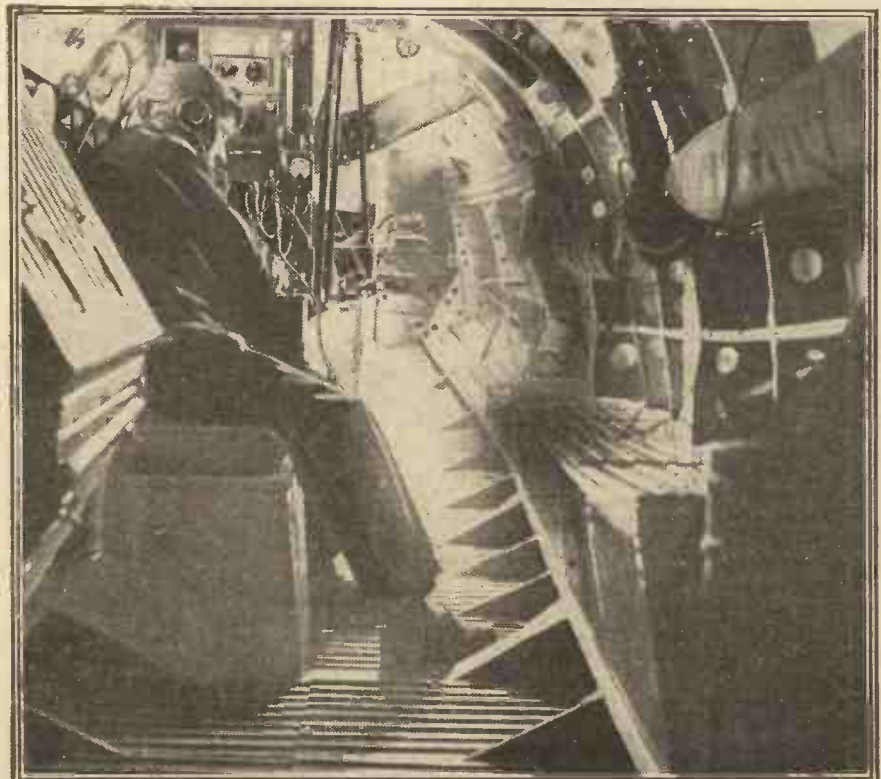
we shall see. "P.W." readers are in luck's way, indeed. They are being "let in on the ground-floor," as the financiers say, and I hope they realise it.

Private and Public Interest.

ONCE more I have got to the state where my desk is thick with readers' letters. To find my pipe or scissors is a job for a man with a spade. May I gently, mildly, point out that many of these cherished and welcome epistles, while of great solace and interest to "Ariel," whose normal reading consists of technical papers, trade reports, newspaper clippings, and

(Continued on next page.)

RADIO ON THE NEW EMPIRE FLYERS.



A wireless operator adjusting his set in one of the super-flying boats to be used on the new Empire Service to the Near East.

NOTES AND NEWS.

(Continued from previous page.)

blue prints, are not necessarily of interest to the radio public, and therefore do not receive notice in these columns. So if you write and tell me all your radio adventures, do not be cross with me if I do not comment on your letter. But continue to write—on the off-chance, please.

"Sich Langwidge."

BUT here is a bit of a letter which I simply must give verbatim. It illustrates the difficulties of the King's English. Posted in Lagos, I think its writer is a shiny black gentleman who has received an A1 mission education. " . . . also I am blasted in my hopes of receiving England legibly for the reason that these damped atmospheres blast all out, blast being science word meaning obliterate. You may not be so damped surprised to know that the gramophone here finds large favour for it cannot blast." Well, *that's* one to the gramophone, anyway.

Society Note.

PRINCE PURACHATRA of Siam, who, in addition to being a prince, is the Siamese Minister of Communications, is now in Mentone for his health's sake, prior to visiting this country. I can state that he is a trained scientist, writes perfect English, and is a keen radio man. Even at Mentone, he is keeping tabs on European wireless, and is vastly interested in 5 SW. Siam should be considered a second Japan for the way in which it has assimilated Western methods.

Readers' Reports, No. 1.

THE "P.W." combination made up by O. L. C. (S. Norwood) is the Reinartz "Blue Print 31" plus one L.F. stage and the "P.W." "Range Stretcher" (for ordinary wave-band). O. L. C. has tried and failed to find a better hook-up. He has won with it recognition from 3 L O. He has found W 2 X 0 on 21.5 metres, and wants to know if any other reader has done so. (I rather guess so, but thanks for report and testimonial.)

Readers' Reports, No. 2.

AN old friend of these columns, F. C. (Greenwich), has been having larks with a "Modern Wireless" super-set known as the "2.35" short-waver. This brings in empty stations, including C J R X (Winnipeg). With the addition of an extra L.F. (transformer-coupled) stage it was seized with "threshold howling," which was cured by earthing one of the primary terminals of the first transformer and putting 1 mfd. across each H.T. tapping. He does not know why this cured the trouble. Surprise, I expect. For your remarks about Chamber Music, brother, I thank you; I can see that you were sensibly brought up!

First of Its Kind.

HERE is a complaint which I think deserves publicity, it being the first of its kind I have received. Mr. A. W. Mann, of Middlesbrough, referring to the requests for reports on amateur transmissions, sometimes published in my notes, says that, although "P.W." amateurs have proved to be courteous enough to

acknowledge reports, there are others who accept reports without a "Thank you." Now, there is no doubt that amateur transmitters, "P.W."-ites and others, are a sound gang as a whole, gentlemanly and only too pleased to acknowledge services. Perhaps the inevitable "black sheep" will fit on the cap—and think.

Radio and Fog.

HASN'T it ever struck you as strange that all the accumulated wisdom of the world's scientists has not yet provided us with an efficient reply to fog? A touch of fog—and the railways go to pieces; trains crawl, and often collide, and such primitive signals as detonators are resorted to. Ships become like blind men; they resort to "dead slow" (sometimes!) and the devilish steam syren. Is it

SHORT WAVES.

THE LOST ART.

A local station ended a morning talk for housewives with the promise of a free cook-book to those listeners who would call at a certain store.

One young housewife, who had purchased baked beans, salmon, condensed milk, canned tomatoes, etc., inquired as an afterthought for the cook-book offered by the radio.

"Lady," said the clerk thoughtfully, "you don't want a cook-book, just a can-opener."—Radio News.

This Week's Optimist.—The beginner who bought a crystal set and a Maori dictionary.

This Week's Careful Body.—The man who asked the P.M.G. whether, if he plugged one ear with cotton-wool, he could have a licence for five shillings.

DOWN ON THE FARM.

Farm Hand: "Could you use a good man who can plough, milk, shear sheep, and make good cider?"

Modern Farmer: "Know anything about a six-valve super-heterodyne?"

Some years ago, William Dubilier went to a lecture given by Marconi. He was so impressed that at the conclusion he went round to see the great Italian.

"Is there anything I can do for the cause of wireless?" said Dubilier.

"Yes," replied Marconi, "you can carry my bag."

STRAIGHT FROM AMERICA.

"Wire you in-su-late?"

"Been out with my Gal-Ena."

"Did you have a quarrel with Meg-Ohms?"

"No; she had a date with Reg-Eneration."

A correspondent writes to say he has tried hertzite, radiocite, permantite, rectarite, electronic, and various other crystals on his "dual," but without success. He asks if we can recommend any others worth trying.

Well, we have heard good reports from dynamite.

beyond the wit of man to give a ship an electric eye which can penetrate a little water vapour, and railways some form of radio signalling?

Charging with a Bell Battery.

WHAT did you think of Mr. B. Flowers's letter in our issue of March 23rd (p. 59)? Quite the freshest thing I have seen for a long time. I admire his nerve in trying the arrangement, and I must say that when I read his letter I was reminded of the story of the boy Edison, who tried to generate electricity for a telegraph outfit by rubbing two tom-cats together! Immediately afterwards I was reminded of the fable about the mouse who helped the lion.

The idea of the humble, domestic Le-clanché boosting the aristocratic accumulator is too funny!

Those Nameless Dances.

THE B.B.C. ban upon the broadcasting of the names of dances continues to excite the smiles and sarcasm of normal folk and the envy of Borough Councils, who have liked to believe that they and "Dora" have the monopoly of idiotic prohibitions. The "Daily Mirror," in a very funny article about a Corporation which shall be nameless, suggests that the idea of banning the titles of "talks" is being seriously considered by the nameless Corporation on the ground that listeners do not know what the lecturers are talking about, anyway.

Birds in a Cage.

ACCORDING to all accounts, the art of multiplexing, that is, carrying on a number of communications simultaneously, on one "circuit," is being successfully developed on the "Beam." I hear that it is expected that in a few years it will be a commonplace thing for a wireless station to carry on simultaneous services of telegraphy, telephony, facsimile transmission and, perhaps, television, all from one aerial system. Yet when the Prince of Wales visited the Post Office recently to see the Beam circuits, blown if the P.O. didn't get the lift stuck. They *would*. Remember the radio play, "Four Birds in a Cage"?

Vanishing Morse.

GOOD news for Morse-haunted listeners. Gradually the coast stations round Britain are having their spark sets replaced by I.C.W. (interrupted continuous wave) transmitters. Seaforth (Liverpool), Niton (I. of W.), N. Foreland, and Mablethorpe have already been changed, and this year, Cullercoats, Fishguard and Wick will be dealt with. All this should make for a quieter "background," and I do not doubt that within a few years complaints about Morse-jamming will be rare.

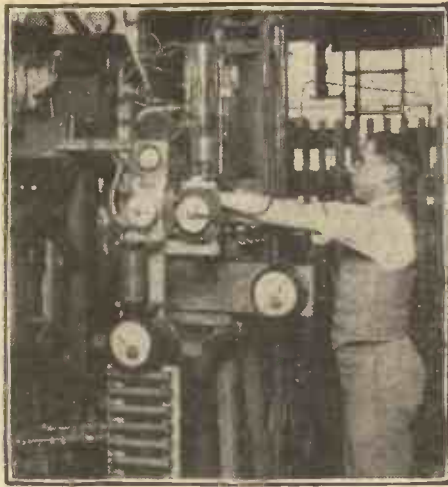
"Pirates" in Canada.

IF the estimate of the Canadian authorities is correct, the number of unlicensed sets working in Canada is not much short of half the number of licensed ones. I hope it's all a mistake, for although the population in Canada is very scattered, and there is consequently great difficulty in "keeping tabs on" the sets, the figures argue an amount of—er—forgetfulness on the part of the Canucks which one can scarcely credit, especially as listeners there are so well treated, every dollar of the fees being used for improving the service.

Bats and the B.B.C.

SPEAKING at Watford on the educational uses of broadcasting, the Chairman of the B.B.C. is reported to have said that "we have a very high opinion of the standard of public intelligence." A peculiar statement, if faith, for only fools would hold the contrary view. I wish Lord Clarendon and the B.B.C. would comfort themselves with that and not fret so much about the standard of *knowledge*. The noble lord also referred to those of us whom he is trying to educate, as "bat-eyed people." Maybe, but we are not bat-belfried or bec-bonneted, like Chamber Music Charlie and Education Ethelbert.

ARIEL.



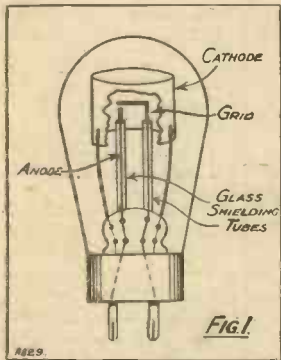
The Cold Valve

The modern dull emitter is rapidly approximating to the "cold" valve, which will liberate an electron stream without the application of any heat. The advent of the "cold" valve is appreciably nearer.

By J. C. JEVONS.

THE time has gone by when there can be any real dispute as to the superiority of the valve for Broadcast reception—though the crystal still claims a wide circle of friends in its own limited field.

The most enthusiastic "valvite" will, however, agree that the battery problem is a troublesome handicap. If one could only get the present performance of the valve without the bugbear of H.T. and L.T. renewal and upkeep, there would be little left to ask for.



This ideal has been sought in many directions by various sanguine inventors. Some look for a solution to the "oscilla-

ting crystal." discovered some time ago by Lossev and Captain Round, and it is possible that they may yet be justified to some degree.

Others pin their hopes on a "cold emitter" filament which will liberate an electron stream without the application of any heat. The modern dull emitter is approximating to this condition already, but it may be possible to discover still more sensitive electron-emitters, as witness the well-known photo-electric action of light on sodium and certain other alloys.

Enormous Amplification.

The so-called "grid-glow" tube represents another interesting development on the same general lines. Here there is no heated filament. All the electrodes are cold, though unfortunately the H.T. is still in evidence.

The ordinary mechanical relay will control efficiently, say, 500 times more energy than is required to set it into action. It is even possible to make this factor as high as 10,000, though only by using a highly expensive type of instrument.

By comparison, the "cold" discharge tube is capable of amplifying one hundred million times, or even more. In form it resembles an ordinary thermionic valve, and costs no more to make.

The arrangement of the electrodes inside the bulb is shown in Fig. 1. The cathode consists of a metal cylinder very similar to the plate of the ordinary valve. The anode is a thin vertical wire surrounded, except for a small part at the top, by a glass tube or shield. The grid is very similar to the anode. It will be seen that the end of the grid is brought out and bent over at right angles until it lies over, and almost touches, the exposed end of the anode.

The whole action of the relay depends upon the size of the small gap between the top of the anode and the bent-over end of the grid. If the distance is less, having regard to the rarified condition inside the bulb, than the average free path of travel of the gaseous molecules, then the intervening space possesses a very high resistance and no discharge will take place, even under heavy potentials, so long as the grid is insulated or open-circuited.

The "Short-Path" Principle.

This is known as the "short-path" principle, which was first discovered by Sir William Crookes many years ago. It has been utilised in various types of rectifier, generally by imposing a magnetic field so as to deflect the path of the electrons until they strike against one or more of the gaseous molecules and so start ionization, whereupon the insulation breaks down and a discharge takes place.

The same effect can be secured by providing a high-resistance leak from the grid to the anode. The result is to relieve the grid from its initial charge of electrons. As soon as these can leak away, other electrons moving between the cathode and anode can strike against the grid with sufficient force to liberate secondary electrons, and so start an ionization process which rapidly renders the gap conductive. This in turn allows the main discharge to set in.

The circuit arrangement of the "cold" relay is shown in Fig. 2. So long as the grid is left insulated, no discharge will take place even if the voltage applied across the anode and cathode is as high as 600 volts.

It will be seen that the anode is connected to earth, and therefore to the anode, through a resistance R. Directly this switch is closed, the tube discharges, and an intense glow sets in across the anode and cathode.

The circuit containing the resistance R may be called the control circuit. Actually the resistance may be as much as 10 megohms, and may carry as little current as the one-millionth part of an ampere, but once the grid is earthed the main glow sets in, and a heavy discharge current will flow in the primary circuit P.

It is necessary to insert a fairly heavy

resistance R I here, as shown, because once the glow discharge is initiated, it exhibits the property of negative resistance. In other words, the heavier the current passing, the smaller becomes the resistance of the tube, so that without the ballasting resistance R I, the whole device would rapidly be burnt out.

Useful Applications.

The winding W, carrying the released power current, can be used to start or stop a machine, release a spring, operate a warning signal or indicator, or do any other useful work that may be required.

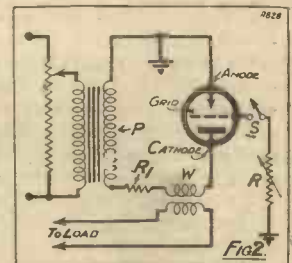
It was stated above that resistance R, in the control circuit, may be as high as 10 megohms, and need only pass a current of one micro-ampere. This at once suggests that it may be replaced by a small condenser capable of taking a charging current of this order.

For instance, suppose a connection is taken from the control grid of the relay to a piece of tinfoil laid underneath the plush covering of a jeweller's tray. A person's hand brought within an inch of the tray will, in combination with the tinfoil, form a condenser of sufficient capacity to start the relay into immediate action.

Here one has an ingenious safeguard against a very common form of theft. The winding, W, could then, for instance, be arranged automatically to close the door of the jeweller's shop and simultaneously sound an alarm. It is obvious that strong-rooms, safes, etc., could be similarly guarded, or the same principle could be applied to a burglar-alarm suitable for the ordinary household.

There are many other possible applications of the extraordinary sensitivity of this device. For example, it is known that matter in solution affects the conductivity of water. Such contamination would at once be indicated by first testing the relay with water of standard purity and then applying it to the suspected solution.

Again, the presence of moisture, dust, or grease on an insulating surface will tend to break down the insulation and render the surface slightly conducting. Such deterioration would at once be indicated by the relay, which in the same way could be used to measure directly the exact value of any very high resistance.



YOUR "TITAN" SET.

Some more hints and tips on "Titans" in which details are included regarding the fitting of a gramophone pick-up control to the famous Three-Valver of the series.

By THE "P.W." RESEARCH AND CONSTRUCTION DEPARTMENT.

NOW about mains units. A pentode valve means very high amplification, and if the H.T. unit is one with any tendency to produce motor-boating you can be pretty sure you will now get it. To stop it, try a resistance of, say, 50,000 ohms in series in the H.T. lead to H.T.+2, and a 2 or preferably 4 mfd. condenser, between H.T.+1 and L.T.—. If this is not enough, try running the lead from the terminal on the side of the pentode valve base to a separate tapping on the H.T. unit if there is a spare one, which should do the trick.

Using a Pick-Up.

Now we come to the question of using a pick-up for the reproduction of gramophone records. Of course, this is a very simple matter if you use one of the adaptor plugs, such as are supplied with many pick-ups (also separately by various firms).

To use one of these you simply insert it in the detector valve socket, put the detector valve back on top, and run flex leads from the adaptor to the pick-up.

Just one point here, to make sure you get the connections right. One of these flex leads goes to the "grid" point on the adaptor plug, but the other can go to either of the "filament" points, and you must choose the *negative* one. This is the one on the side of the plug which is nearest the H.F. choke when placed in the socket.

You will find that with any reasonably sensitive loud speaker and pick-up you will get quite good volume with an ordinary power valve in the last socket, if you use fairly hard needles, such as the "loud" and "extra loud" type (they are differently described in the various makes, but any gramophone enthusiast will know the ones to use). With a pentode, of course, there is ample volume for any pick-up and speaker, and it will be desirable to provide a volume control between the pick-up and the set. A half-tone needle can also then be used in many cases with advantage.

Fitting a Switch.

To make a good job of the gramophone attachment and secure the greatest convenience it is really best to fit a change-over switch and other refinements, and so save oneself the rather fiddling job of inserting the adaptor whenever the gramophone is to be used. We have done this in the original set, as the photographs show, and it is quite a simple little job.

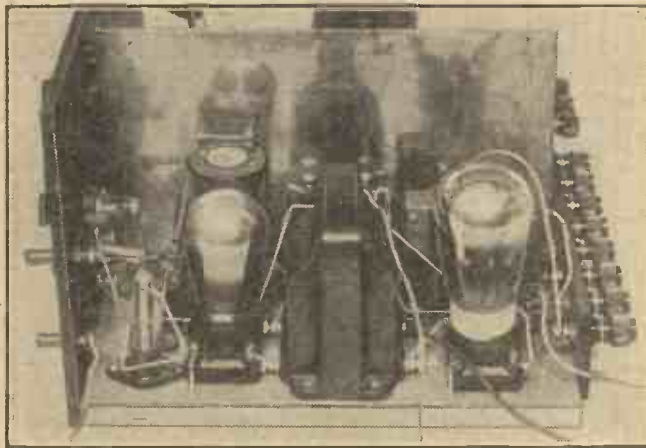
First of all, you want a single-pole change-over switch of the push-pull type, some suitable examples being the Bulgin and Lissen.

This is to be mounted on the panel either just below or to the left of the L.T. switch. Below looks probably the neatest and gives the best wiring, but if it is a long switch you may have to move the grid condenser a little to make room for it (we did so). Also, you want two little terminals

or else two sockets, such as the Eelex, Clix, etc. for the leads from the pick-up.

We actually used the sockets and furnished the pick-up leads with plugs to fit therein, since this struck us as the neatest scheme. A suitable position for these can be gathered from the photo of the panel last week. The new connections are quite simple, and do not involve any serious alterations.

First of all, note that in the original form of the set the grid of the detector valve was wired to one side of the grid condenser and one side of the grid leak. Remove these connections for a start and wire the side of the condenser and leak in question straight to each other.



Here you see the alterations made in the set in the detector grid circuit when the gramophone switch was incorporated.

Now examine the switch. You will find that one of its tags makes contact either with the spindle or else through a spring with a metal sleeve which makes contact with either of the other two tags according to the setting of the switch.

Wire the grid of the detector valve to this moving contact tag of the switch. Wire one of the other tags to the upper pick-up terminal or socket, and the third tag to the side of the grid condenser which was previously connected to the detector grid, and which is at present wired only to one side of the grid leak. Now solder to the lower pick-up socket (or terminal) a piece of flex bearing on its end a battery plug. Insert this plug in the $1\frac{1}{2}$ volts negative socket of the grid-bias battery and the job is done.

A Quick Change-Over.

Now, with the switch in one position the set will work in the ordinary way, and in the other it will reproduce any records over which the pick-up is running. You will find that the switch gives you a very convenient instantaneous change-over from radio to gramophone and back again. This, you will find, is a great convenience, and

makes it quite easy for non-technical members of the family to operate the gramophone electrically, with an occasional touch of the switch to see whether the local station has finished that "talk" yet!

Watch This Carefully!

Mention of switches reminds us to cover a point concerning the wave-change switch over which certain constructors appear to have gone astray. We have received several reports of erratic behaviour, such as working well on one wave-band and not the other, working only when some unusual connection is made, and so on, and these have been traced, not to a defective coil, but to the use of the wrong kind of switch.

You do *not* want any kind of change-over switch for the "Titan" sets, but a type already standardised for wave-change purposes in "P.W." sets. It can be either of two types which have exactly the same action. One is an L.T. on-off switch of the type having two side spring contacts, and the other is also a plunger type switch, but has three side spring contacts.

In each case what happens is this: in the long-wave position (knob pushed in)

all three points are separated by the action of the switch. In the low-wave position (knob pulled out) all three points are switched into contact. This action is absolutely essential, and you must see that your switch does exactly this, if the set is to work properly.

FOR YOUR NOTEBOOK

If you are a newcomer to short-wave work do not forget to keep your H.T. wander plugs really wandering, for this

makes a very great difference to smooth reaction effects in many cases.

Do not assume that the higher the H.T. voltage used the better your reception will be on short waves, as very often it is a distinct advantage to drop down to 25 volts or so.

So great was the demand for "Titan" coils that manufacturers were at first snowed under, but there is now little or no delay.

Generally speaking, if your aerial is situated within six or seven miles of the broadcasting station you will need a wave-trap if you are going to indulge in long-distance reception, even with a "selective" receiver.

Generally speaking, the moving vanes of variable condensers should be connected towards earth in order to avoid hand-capacity trouble.

The usual rule about the inadvisability of having leads parallel to one another does not apply to the filament wiring, as these can be as close as possible without detrimental effect.

Persistent oscillation with a condenser controlled reaction set is often due to the use of a high-frequency choke of unsuitable value.

IN the early days of radio the construction of receiving sets was largely a matter of hit and miss or trial and error experiment. Even when broadcasting came it was still a somewhat hazardous business.

If the coils and condensers, and other such things that were available, had been of present-day mass-produced, standardised characters, things would have been easier, for the theory of radio runs very parallel with its practice whatever is said to the contrary by those who endeavour to cover their ignorance by asseverating that "even now we do not know exactly what happens."

Take, for an example, tuning. We know, and have known for a very long time, that the wave-length to which a tuning circuit will tune is $1885 \sqrt{LC}$ metres, when L = inductance in microhenries, and C = capacity in microfarads.

Those S.L.C. Condensers.

But it is only recently that the average available ".0005 mfd." variable condenser sold could be relied upon to have an actual maximum moderately close to its specification. And as for coils and, worse still, fixed condensers, these are even now only just reaching a reasonable standard of accuracy of rating.

And the amateur cannot measure the inductance of his home-made coil or the capacity of his variable; to do so he would have to use elaborate equipment. Therefore, before manufactured coils and condensers became standardised, the constructor had to endeavour to cope with the formulæ of coil and condenser values, and try to work out mathematically what the L and C of his apparatus were before he could be certain he could tune in the stations he desired.

There were comparatively few broadcasting stations, and what there were could not be relied upon to be exactly on the wave-length they were supposed to be, so that he had few guides for drawing up tuning graphs.

But if variable condensers were snares and delusions in regard to values—one plainly marked .001 mfd. might, in fact, be of only two-thirds this capacity—most of them followed a fairly true straight-line capacity curve in adjustment.

Another Delusion.

They did this because their vanes were true semi-circles, and, providing the movement of these also was moderately true, the capacity resultant was directly proportional with the rotation of the adjustment dial. You could not say that if the scale read from 0 to 100 that the 100 reading gave twice the capacity of the 50 reading, because the "0" was, and is, another delusion. No variable condenser will have

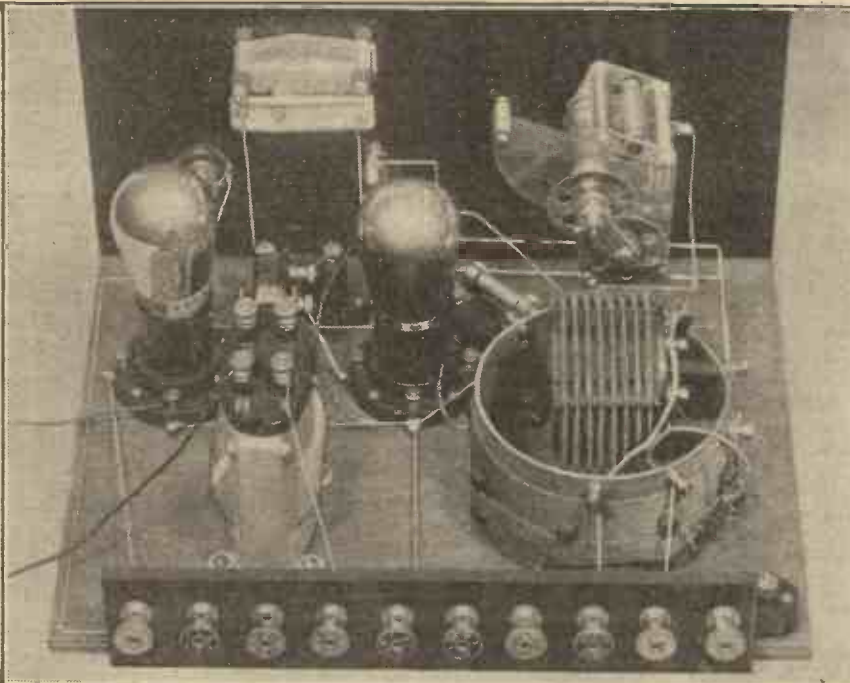
JUGGLING WITH WAVE-LENGTHS.

Some refreshing aspects of radio set tuning which will provide the amateur with an interesting new line of thought in connection with both theory and practice.

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

zero capacity. It provides a range of from a certain minimum (not often stated) to a certain maximum.

The minimum, by the way, is generally about one-tenth of the maximum. However, as a result of the rather hit-and-miss methods of the day, and the terrible prices of wave-meters, I remember digging down into radio theory in order to evolve some means of enabling the amateur to calibrate his set fairly closely without having to resort to complicated mathematics of measuring instruments.



As modern an example of present-day tuning practice that one could find. This is the "P.W." "Titan" Two, which, of course, employs a "Titan" Coil Unit. You will notice that the tuning variable is of the compensated Straight Line Tuning variety and NOT Straight Line Capacity.

Perhaps the scheme may be of some slight interest to modern enthusiasts, especially those who have straight-line capacity variable condensers in their possession. There won't be a vast number of these, for straight-line frequency and wave-length types have practically swamped them.

However, examining that above-mentioned formulæ which makes wave-length working as easy as Ohm's law, we see that wave-length is given by the product of the square roots of two factors multiplied by a constant. Obviously, too, wave-length varies proportionately with variations of either capacity or inductance. But note that as the roots of these are taken you do not double the wave-length by doubling the value of either factor.

Identifying Stations.

Reverting to the straight-line-capacity condenser, we have seen that the dial readings follow the resultant capacities in a like proportional manner. Therefore, it becomes obvious that the relation between one dial reading and another must be of a similar relation to that which exists between the two wave-lengths tuned when the condenser is used for tuning purposes. Expressed concisely:

$R1 : R2$ as $W1 : W2$ where R = dial reading and W = wave-length in metres.

But because in the wave-length formulæ capacity is expressed in root form we must take it forward in a similar fashion so that our expression must be $\sqrt{R1} : \sqrt{R2}$ as $W1 : W2$.

What does all this boil down to? you might well ask. It means that given a true straight-line-capacity variable condenser connected in a tuning circuit, we can work out the wave-length at every dial reading without worrying about anything else at all in the circuit, even including the coils, providing we know the wave-length of one station identified at one particular reading.

Let me quote an example. Supposing you have an S.L.C. variable reading from 0 to 100 on its dial—don't worry about its capacity. You tune in a station at 25. Then the square root of 25, which is 5, will bear the same relation to any other reading as the wave-length of the station tuned in at 25 will to the wave-lengths indicated by the other readings.

The Result.

Supposing reading 25 brings in a station you know to be working on exactly 400 metres, and you tune in another station at reading 36. Then you can work out this station's wave-length and so identify it very easily for:
5 : 6 (these are the square roots of the readings) as 400 : x ,
 x being the unknown station. Clearly x will have a wave-length of 480 metres.

I have purposely chosen easy figures, so that you can follow

the working without the necessity of elaborate explanation.

I have something of a facility for working out moderately simple formulæ in my head, so that I remember how I used to mystify friends by identifying stations on their own sets without waiting for more than a note or two of music from each. Of course, that was in the days of universal S.L.C. condensers and when stations were very well separated, and rendered slight errors of no great account.

I couldn't do it now, and I don't suppose anyone could!

There are several other interesting little tricks in radio calculations, and when space permits, perhaps I will be able to tell you about some of them.

RANDOM RADIO.

The Story of an S.O.S.—Eiffel Tower's Wave-length to Clear 5 X X and Radio Paris—Canada's New Stations—A Wireless Theatre.

By THE EDITOR.

THE "Daily Chronicle" reported the other day an interesting little story about the origin of the first S.O.S. sent out by the B.B.C. It appears that a man lay dying in Middlesex Hospital. The doctors wanted to get in touch with the man's mother. The woman, states a correspondent in the "Chronicle," lived at the small village of Flitwick, near Ampthill, Beds.

It was Sunday evening, and as telegraphing was out of the question, some other means had to be found of getting in touch with her. It was then found that the telephone exchange serving the district did not operate between 6 p.m. and 10 p.m. Hence, the need to try unorthodox methods, and an appeal to the B.B.C. which was successful beyond expectation.

The appeal was broadcast and, within an hour, thirty people in the Ampthill neighbourhood who had wireless sets and had picked up the S.O.S. went to the mother of the dying man and offered to drive her to London. Eventually she motored to Luton and caught a train to London in time to see her son before he died.

The date of this first S.O.S. was April 29th, 1923.

Eiffel Tower's Wave-length.

All the fuss and bother about the Eiffel Tower station has now resulted in the fact that the station is being overhauled and will in future work on a wave-length of 1,465 metres instead of the wave-length of 2,650 which it has worked on, by the way, for the last six years. This new wave-length has been chosen, it is understood, to cut out the difficulty of the Eiffel Tower station swamping Daventry and Radio Paris, but it is anticipated that very careful experiments and adjustments will have to be made, even on the new wave-length, in order to cut out interference with the Paris Aerodrome, Le Bourget.

A new list of radio stations issued by the Radio Branch Department of Marine and Fisheries at Ottawa, Canada, shows that Canada has now two new stations.

C J R X, working on 25.5 metres, with a power of 2 kilowatts, broadcasts simultaneously with another station owned by a grain company in Saskatchewan. This second station is C J R W, and works on 296.9 metres. The station at Winnipeg, C K Y, now operates on 5 kilowatts, and in Manitoba, at Brandon, another station has been built with the call-sign C N R W. There are now 78 broadcasting licences for stations in the Dominions; not all, however, are in use. Sixteen of these stations are owned by firms, associations, and churches which have not their own broadcasting stations, but rent them from time to time in various cities. The Montreal station, C F C F, now operates on the wave-length of 291.1 metres. According to the B.B.C. Publicity Department, the Canadian Government is in receipt of more than a

quarter of a million dollars from contributions from listeners. The tax is one dollar.

A Wireless Theatre.

According to Mr. Bernard Shaw, the famous author and playwright, the need for a public hall for listeners-in who have no private sets is so obvious that it is surprising that the B.B.C. has not already made the experiment. It can, however, leave it to private enterprise and increase its revenue by a royalty on the receipts.

This is the outcome of an idea put up by the "Morning Post" newspaper that a wireless theatre should be opened, where people who do not possess their own sets could enjoy the programmes under conditions ideal in regard to both comfort and apparatus.

Whether such a theatre would be a success or not, we don't know, but it must be borne in mind that a wireless set is so cheap these days, and reception so easy to obtain by the majority of people in the big cities to-day, that it is hardly likely that after the novelty had worn off a wireless theatre would be patronised to any great extent.

It does not matter which way you connect your telephones to a crystal set, but there is a right and wrong way for 'phones in a valve set, and the connections should be watched accordingly.

If your telephones have been made insensitive by being connected the wrong way round they can be reconditioned in a properly equipped factory.

Unless you have seen it done before be very careful how you take the diaphragm out of a pair of 'phones, as they are very easily damaged, especially if bent.

Poor reception from a crystal set may sometimes be cured by clipping a little piece of the cat's-whisker so as to present a new surface to the crystal, or by breaking a small piece of the crystal so as to present a new surface to the cat's-whisker.

RUINED VALVE EMISSION.

Gradual weakness of reception in a valve set is very often caused by the emission of the valve failing.

Too much H.T. and too much L.T. are both liable to ruin the emission of the valve operating under such conditions.

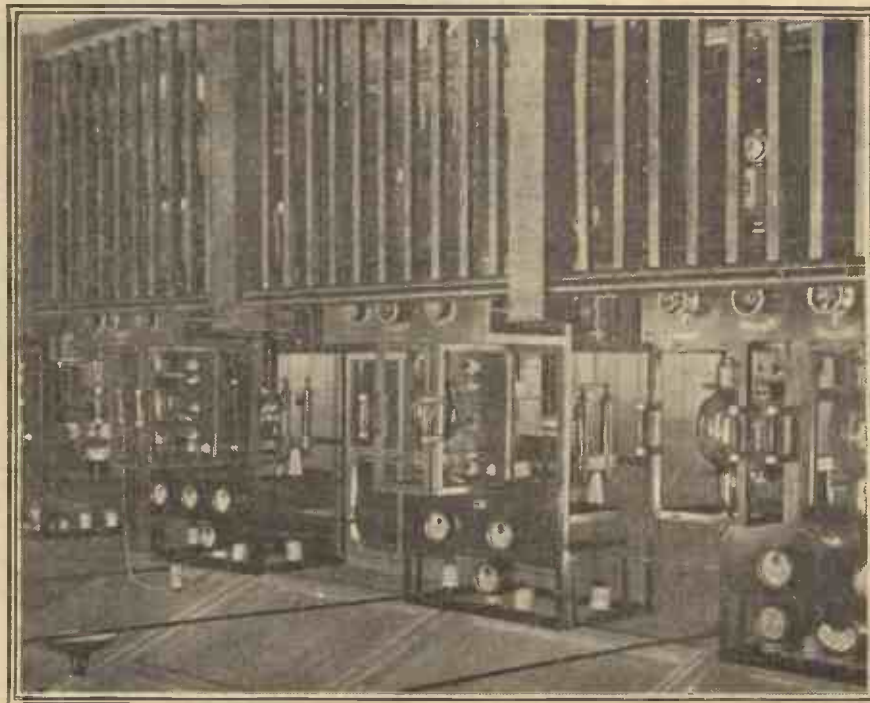
Hydrometer tests of an accumulator should not be made directly after distilled water has been added, as the reading is then inaccurate.

The acid in an L.T. battery should always be above the level of the plates.

One of the worst ways to treat a battery is to allow it to stand near to a fire.

Although special cells are obtainable for

DUBLIN CALLING.



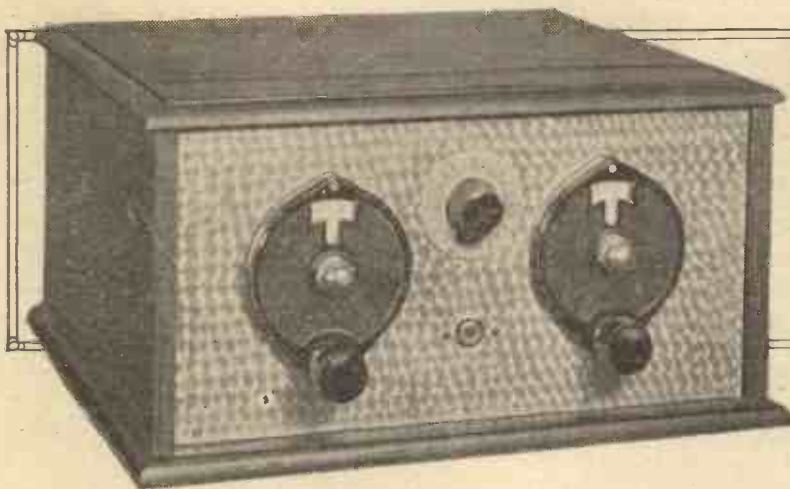
The layout of the transmitting apparatus at the Dublin Broadcasting Station. The rectifying panel is to the left, the modulator to the right, and the two oscillators between.

RECEPTION WRINKLES

Rust inside the telephone diaphragms is one cause of gradual falling off of reception in a crystal set.

work in slow discharge conditions it is not advisable to leave the ordinary L.T. battery discharged and standing aside, or it will tend to sulphate.

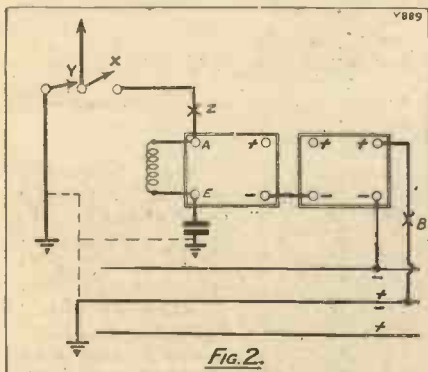
If a battery is to be out of use for some time it should be given a really good long charge before being left.



METAL PANEL TROUBLES

Has your set got a metal panel? If so you should read this article, which contains some valuable information with regard to the "snags" that are often met in cases where metal panels are employed. From A CORRESPONDENT.

METAL panels may have advantages, but there are snags when they are used for sets connected to D.C. mains units. Fig. 1 shows a normal "three-wire" mains arrangement. In modern practice the centre wire marked B is generally earthed. Now we will assume that two listeners X and Y both have H.T. battery eliminators working on these mains. One eliminator is joined between A and B, whilst the other is connected to B and C.



Between A and B is 200 volts, and between B and C is another 200 volts, whilst across A and C the voltage is 400.

In the case of Y everything is in order, for the earth terminal of his set is joined to the high-tension negative main direct, and this already is earthed.

With X, however, the arrangement is rather different, for it will be seen that the effective positive on his mains is taken to earth, and so also is the negative mains wire via the earth terminal on the set.

In X's case, switching on the set will result in the burning out of the fuses, as the mains leads will be directly shorted to earth.

If, however, he inserts a fixed condenser of capacity sufficient not to upset the tuning, at the point C, in the earth lead, a short circuit cannot take place, unless the insulation of the condenser itself breaks down.

Severe Shocks Received.

Now let us assume that X has a metal panel on his receiver joined as it is in most cases to the earth terminal.

Mr. X is standing on a partially earthed object, such as an ordinary floor covered with linoleum, and he touches the panel with his hand. Unless the insulation of

the material between his feet and the true earth is sufficiently high, he may receive a shock.

In the newer houses, where the conductivity of the composition floor material may be fairly high, a really nasty shock can in such circumstances be received.

Where the positive main is earthed, the only real safeguard is to employ an ebonite panel in front of the metal screening panel.

Even this may not in every case entirely eliminate the possibility of a shock, for the metal spindles of the variable condensers, switches, etc., may still be making contact with the metal panel, and unless you touch only the insulated dial or knob a shock can still be received. Obviously perfect safety can only be attained by fitting insulating bushes to all panel-mounted components.

Quite recently I heard of a case where a listener had burnt out his main fuses by earthing his aerial, and this, at first sight, may sound rather absurd. But we will examine in detail what really happened. The set was equipped with an earthing arrangement similar to that shown in Fig. 2, and owing to trouble experienced with corroding earthing switches a switch was arranged inside the house and included in the circuit at the point X.

Mains Short-Circuited.

The usual procedure was as follows: The mains and set were switched off, the aerial circuit broken at the point X, and the aerial earthed by plugging the earth lead into a socket (Y) joined to the earthing switch. One night the procedure was reversed, for there seemed to be no particular reason why the aerial should not be earthed while the set was working. But, unfortunately, there was a reason. Immediately the earth lead was joined to the point Y the whole of the lights in the house went out, and the listener received a nasty shock.

If you examine the circuit it will be seen that, with the switch X closed, a direct path is provided from the negative to the positive side of the mains through the aerial coil in the set, and the mains are, therefore, practically "dead shorted."

The trouble could easily have been avoided by the insertion of an extra fixed condenser of .006 mfd. or so capacity in the aerial lead at the point Z. This condenser would not have affected the tuning, but yet would have prevented the short circuit taking place.

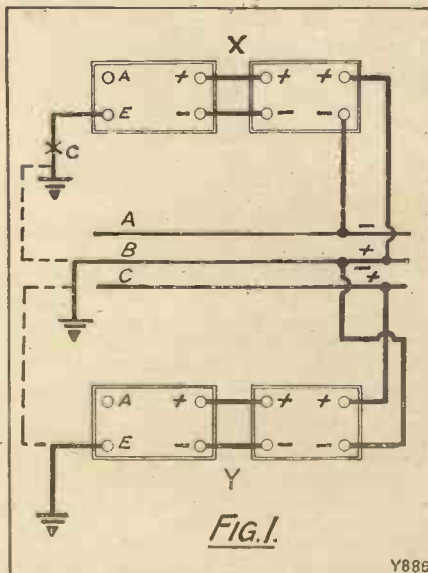
Therefore it is advisable, if you use D.C. mains for radio purposes to join a fixed condenser not only in the earth lead, but also in the aerial lead.

A mains unit, if correctly used, is an extremely useful piece of apparatus, but if carelessly or incorrectly employed can be dangerous.

Necessary Precautions.

It is strongly advised that no adjustment, other than tuning, should be carried out except when the mains devices are switched off.

It is also advisable entirely to disconnect a unit when it is not in use, for, if the mains switch in the above case had been in the positive mains lead at the point B the short circuit could still have occurred, even although the mains were apparently switched off.



It is unwise to place a moving coil loud speaker too close to a gas fire or other source of intense heat, as this will have a detrimental effect upon the material by which the cone is suspended.

Where a variable condenser is used to tune a coil always make the leads between the two as short as possible, which is another way of saying always place the coil as near to the condenser as possible.

MORE ABOUT "EVERYBODY'S" THREE.

As our "Correspondence" columns have shown that there is still a great deal of interest in this popular receiver, this article has been especially written.

By G. P. KENDALL, B.Sc.

A READER new to "P.W." might well have concluded after a perusal of the many letters published about this set that it contained some awkward "snag" which was causing constructors lots of trouble. Older readers will have realised, of course, that it is our policy to print readers' letters "without prejudice," even though they may suggest that they have found it necessary to modify one of our designs.

Consequently, it is not safe to assume that we ourselves agree that the modifications were necessary, or were the best way to overcome what was really an individual difficulty encountered by the particular constructor!

However, the reader will have noticed that several of our correspondents referred to one particular difficulty, and since it seemed that this point was of general interest, it was decided to try and clear it up in this further article. As a matter of fact, this difficulty arises not so much from any snag in the design as from the fact that the set is of a type quite unfamiliar to modern constructors, and behaves rather differently from the receivers to which they are accustomed.

We emphasise this point, because we want to reassure the constructor who may have imagined that the set in its original form gave bad and floppy reaction control and required modification to remove this defect.

The reason why some of the builders of the set have gained this impression is twofold: first of all, they were not familiar with sets with an extremely powerful L.F. side, since such receivers are rare nowadays, for reasons discussed in the original article.

The Effect of High Magnification.

The point is this: where the L.F. stages are so powerful anything occurring at the detector stage is amplified up tremendously before it reaches the loud speaker, and hence the very faint plop heard as the ordinary set goes into oscillation is made to sound quite loud in this case. This alone has been found to be the cause of the impression of bad reaction control on the part of several constructors whose difficulties were specially investigated. What was actually happening was that they were getting just ordinary reaction control, whereas to get a good impression, what was needed was super-smooth reaction, such as we obtained in the original set by careful attention to certain points which we will detail presently.

Although such extra-perfect reaction control is desirable if the set is to be pleasant to handle, it is worth noting that the mere presence of a fairly definite plop as the set starts to oscillate is not in itself a very serious matter. It is still possible to get the usual build-up of signal strength,

and to set the circuit only a little way below oscillation point when maximum sensitivity is required.

Overlap on the reaction control is, of course, quite another matter, and must be removed before good results will be obtained on distant stations.

An apparent ploppiness of reaction control in a set with two very powerful L.F. stages, then, does not necessarily mean anything radically amiss, and should not prevent good results from being obtained. It really means that the super-excellent degree of smoothness necessary to prevent an audible "plop" has not been achieved.

Meet young Edward Redington, of Washington. He is only fifteen years old. By day he goes to school, and reads the wireless papers for hook-up ideas. And one night recently he established contact by radio with the Byrd Polar Expedition in the Antarctic.



While it is desirable, for reasons of pleasantness in handling, to secure this smoothness, it is not to be imagined that a distinct plop with such a set is anything like so bad a sign as it is with one having a normal L.F. side.

This, then, was one very natural reason why some constructors have thought there was something radically wrong with their sets. The second reason also seems to be a natural result of the fact that sets with this type of ultra-powerful L.F. side are quite unfamiliar to most present-day constructors.

One of the Causes.

They are, it is to be noted, a little more particular as to the type of detector valve employed than are the more usual lower magnification receivers, and unsuitable types are pretty sure to show up in poor reaction control. Here, evidently, was a possible cause of really bad reaction.

We have gone into these preliminary matters rather fully, because we want to help the reader to decide whether he is merely getting the comparatively harmless kind of "plop" which is just a matter of a little adjustment to remove, or whether

there is really something amiss. It was necessary to put these points clearly, because, as we have said, this type of set is a new one to most people.

Possible Reaction Troubles.

Now, suppose the reader has gone through all this, and concluded that his reaction control is definitely unsatisfactory, let us see what is likely to be wrong. Our experiments with this type of circuit indicate that one of the most likely causes is an unsuitable detector valve, for one which gives slight overlap in an ordinary set will be very fierce and objectionable in a high-power set.

Another possible cause of reaction trouble is the H.F. choke, just as in other sets, but with the difference that any little mis-conduct which results will again be greatly magnified by the unusual power of the L.F. part of the set. (We may seem to be labouring this point, but we must risk wearying the reader, for it is a vital factor in dealing with this type of circuit.) Obviously, then, we cannot afford to risk using a doubtful H.F. choke.

Just one more point for the present. A possibility which we observed during our experimental work before the publication of the set was that some unusual pairs of transformers gave a tendency to L.F. instability which might show up as fierce reaction. This is not at all a likely happening, and we only mention it because we want to cover all possible points.

So long as two different types or makes of transformers of good manufacture are used, it is practically impossible.

Where there is a tendency to L.F. instability from this cause it is obvious that the slightest

trace of battery coupling may set things off, and the normal safety device may not be adequate. (We mention this point for the benefit of those who may assemble a set of this type from odd parts and may not be sure of the suitability of their transformers, for it is rather beside our main theme.)

The Remedy.

In cases where you want to remove the last traces of battery coupling from a set like this, the main step is to increase the capacity of the filter condenser (C_7) to 2 mfd., or even 4 mfd. In any ordinary version of "Everybody's" Three this is not a thing likely to have any effect, so do not let us incite you to go buying expensive condensers to try the experiment. It is really only of interest in this particular receiver when you are seeing how long you can make an old H.T. battery last, and you chance to have a few spare 2 mfd. condensers at hand.

Put one or two of them in parallel with C_7 , and you will be amazed at the dud old batteries which will work so long as you put enough of them in series to total up about 100 volts.



MAKING YOUR OWN COMPONENTS

2. COIL HOLDERS.

IN modern sets where plug-in coils are required they are almost always in groups of two or three, and when we come to make up our own holders it is as well to bear this fact in mind.

In the ordinary way, of course, single-coil mounts are used in building such a set, and they are screwed down in groups, but it is possible to improve on this scheme.

Since we practically always use either two or three coils placed side by side, why not make up the necessary double and treble holders to suit? We should then, in building a set, only have to screw down one component in each place instead of two or three, and we should besides obtain a distinctly

our readers were likely to experience considerable difficulty likewise, and we accordingly adopted a different scheme. Perhaps it will not quite satisfy the man who wants to construct everything from the raw materials, but one must be practical, after all.

A Simple Way Out.

True, one could make the necessary pins and sockets from brass rod and tube, but it really calls for more skill in metal work and more tools than we feel justified in assuming that our readers possess (a lathe would really be needed to do the job easily, and there would be some tapped holes to deal with).

This is what we did. We found that many dealers stock a cheap type of single-coil holder which consists of a small piece of quarter or three-sixteenth ebonite on which the actual pin and socket are mounted, and usually two small terminals as well. These holders are very cheap, and we obtained a small supply and took them to pieces.

Then, for the two-coil holder, we cut a piece of $\frac{1}{4}$ -in. sheet ebonite 2×2 in., to form the base of the component.

On this we mounted the necessary two pins and two sockets for the coils, and also four small terminals (in our case these were from the original holders, but no doubt your junk box would yield some if the holders you buy have soldering tags instead of terminals).

The necessary metal parts must be mounted through holes drilled in the ebonite—and care should be taken to counter-sink these on the underside as requisite to prevent any screw heads or terminal shanks and nuts from projecting.

These should all, as a matter of fact, lie a trifle below the surface, so that they will not touch the baseboard on which the holder will be screwed down. To secure this you may have to shorten the shanks of your terminals a little with a metal saw, but this is not likely to be needed if you choose a small type of terminal.

The connections from the pins and sockets to the terminals we arranged in a

very simple way, and we suggest you follow the same scheme. We got some fair sized soldering tags and secured the eyes of these under the pins and sockets, and placed the terminals so that their body nuts gripped the projecting portions of the tags. To do

This is the second of a new series of articles we are publishing in response to the direct request of a large number of readers desirous of constructing components for their sets. It is not every radio enthusiast who wants to do this, but it would seem, judging from our correspondence, that the number who do, is increasing very considerably.

Readers can follow the instructions given in these reliable "how to make" articles, certain that success will follow their efforts, providing they adhere to the various specifications. The articles have been prepared by the "P.W." Research and Construction Department, and every component dealt with has been assembled and then very carefully tested for electrical efficiency and, in the case of condensers, coils and like devices, its value closely measured.

The devices will be found to be very easy and inexpensive to make, and the most inexpert constructor should find the fascinating work well within his mechanical powers.

this neatly, of course, you must place the terminals at a suitable distance from the pins and sockets, and since this will depend on the size of the tags you use it is evidently useless for us to give you dimensions.

The three-coil holder is to be made up in exactly the same way, except that the base



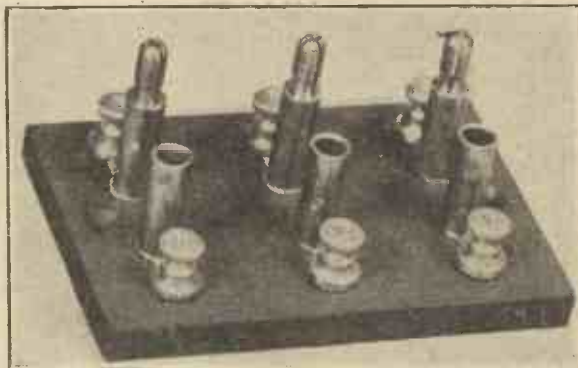
The two-coil holder. Single versions can be made up on the same lines, using a smaller base.

better appearance. Incidentally, it is rather a wonder that no component manufacturer has produced holders like this.

For this series we have accordingly made up a specimen of a double and one of a treble holder, and the photos will give you a pretty good idea of how it was done. Just how to set about it depends to some extent upon the materials you are able to obtain, and we will accordingly explain one or two methods we have found suitable.

Difficult to Find.

The question is complicated rather by the fact that the pins and sockets we want are no longer so easy to pick up in the average dealer's shop as they used to be. A year or two ago, of course, these parts for panel mounting could be bought almost anywhere, but nowadays they are rarely called for and few dealers stock them.



The three-coil unit is a neat and compact affair which will simplify set building.

measures 2×3 in. Now you have all the information you need, except that you want the correct space between each pin and socket.

This is $\frac{3}{8}$ ths of an inch. A suitable space to allow between coils, by the way is $1\frac{1}{4}$ in.

LATEST BROADCASTING NEWS.

TELEVISION TO BE BROADCAST?

SOCCER AGAIN ON THE AIR —“LOOK YOU, WHATEVER” ON APRIL 15th—B.B.C. PLANS HOUSEHOLD BUDGETS— TOMMY HANDLEY'S CIRCUS AT BELFAST—BRISTOL ON THE AIR.

Television to be Broadcast?

THE result of the recent "secret" test of Baird Television by a panel of Members of Parliament is likely to be announced next week. It is understood that the Postmaster-General's statement, while justifying the attitude of the B.B.C. on service requirements, will recommend substantial concessions of experimental broadcasting facilities, thereby bringing Baird Television into line with the Fultograph. But wave-length difficulties will impose some delay on the inauguration of the new series of Baird broadcasts outside programme hours.

Soccer Again on the Air.

When Scotland entertains England at Hampden Park, Glasgow, in the annual Soccer International match on Saturday, April 13th, a running commentary will be broadcast from all stations throughout the country. The commentator will be Mr. George Allison, who described last year's match at Wembley.

Just in case Mr. Allison's voice is rather too "English" for Scottish listeners, arrangements have been made for him to have the assistance of a native of Scotland, who will "chip in" appropriately according to the state of the game.

In view of the partial suspension of Soccer commentaries this season, listeners everywhere will be glad that the big international has been arranged. Incidentally it is understood that in its desire to remove the present deadlock, the B.B.C. offered to give a substantial sum to a football charity for the right to take the Cup semi-finals and the final.

"Look You, Whatever" on April 15th.

Wales has a message, and Welsh listeners have jolly well got to hear all about it in a talk to be broadcast from the Cardiff Studio by the Rev. D. C. Davies, on Saturday evening, April 13th. Mr. Davies is known throughout the Principality for his work on behalf of the League of Nations Union.

He believes that this is the day of small nations (so does Mr. Lloyd George for that matter), and he says that Wales should develop her distinctive qualities rather than allow them to become part of the common stock. No doubt lots of people on the other side of the Bristol Channel are in complete agreement with these views, but most Englishmen will gasp with surprise at them. Indeed to goodness, look you, whatever!

B.B.C. Plans Household Budgets.

Mrs. C. S. Peel, whose book, "How We Lived in War-time," based on her experiences as Director of the Women's

Section of the Ministry of Food, was recently published, is to give two morning talks for 5 X X listeners entitled "Planning the Household Budget."

The first is down for Monday, April 8th, and will concern a family with an income of £500 a year. Correspondence, the most reliable barometer of the popularity of all B.B.C. activities, shows that the morning talks, which have now been broadcast for some time from Daventry Senior, are greatly appreciated by women listeners, and there is not much doubt that when their continuance is considered in the near future that the demand will show a justification for what was originally an experiment being retained as a permanent feature.

Even now British broadcasting lags far behind that of America where early morning talks and exercises on health matters have long been an established part of the day's radio routine, and the time may not be far distant when we shall have a further extension of broadcasting hours.

A LABORATORY OF THE SKIES!



To investigate the problems associated with the direction of aircraft by radio, the U.S. Bureau of Standards has recently equipped this plane with super-sensitive radio receivers.

TECHNICAL NOTES.

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

A.C. VALVES

THE QUESTION OF HUM—LOW RESISTANCE FILAMENTS.

A.C. Valves.

ALTHOUGH there are now several types of alternating-current valves on the market, some of which operate very well, no one seems quite to have got rid of the A.C. hum. Probably with further improvements in design this hum will be reduced so as to be quite inaudible.

The cause of the A.C. hum is as follows: Taking a type of valve which has what is called an "indirectly heated filament," we have a "heater" to which the raw alternating current is supplied. This is surrounded by a very fine metal cylinder which, although not electrically connected to the heater, becomes heated to a red heat by the radiation from the heater—this outside cylinder constitutes the "filament" of the ordinary valve, and gives out electrons by virtue of its high temperature. If it were not for the alternating potentials in the heater inside (and the leads to the heater) all would be well, and the valve would be as silent as a valve operating from a low-tension battery.

The Question of Hum.

But it is impossible to introduce the alternating-current potentials without, to a greater or less extent, upsetting the electron stream, and as this is modified in unison with the alternating current, we have an alternating-current "hum" corresponding to the A.C. frequency.

Low Resistance Filaments.

All kinds of attempts have been made to reduce this hum by various devices, one of the simplest being to make the heater of very low resistance so that the difference of potential applied to its ends in order to drive the necessary heating current through it shall be extremely low—a small fraction of a volt. This means that only very low A.C. potentials are brought in by the leads to the heater, and undoubtedly this arrangement has the effect of reducing the A.C. hum very appreciably.

(Continued on page 140.)

Tommy Handley's Circus at Belfast.

Whoever is still responsible for what, in the early days of broadcasting, were called "stunts" and later were given the more dignified title of novelty programmes, has not yet been able to visualise (or maybe has not even considered the possibility) of a successful broadcast from that great treat of our childhood, the circus.

Tommy Handley is staging a studio representation of one at Belfast, on Saturday, April 13th. Let us hope it "goes" well, and then, like every other circus did at some time or other, moves on to London.

Bristol on the Air.

When the citizens of Bristol realised, about three years ago, that their long and patient agitation for a relay station of their own was never likely to be realised, they allied themselves to Cardiff, and said they would help to manage the Welsh station for the small consideration of half the programmes being arranged for the special benefit of Bristolians.

It seemed a very nice solution of what had been a knotty little problem. Savoy Hill welcomed it, and encouraged Bristol to set up a local committee to work with the Cardiff Station officials.

That is why a good proportion of the transmissions from Cardiff are designed for Bristol. Quite often Saturday is given over to Bristol, such as on April 13th, when a Bristol Variety entertainment will be broadcast.

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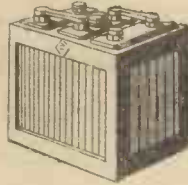
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They are machined dead true and hold the unit perfectly aligned in a vice-like grip.

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PRICE COMPLETE 35/-
15 in. Kraft Cone Kit separately .. 5/-
No. 97. 9 in. 15/6
Cradle complete
9 in. Kraft Cone Kit, 2/6

THE "TITAN" THREE.

The Editor, POPULAR WIRELESS.

Dear Sir,—I am writing to compliment you on your achievement in giving "P.W." readers and others such a fine set as the "Titan" Three. I made the set as soon as every article for same was available, and have given it a good, searching test, and it is wonderful. Stations come in all round the dial at full L.S. volume, and that without touching the reaction at all. It really is a wonderful set for distance and volume. What amazes me is the sweetness of it; it makes a speaker human. Again I congratulate you, and my advice to readers of "P.W.," if they want a real set, is start on the "Titan" Three and stick to it.

Yours truly,

R. JACKSON.

Lytham, Lancs.

THOSE ADVERSE CRITICISMS!

The Editor, POPULAR WIRELESS.

Dear Sir—Recently you printed a scathing letter re your set designs, and the writer stated you did not report any letters which gave an adverse criticism of sets constructed.

I constructed "Everybody's" Three, and had considerable trouble with it; first continuous L.F. oscillation, then distorted reproduction. But being certain from the "feel" of the set that it was a winner if I could only get it just right, I persevered until at the present time I am the proud owner of one of the finest sets I have ever operated or heard, and its performance for such a circuit is little short of marvellous. In fact, I have discarded my H.F. detector and L.F. altogether.

I agree with the other constructors that reaction is perhaps too fierce, and requires knack to get the best results. But after changing one of my transformers, where previously I had two exactly alike of a very expensive pattern, using either 50,000-ohm or 100,000-ohm resistance in the detector plate lead, increasing the 1 mfd. condenser to 2 mfd. and placing a 500,000-ohm potentiometer across the secondary of the first transformer, I am getting wonderful results.

The reason for this latter seemingly unnecessary refinement is because at two miles from 2 L.O I find reception so loud, even when detuned, that the only means of bringing it down to bearable volume was to use this volume control, when the quality is so deliciously pure that it is a treat to hear even a rotten programme.

So far as long and medium stations are concerned, I have nothing to add to the other reports. Suffice it to say I can get a very large number of stations, ranging from Huitzen to Hilversum and Budapest to Nurnberg. But it is with regard to the short waves that I would now report, as I have not seen any regarding this.

I have picked up several Continental and amateur broadcasters, but my piece de resistance is W 8 X K, Pittsburg, which I can tune in on 25.4 metres at any time after 10 p.m. any night. Some nights it is not so good as others, but on the night of March 5th the reception from this station was exceptionally good, excellent in quality and volume. Every word coming through as distinctly as if it was the local station, and from 11 p.m. towards midnight I

CORRESPONDENCE.

THE "TITAN" THREE.

THOSE ADVERSE CRITICISMS!— S.G.'s AS DETECTORS—THREE L.F. STAGES.

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.

heard the Waldorf Astoria Hotel orchestra in New York, which was being relayed from Pittsburg, play "Raymond Overture," "Andante Cantabile," and another item with surprising lack of interference from atmospherics and fading.

I am so pleased with my S.W. results that I consider the set worth constructing for that alone.

Yours faithfully,

ERNEST NICHOLS.

St. John's Wood, N.W.8.

[EDITORIAL NOTE.—A special article is in this issue which deals with many interesting points concerning this set, particularly the question of reaction control, which appears to have presented some difficulty to readers unfamiliar with the behaviour of a set with a very powerful L.F. side.]

S.G.'S AS DETECTORS.

The Editor, POPULAR WIRELESS.

Dear Sir,—Page 1193, Mr. Evans writes: "The screened valve cannot be used as a detector in any satisfactory way."

As an experiment I tried the Mullard S.G. valve as detector (det. and L.F. set), which resulted in increased volume with perfect clearness.

In this position it compares very favourably with many of a fair number of valves used during a number of years—in fact, since before the B.B.C. commenced.

I should be much interested to know your opinion, and whether my experience is exceptional. I ignore the top terminal.

Yours faithfully,

HARRY SIMMONS.

Loughborough.

THREE L.F. STAGES.

The Editor, POPULAR WIRELESS.

Dear Sir,—I should like to say that I entirely agree with Mr. S. Burnard regarding the excellence of a circuit using Det. and three L.F. stages. I have done a good deal of experimenting with various

circuits for several years past, and have at last evolved a set which will, I believe, be my last effort. The circuit consists of Det. followed by two R.C. stages, with a final stage of push-pull, and the only thing which can be said against it is a certain lack of selectivity, a fault which is easily overcome by the use of a wave-trap.

Used with small-power valves in the output stage, results on an ordinary cone speaker are definitely excellent, frequencies ranging from organ bass to top violin notes being clearly produced with surprising naturalness, while with super-power valves and an M.C. speaker results can only be described as superb.

I use the same set for short-wave work, and here again find results all that can be desired, both on phones and speaker. At present I am working under the disadvantage of an indoor aerial and gas-pipe earth, but this being only a temporary annoyance I trust soon to have the set going with its old power again shortly.

If Mr. Burnard would care to communicate with me (addressed care of "P.W."), I shall be pleased to send him the circuit for inspection; and as it contains one or two novel features resulting from several chunks of hard thinking during the process of construction and testing, it may be of interest to him.

Best wishes to "P.W." which I have had the pleasure of reading from No. 1.

I remain, yours faithfully,

STANLEY W. FORSYTHE.

Dover, Kent.

The Editor, POPULAR WIRELESS.

Dear Sir,—I was interested to note in your issue of February 23rd Mr. S. Burnard's report on the use of a 0-v-3 set. I possess a set exactly similar in its essentials (anode-bond detector with reaction, two resistance and one transformer-coupled stage), and in my opinion it is a type which deserves more general notice. For listeners situated as I am (my "local" station, Newcastle, is some sixty miles distant) it is capable of admirable service. Any night I have the choice of at least half a dozen programmes at good strength and quality on a moving-coil loud speaker and several more on a cone or horn speaker.

There are, of course, several snags of which an inexperienced constructor should beware, such as a tendency to "motor-boating." The use of a transformer in the last stage would be impracticable near a transmitter, as the large amplification would make it necessary to precede the transformer with a low-impedance valve capable of handling considerable grid swing, and quality would suffer. I have to use two 2-volt super-power valves in parallel to handle the output distortionlessly. The anode-bond detector needs careful adjustment of H.T. 1 grid bias and choice of valves, but when working properly its sensitivity is little short of that of the more usual grid-leak detector.

Without casting aspersions on Mr. Burnard's veracity, I am inclined to take his statement of having received twenty-five American stations with a pinch of salt.

Wishing your paper ever success.

Yours faithfully,

Whitby.

G. BLENKEY.

I HAVE always said that it should not be necessary, in a good short-waver, to resort to elaborate screening extension handles, etc., etc., to produce freedom from hand-capacity effects. Encouraged by a passing whim, I built a receiver the other day with both variable condensers set back six inches from the front panel, behind a "dummy" metal panel, long extension handles connecting up the spindles with two slow-motion dials on the front panel.

A Peculiar Remedy.

Curiously enough, the capacity effects arising from the metal plates on these two dials (although not connected to anything at all) were considerably worse than anything I have ever run up against with the two condensers actually mounted on the front panel. Earthing the metal portions of the dials did not help in the least, and I was forced to admit myself beaten by using two dials of the all-ebonite type, which, of course, gave total freedom from any undesirable effects whatever.

As a matter of fact, I am at a loss to prescribe a complete cure for hand-capacity troubles in the cases of quite a few people that I know. The cause is usually the length of the earth lead, and the capacity effects are usually prevalent on one wave-band only.

SHORT-WAVE NOTES.

By W. L. S.

If you happen to have an earth lead of a certain length, nothing will stop a decided "creep" of a signal when you actually touch the earth terminal or lead, so that it is easy to see that earthed screens and metal panels are not likely to be of much assistance. It is as well to bear in mind that lengthening the earth lead, if it is not possible to shorten it, will often effect a cure.

The strength with which the South Americans come in most nights now at about 10 p.m. is astounding. I have logged upwards of 30 Brazilians, as well as quite a useful handful of Chilians, "Argentines," etc.

And, in accordance with the old rule that held good on the higher wave-lengths years ago, when the South Americans are coming in well, the United States are practically inaudible. Only very rarely indeed does one strike a night when they both come in together.

It is interesting to note, however, that whichever set of stations comes in best here, the United States people seem to be able to get into touch with Brazil quite easily, and vice versa; one always hears them calling the other half of the continent.

The Longest Way Round.

What is the greatest distance that a transmitter in this country can possibly cover on this globe? It is not just the mere 12,490 miles to the Antipodes! No, since these short-waves will go out of their way to take a suitable path and will go more than half-way round the world to keep along the line of light and shade, which seems most favourable for the 20-metre wave-length, at any rate.

I, personally, think it is from here to the American 6th district (California) going across Russia, Asia and the Pacific. One or two transmitters have achieved this in the afternoons, and there is no question that the waves travel "the long way round" since California, with the rest of the States, is audible in the early morning, but in the afternoons an occasional Californian may be heard, while all the other audible stations are Asiatics; none of the East Coast Americans is audible.

If you are thinking of making a one-valver, either as your first venture in valve sets, or to replace one which you feel is no longer as up to date as you could wish, why not take advantage of the many special features offered to you by the new "P.W." wave-change coil? If you want your new set to remain up to date for some time to come, some sort of wave-change switching scheme is highly desirable.

Without it you have the perpetual nuisance of coil changing, and although it may be worth while putting up with this

drawback in some special circuit, or to achieve simplicity in some particular case, it is a real defect in a general-purpose set. We need not labour the point, for no doubt the majority of our readers have by now realised the convenience of wave-change switching.

So far, it has not been easily obtainable in single-valve receivers, because it has generally involved more expense or complication than is really desirable in a simple set of this type. Now, however, we have a simple but effective coil unit which solves the problem for us at one stroke. It does not put up the cost of the set at all as compared with one using plug-in coils, it renders it considerably easier to make, and gives a really good performance.

With so much granted it was evident that a good wave-change single-valver ought to be added at once to the "Titan" range, and we have lost no time in preparing the necessary design. Obviously it did not take long, for to make a "Titan" one-valver, all that you have to do is to mount a variable condenser, two switches, and a reaction condenser on a panel, a coil unit, valve holder, grid condenser and leak, etc. on the baseboard, wire up, and the job is done.

An Excellent Performance.

Of course, it was not quite so simple as that, because there was the question of layout, and we had to devote some time to finding a good one promising efficiency and easy wiring. We think you will like the one adopted, for it makes construction very easy, and the little set works very well indeed, giving a particularly good account of itself on test. Selectivity is well up to standard for a set of this type, and its sensitivity is decidedly above normal. (It brought in nine foreigners really clearly on test after dark under average conditions.)

The circuit is really a very simple affair, and is practically a Reinartz of the improved type. The reaction arrangements may look a little out of the way at first glance, and we had, perhaps, better explain them before we go further. As a matter of fact, it is just the usual Reinartz scheme



when you analyse it, but with the special feature that the reaction circuit is so placed as to eliminate hand-capacity effects on the reaction condenser as far as possible.

This is done by placing the condenser on the "earth" side of the reaction coil for the ordinary wave-band. In this way we secure the advantage of having one side

Designed and described by the "P.W." Research Dept., this attractive little set represents a very effective solution of the problem of a one-valver which shall be both efficient and simple. It is particularly easy to make.

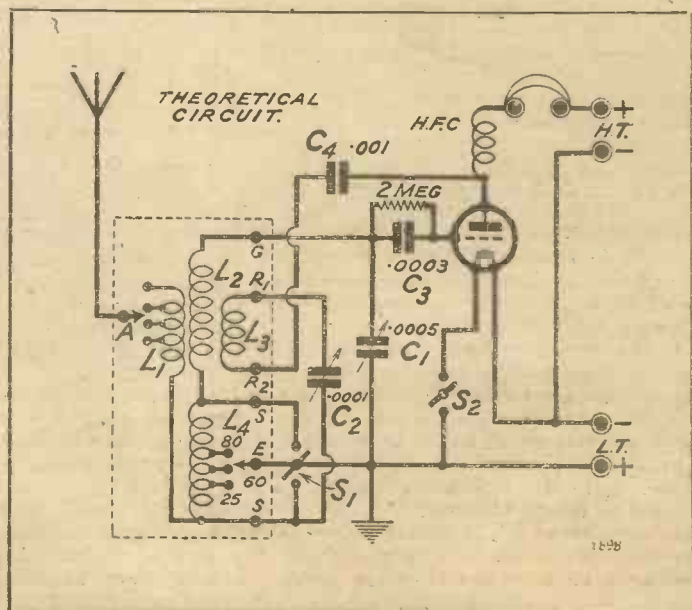
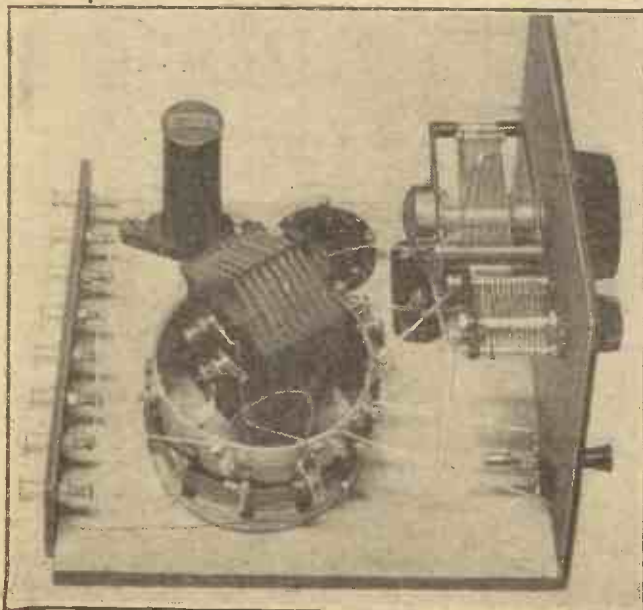
of the condenser at earth potential, and even the other is not at such high potential as would be the case were it to be on the "plate" side of the coil.

Reducing Hand Capacity.

In this way we ensure that there shall be no noticeable hand-capacity effects here, which is a very valuable feature in a small set depending upon accurate adjustment for good results. The same scheme cannot be applied to the long-wave circuit, because to do so would involve a more complicated system of switching, but this is not a serious

COMPONENTS REQUIRED.

- 1 Panel, 9 in. X 7 in. X 1/8 in. or 1/4 in. (Beol, Kay Ray, Ripault, Trelleborg, Red Seal, Resiston, etc.).
- 1 Cabinet to fit, with baseboard 9 in. deep (Raymond, Cameo, Bond, Artcraft, Lock, Pickett, Gilbert, Caxton, etc.).
- 1 .0005 mfd. variable condenser (J.B., Igranic, Lotus, Dubilier, Ormond, Cyldon, Utility, Burton, Colvern, etc.).
- 1 On-off switch (Benjamin, Igranic, Lotus, Burne-Jones, etc.).
- 1 3-spring wave-change switch (Wearite, Bulgin, Pioneer, etc.).
- 1 .0001 or .00015 mfd. reaction condenser (Burton, Utility, Peto-Scott, J.B., Cyldon, Igranic, Raymond, Bulgin, etc.).
- 1 "Titan" coil unit (Wearite, Ready Radio, Burne-Jones, Peto-Scott, Goltone, Paroussi, etc.).
- 1 Sprung valve holder (Lotus, Igranic, W. B., Benjamin, Pye, Marconiphone, etc.).
- 1 .001 mfd. fixed condenser (Clarke, Goltone, Dubilier, T.C.C., Igranic, Mullard, etc.).
- 1 .0003 mfd. fixed condenser, with 2 meg. leak and grid-leak clips or separate holder (Dubilier, T.C.C., Mullard, Igranic, Burne-Jones, Goltone, Clarke, etc.).
- 1 H.F. choke (any good make).
- 1 Terminal strip, 8 in. X 2 in. X 1/4 in. and 8 terminals.



The photograph to the left shows the position of the components. That of the "Titan" Coil itself is somewhat important, and not only its location but the position of its terminals should be arranged with care.



matter. Adjustments are much less critical on the long waves, and so hand-capacity effects do not trouble us.

The rest of the circuit is an absolutely standard wave-change arrangement, exactly as was used in the "Titan" Two and the "Titan" Three, and many previous sets where somewhat different coils were employed. We think we need scarcely spend any more time over the circuit,

Why not build a set with which the non-technical members of the family can switch over to 5 X X by pushing a knob and turning one dial? Here is a really neat and simple little receiver which "fills the bill."

therefore, and we can get on to practical matters.

Since a one-valver may well be a set for the beginner we had perhaps better go into the constructional side in some detail. First of all, the panel. You will no doubt buy this ready cut to size, and the first step is to see that it is a nice fit in the front of the cabinet. It is not likely to be under-size, but may possibly be a little tight (cabinets are very difficult to make accurately to size). If so, take a fairly coarse file and reduce it carefully to a rather slack fit.

Next, see about attaching it to the front edge of the baseboard, and for a small set like this there is no use to use panel brackets for the purpose. Three or four brass screws with countersunk heads will serve quite well (No. 4's are suitable), in a row across the lower edge of the panel. Don't forget to countersink the holes in the panel for these, so that their heads shall be flush with the surface.

Next comes the question of the drilling of the panel, and the first step is to mark it out with the aid of the diagram. An easy way is to work on the back, scratching the positions of the holes with something sharp-pointed with the aid of a ruler. Remember, however, to reverse right and left on the diagram, which shows the panel from the front. As regards the actual drilling, you will find it a good scheme to start by running quite a small drill, say a $\frac{1}{8}$ in., through each, and then enlarging up as necessary to suit your particular components.

Drilling being complete, attach all the components to the panel and fix it to the baseboard. Next, cut, drill, and attach the terminal strip, and then proceed to screw down the various components on the baseboard in the positions indicated on the wiring diagram. Just one point here: be careful to put the coil down correctly, so that the terminals thereon come in the right places.

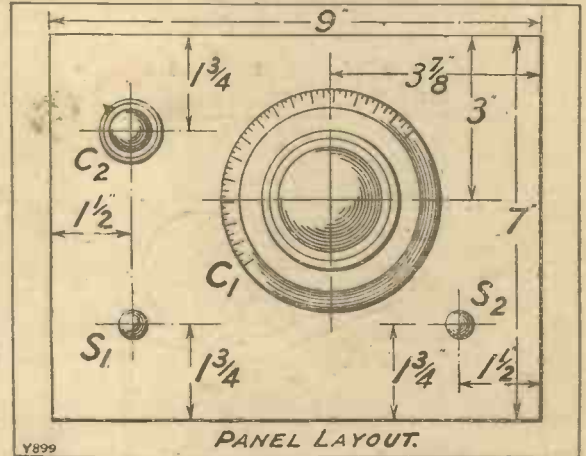
Methods of Wiring.

Now for the last step, which is the wiring. Here you have a choice of methods and materials. For example, if you distrust your ability with the soldering iron, it is quite easy to choose components with terminals all through and screw down the connections thereunder. If you decide

on this method it is best to use a medium gauge of wire, not too thick to be bent into neat hooks and well gripped by the terminal heads.

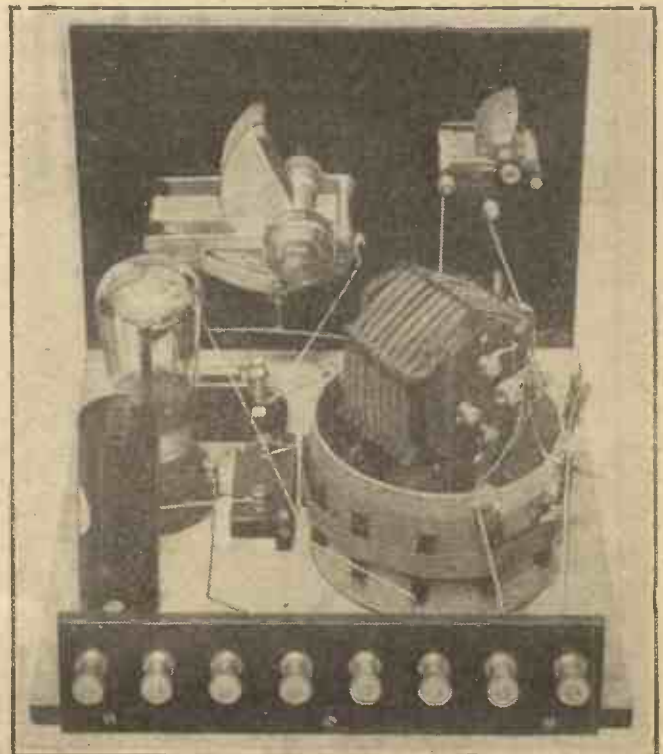
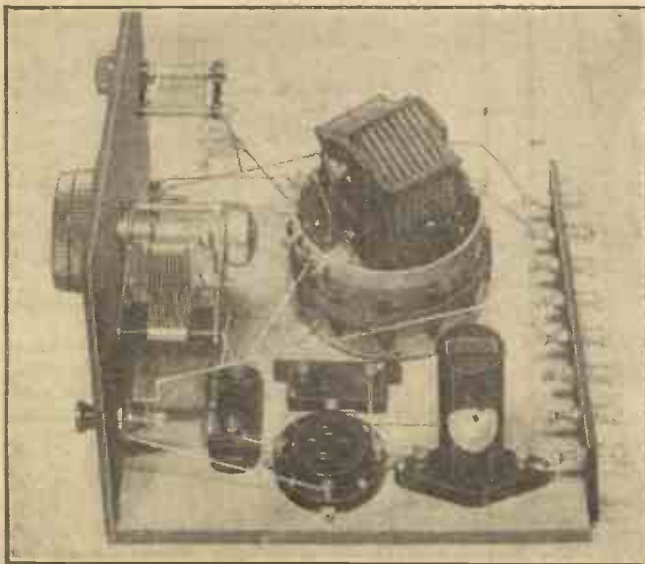
Choice of Materials.

The wiring is so simple that bare wire can be used, with due care, or Systoflex sleeving if preferred. Again, you can use one of the special covered materials, such as Glazite. By the way, if you decide to use the "no soldering" method, let me urge you to adopt a precaution which may save you quite a deal of bother later. It is just this: when the set is quite finished,



go over every connecting point with a pair of pliers and make quite certain that they are really tight.

Now for the first steps with the finished set. First of all, we want a suitable valve, and the usual procedure is to use one of the H.F. type, with an impedance of round
(Continued on next page.)



Most of the wiring can be seen from these photographs, that on the left showing also the alignment of the valve-holder terminals, so arranged to shorten the wiring as far as possible. The right-hand photograph shows the coil connections in greater detail.

THE "TITAN" ONE.
(Continued from previous page.)

about 20,000 ohms, 2, 4 and 6 volts, all working well in this circuit. Naturally, the higher filament voltage types are a little better, but the 2-volters are very nearly as good and are obviously far more economical. Another type which is often very good

indeed is the R.C. variety, especially if the impedance is not too high (say 40,000 or 50,000 ohms). A really suitable specimen of this class may be perceptibly better for long range work than the H.F. type. However, since they vary in their suitability as detectors it is usual to recommend the H.F. kind instead. Obviously, if you already have an R.C. valve it is well worth trying. One of the most important adjustments to be made in any small set where sensitivity depends upon perfect reaction control is that of the H.T. voltage on the detector

valve, and this is so vital that we need make no apology for going into it pretty thoroughly. If you are to achieve much success in long-distance work it is essential to be able to get a gradual adjustment of reaction, without any perceptible overlap. A slight plop as the set goes into oscillation is not a very serious matter, although it is best to try to get rid of even this, but actual over-lap is fatal. To achieve this smooth control is chiefly a matter of adjusting the H.T. very carefully, and voltages from 30 to 60 should be tried.

In some cases, however, one comes across an obstinate sort of valve which refuses to give really smooth control until special dodges are tried. In such cases a different value of grid leak often helps, so try a 3 or a 1 meg. instead of the normal 2 meg. (rarely necessary, but useful to know). The easiest way out, of course, is just to try a different valve, but that is only possible where one or two spares are available, and so we give this grid-leak tip.

Selectivity Control.

Now about selectivity. Assuming that you have connected up the batteries, phones, aerial and earth, and got a pretty good H.T. setting as described, this is the next question. Now, on the lower wave-band selectivity is adjusted by means of the tapping clip on the primary winding on the coil unit. You will find that this winding has tapping points at 5, 8, 12 and 16 turns (the latter is the upper end), and you should try the clip on each of these.

As a rule, the 8 or the 12-turn tapping will be found a good average adjustment for most aerials, but conditions and requirements differ, and so actual testing is needed. You will find that selectivity is higher as you bring the clip down towards the lower tappings but volume is usually best on the higher tappings.

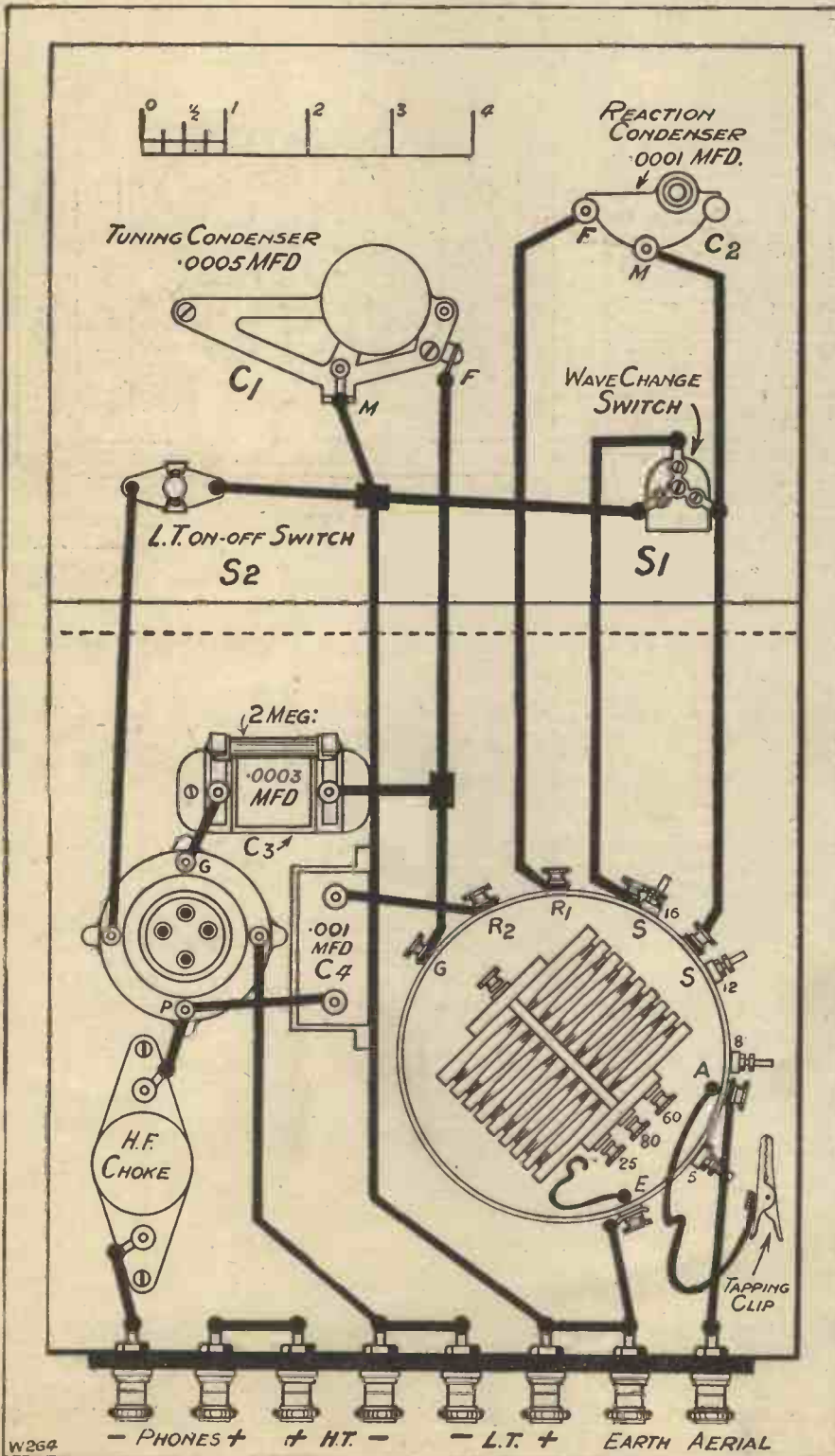
When you get the right setting for your particular requirements you will find the selectivity is really unusually good, but remember that this is a simple type of set with only one tuned circuit. Do not, therefore, expect it to perform impossible feats of cutting out the local station if you are only a few miles away. If you live in the real "agony area," close up round a main station, what you need with any simple type of set is a wave-trap. With the aid of the "P.W." standard one you will find you can shut out the local with the greatest of ease, so give it a trial if you have any difficulties of this sort.

Long Wave Adjustments.

There is another simple control of selectivity on the long waves, and this is merely a matter of placing the flex lead from the E terminal on the coil unit on a suitable tapping point on the loading coil. No. 60 will usually be about right, but for the highest selectivity, especially on a large aerial, the No. 25 should be tried.

By the way, about that wave-change switch, let us make it quite clear that when the knob is pulled out you are on the lower wave-band. To receive 5 X X you must push the knob inwards.

Since this may in some cases be a "first set," we ought perhaps to give a few words of warning about oscillation. Remember always that sets of this type will radiate and cause interference when allowed to oscillate, so do be careful never to let it go on for more than a minute.



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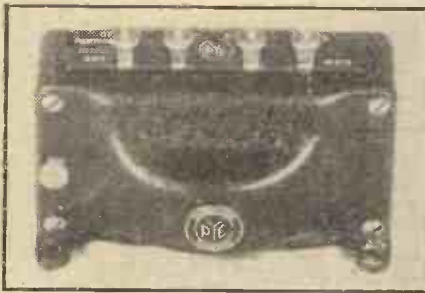
FROM THE TECHNICAL EDITOR'S NOTE BOOK

**PYE PENTODE TRANSFORMER.**

IT is one of the peculiarities of the Pentode valve that it needs a special output transformer. You can, of course, operate the valve without this, but the reproduction will not be what it should. The reason is that this valve has a very high impedance and the transformer it demands is, therefore, of a "step-down" variety.

Messrs. Pye, of Cambridge, are, as befits a firm of such standing in matters relating to chokes and transformers, early in the field with a Pentode transformer. Its catalogue description is "Pye Tapped Primary Shrouded Output Transformer No. 657/P."

As with all Pye transformers this one is in every way up to standard. It is interest-



This is the Pye Pentode Transformer.

ing to note, by the way, that in their leaflet Messrs. Pye state: "The first frequency efficiency curve to be published in this country was by W. C. Pye and Co., the authenticity of which was vouched for by the National Physical Laboratory."

Reverting to the Pye Output Transformer, the price of this is 20s., a reasonable price for a first-rate production. If you use a Pentode valve in the "Titan," this transformer is quite suitable. We have tested it and find its qualities and characteristics are as claimed. It is worth noting that it is guaranteed by its makers for a period of one year.

A POCKET VOLTMETER.

Usually the pocket voltmeter has a small scale comprising thick, black lines over which passes a thick, black needle. The pocket voltmeter recently sent us for test by Louis Holzman is one of the first we have seen with a "knife-edge" needle. The size of the scale is, of course, necessarily small, owing to the very nature of the instrument, but over the range of 0 to 150 volts readings can be taken accurately to within two or three volts.

The resistance of the meter is 15,000 ohms, and at the maximum reading the current consumption is 10 milliamps.

Therefore, when testing an H.T. battery with this meter on "open" circuit, you more or less approximate the conditions met with when the battery is in action on a small valve set! It is a neat, watch-pattern meter in a highly-nickelled case. We consider it good value at 7s. 3d.

AN EXCELLENT SET.

Messrs. Ferranti, one of whose famous L.F. transformers is referred to in this page, have produced a chart of a "Screened-Grid" Three receiver. Supplies of these fine charts are available to everyone on request, and the whole of the special components needed for the set are in production. This Ferranti "Screened-Grid" Three seems to be an excellent proposition and one that should achieve considerable popularity.

A THREE-POINT SWITCH.

Many "P.W." wave-change receivers, among which the "Titans" stand out as notable examples, necessitate three-point push-pull switches. This type is also useful for filament switching purposes when it is desired completely to break the H.T. battery circuit. Messrs. Wright & Weaire's version of this component is a neat, well-made piece of apparatus. The action is particularly smooth and positive while there is not the slightest bit of play in its spindle.

It has the self-cleaning contacts so essential to preserve the cleanness needed for switching operations in H.F. circuits. It is of the one-hole-panel-mounting variety, and is fitted with soldering tags and not terminals. Messrs. Wright & Weaire also have produced a new push-pull on-off switch. This is fitted with two small terminals and has a very nice "click" action. It switches in and pulls out with a definite snap and does not leave you in doubt as to whether or not it is doing its work.

FERRANTI L.F. TRANSFORMER.

There are more things that can happen in an L.F. transformer than possibly could be revealed by one simple curve. Nevertheless, an amplification curve such as the National Physical Laboratory will prepare for any transformer sent them, can be an excellent indication of the component's capabilities.

If the curve were a straight line from a frequency of 20 to 20,000 you could reckon the transformer was something near the ideal that is being constantly aimed at.

The curve of the Ferranti A.F.5 is abnormally good, so good that you do, in fact, get results approaching the best R.C.C. with the corresponding greater amplification only to be achieved by using a transformer.

The phenomena which occur in connection with the magnetisation of iron would need a hefty volume before even the ground-work could be covered. And in the design of L.F. transformers the subject is of vital importance, while there are further problems encountered, although these are, of course, interlinked in the behaviour of iron.

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.

The Ferranti L.F. transformer is made by people well versed in these complicated technicalities. You cannot duplicate an L.F. transformer merely by duplicating its core and winding sizes.

And the Ferranti A.F.5 L.F. transformer is a component that has wonderful individuality in this regard! Its N.P.L. curve is extraordinarily good, and its performance completely fulfils the promise of its curve. We have included one in a resistance-transformer amplifier combination, and have no hesitation in saying that we see no reason why we should sacrifice amplification and use R.C. throughout for normal broadcast reception purposes. The A.F. family is a noble one, and the A.F.5 deserves its leading position in it.

COMPONENTS, ETC., RECEIVED.

Among the large number of sets, accessories and components in hand for test and report purposes are an Ekco "All Mains" Set, an Ekco H.T. Unit, various makes of short-wave coils for the Cossor "Melody Maker," and a modified Osram L.S.5A. valve.



An indication of the vast number of Cossor maps that is being sent out is afforded by this photo of the replies to just two day's applications leaving the premises of Messrs. Cossor.



The WORLD CALLING YOU !

The new
Igranitic Screened-Grid Short-Wave Receiver
 brings you programmes from America, Africa, Australia, Canada, on all wave-lengths of 10-85 metres, and is as simple in operation as an ordinary broadcast set. Its features are neutralisation, plus the screened-grid valve, giving great sensitivity and stability with high amplification and purity even on 10 metres. The old method of excessive reaction with its difficult adjustment and distortion has thus been replaced and the effects of fading or interference greatly reduced. Ask your dealer to let you hear America on it, or write to Dept. R 115.
 Price, in mahogany cabinet, £33.



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The following is a list of the “P.W.” 6d. Blue Prints for Constructors in stock, showing the different circuits available.

- P.W. BLUE PRINT Number.
1. DETECTOR VALVE WITH REACTION.
 2. OUT OF PRINT.
 3. 1-VALVE L.F. AMPLIFIER.
 4. CRYSTAL DETECTOR WITH L.F. AMPLIFIER.
 5. H.F. (Tuned Anode) AND CRYSTAL WITH REACTION.
 6. H.F. & CRYSTAL (Transformer Coupled, without Reaction)
 7. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Tuned Anode).
 8. 1-VALVE REFLEX AND CRYSTAL DETECTOR (Employing H.F. Transformer, without Reaction).
 9. H.F. AND DETECTOR (Transformer Coupled, with Reaction on Anode).
 10. H.F. & DETECTOR (Transformer Coupled, with Reaction).
 11. DETECTOR AND L.F. (With Switch to Cut Out L.F. Valve).
 12. OUT OF PRINT.
 13. 2-VALVE REFLEX (Employing Valve Detector).
 14. OUT OF PRINT.
 15. OUT OF PRINT.
 16. H.F. (Tuned Anode), CRYSTAL DETECTOR AND L.F. (With Switch for Last Valve).
 17. CRYSTAL DETECTOR WITH TWO L.F. AMPLIFIERS (With Switching).
 18. 1-VALVE REFLEX AND CRYSTAL DETECTOR, with 1-VALVE L.F. AMPLIFIER Controlled by Switch.
 19. OUT OF PRINT.
 20. OUT OF PRINT.
 21. THE 2-VALVE LODGE “N.”
 22. “THE GUARANTEED REFLEX.”
 23. THE 1-VALVE “CHITOS.”
 24. THE “SPANSPACE THREE.” Three-Valve Receiver employing 1 Neutralised H.F. Valve, Detector with Non-radiating Reaction Control and 1 L.F. Valve.

- P.W. BLUE PRINT Number.
25. OUT OF PRINT.
 26. A “STRAIGHT” 4-VALVER (H.F., Det. and 2 L.F. with Switching).
 27. OUT OF PRINT.
 28. A “MODERN WIRELESS” 5-VALVER (H.F., Det. and 3 L.F.).
 29. AN H.T. UNIT FOR DIRECT-CURRENT MAINS.
 30. A REINARTZ ONE-VALVER.
 31. A STANDARD TWO-VALVER (Detector and L.F.).
 32. THE “CUBE SCREEN” THREE (H.F., Det. and L.F.).
 33. A “KNIFE EDGE” CRYSTAL SET.
 34. AN H.F. AND DETECTOR TWO-VALVER.
 35. THE “UNIVERSAL THREE” (Det. and 2 L.F. stages resistance-coupled).
 36. THE “SPANSPACE FOUR” (H.F., Det. and 2 L.F.).
 37. THE “LONG SHORT” CRYSTAL SET.
 38. A TWO-VALVE L.F. AMPLIFIER.
 39. THE “SYDNEY” TWO.
 40. THE “SUPER SCREEN” THREE.
 41. THIS YEAR’S “CHITOS” ONE-VALVER.
 42. THE “Q AND A” THREE. A simple set (Det. and 2 L.F.).
 43. THE “INEXPENSIVE FOUR.”
 44. THE “ECONOMY FIVE.” For long-range loud-speaker work.
 45. A SIMPLE A.C. H.T. UNIT.
 46. THE “REGIONAL” THREE.
 47. THE “WAVE-CHANGE” ONE.
 48. THE “REGIONAL” CRYSTAL SET.
 49. THE “ANTIPODES ADAPTOR.”
 50. THE “ANY MAINS” TWO.
 51. OUT OF PRINT.
 52. THE “BANDMASTER.”

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All orders for these Blue Prints should be sent direct to the “Popular Wireless” Queries Department, Fleetway House, Farringdon Street, London, E.C.4, enclosing a stamped addressed envelope and a postal order for 6d. for each Blue Print ordered.

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When planning your new set ensure perfect amplification by including a BROWNIE POPULAR TRANSFORMER. The core iron and the windings which are the very finest obtainable are assembled in the famous Brownie Factory; while all the delicate parts are protected by an attractive moulded Bakelite casing which seals the whole transformer against any atmospheric interference. Send P.C. to Dept. 22 at address below for free booklet, "Wireless Without Worry."

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BROWNIE



RADIOTORIAL

All Editorial communications to be addressed to the Editor, **POPULAR WIRELESS**, Tallis House, Tallis Street, London, E.C.4.

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 and 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.

WAVE-CHANGE SWITCHING OF THE "TITAN."

C. B. (St. Ann's-on-the-Sea).—"On return of 'Titan' Three Coil Unit from the makers I fixed up, with following results: Lower wave-band, splendid; but on changing over high wave-band, very faint. Eventually I disconnected the wire between wave-change switch, and S2 and 5XX came through all right.

"So that now when I switch out low-waves the long waves come through automatically

without there being any connection between switch and S2.

"I'm very much puzzled and should be very grateful if you could explain, as the blue print shows distinctly one side of switch to one S and the other side to the other S.

Apparently you are using a switch of the wrong type, which, of course, would play havoc with reception.

There are two kinds of switches now on the market which are entirely suitable for operating the wave-change for the "Titan" coil. They are:

- (1) Special three-spring wave-change switches (the makes available being "Weareite," "Pioneer," and Bulgin).
- (2) Ordinary L.T. on-off switches of the two-spring-side-contacts-and-central-plunger type.

Either of these will do, but in the case of the second kind (the L.T. on-off switch) a slight modification has to be made to the switch to enable it to function as a

(Continued on page 136.)

READY RADIO TITAN PARTS

USE ONLY APPROVED COMPONENTS.

As originally specified and approved by the Editor of "Popular Wireless." EVERY COIL GUARANTEED.



TITAN COIL UNIT 15/-



TITAN H.T. FUSE & SCREEN 1/- — 2/6



TITAN THREE KITS

Approved by "Popular Wireless." READY FOR IMMEDIATE DESPATCH!

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| KIT A | Complete, valves excepted .. | £4- 7-0 |
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All kits include special connecting links which **OBVIATE SOLDERING.** Official blue print, and full instructions are also included.

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The "OBLICUT" PLAQUE

"SELLING LIKE WILD FIRE"

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BLUE SPOT or TRIOTRON UNIT FITTED IN 3 MINS.

"PRICE and FINISH Remarkable" says a user.

No Chassis, No Cabinet and No Unsightly Baffle required.

8/6 POSTAGE 9d. EXTRA.

THE FINEST VALUE YET OFFERED!

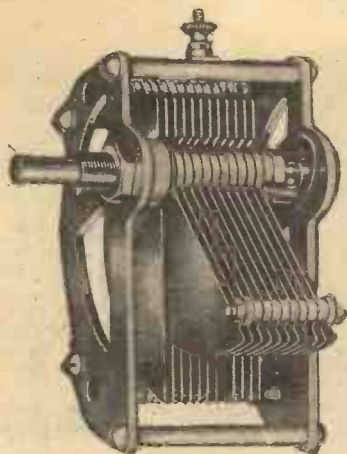


The "OBLICUT" PLAQUE is a baffle in itself. It hangs on the wall and is of handsome appearance. It is supplied in Oak or Mahogany finish. A coupling device is included and full instructions for fitting unit. The Cone is already fixed with edge floating on suede-like material and is specially impregnated to give the finest possible results.

The combination of an "OBLICUT" PLAQUE with a good Unit, is guaranteed to give results equal to the most expensive loud speaker yet made. Diameter of Plaque, 16 in.

IMMEDIATE DELIVERY. TRADE ENQUIRIES INVITED.

CALYX MANUFACTURING CO.
 945, ROMFORD ROAD, LONDON, E.12



Build your
Set with
Lotus
Components



The best of circuits cannot produce a good set if you use cheap shoddy components. Ask your dealer for Lotus.



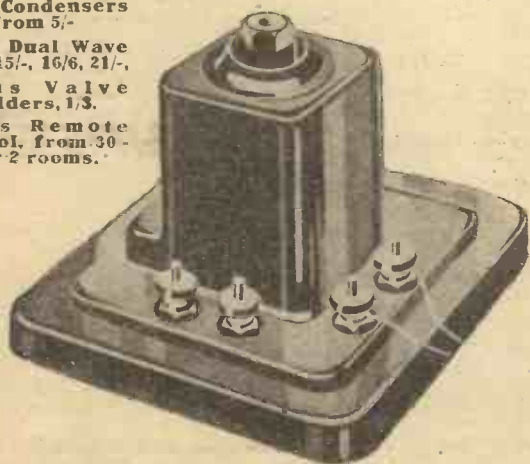
Every Lotus Component is a well constructed, reliable unit built to do its particular job accurately and without fail for a long life. Don't forget—get Lotus.

Lotus Condensers from 5/-

Lotus Dual Wave Coil, 15/-, 16/6, 21/-

Lotus Valve Holders, 1/3

Lotus Remote Control, from 30/- for 2 rooms.



From all Radio Dealers.

LOTUS COMPONENTS

Made by Garnett, Whiteley and Co., Ltd., Lotus Works, Broadgreen Road, Liverpool.

POWQUIP PROVIDES PERMANENT POWER



JUST CONSIDER

what happened when dull-emitter valves arrived. Would you entertain the idea of bright-emitter valves in your set? Why therefore continue to waste money on H.T. batteries? Indisputable facts will speak for themselves.

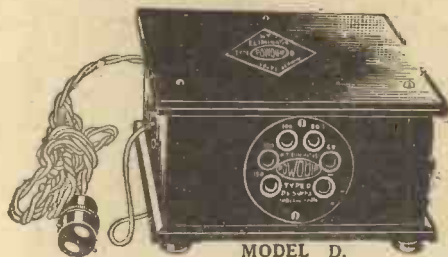
Any reputable 100 volt Battery costs twelve to thirteen shillings, the useful life of which is approximately six months **£1 4 0** per ann.
POWQUIP D.C. Eliminators cost approximately one shilling per 1,000 hours to run **1 6** per ann.
and remember, it will maintain its maximum voltage all the time for all time. It is Everlasting, Silent and Safe. **Net Saving £1 2 6** per ann.

Model D.S. designed for D.C. Mains. Suitable for 3 Valve Sets. PRICE **£1 12 6** complete.

Model D.

A larger edition of the above. Suitable for Sets embodying 2 stages of L.F. Amplification and capable of operating Sets up to 5 Valves.

PRICE **£2 15 0** complete.



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A.C. MODELS from £2-10-0

Write for descriptive pamphlet.

THE POWER EQUIPMENT CO., LTD., Kingsbury Works, Kingsbury Rd., Hendon, N.W.9.

POWQUIP PROVIDES PERMANENT POWER

Mr. L. HARDAKER ENTERTAINED NEIGHBOURS FOR A 1/4-MILE AROUND!!

HE USED WEILO TRANSFORMERS.

Horsforth, March 18th, 1929.

I have given your two No. 3 "Weilo" Transformers a good stiff test, and find that they are much better than I first expected them to be. I replaced two transformers that I had in my 3-valve receivers (costing treble the price of yours) and the result was most amazing, the volume and quality of tone was delightful to hear. I got so enthusiastic I placed my L.S. out of front window (I live 250 yards away from main road) and entertained the neighbourhood for 1/4 mile around, every word being distinct. I used four-volt valves with 45 volts H.T. on set and 200 volts on amplifier. I tried four types of valves and am pleased to say your transformers worked very well with them all. (Signed) L. Hardaker.



POWER TYPE MODEL 10.

HEAVY TYPE MODEL 3.

Price **11/6**

Price **8/6**

GUARANTEED TWO YEARS.

Weilo Transformers have been specified for the Pitman "All Europe 3" and the Manchester Evg. Chronicle "Distance 2". Send for fully illustrated catalogue describing the quality Weilo and N.S.P. components, free and post free on request. Stocked by Harrods Stores and most good-class Radio dealers. S. W. LEWIS & CO., LTD. (Dept. P.W.) 39, Victoria Street, S.W.1. Indian Agents: Bombay Radio Co., Bombay and Calcutta.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 134.)

wave-change switch instead of what it was originally intended for—namely, a simple make or break switch. The three-spring wave-change switch, on the other hand, needs no alteration.

If you obtain one of the special three-spring wave-change switches you will find that in one of its positions it makes contact with all three springs, thus connecting up for the short waves. In its other position the plunger makes contact with none of the spring contacts. This is the long-wave position.

If, on the other hand, you are fitting a suitable switch of the on-off type you will find that it has two terminals, and a central metal plunger, which, in one position, makes contact with both terminals, and in the other position with neither of them.

This metal centre-piece has to be fitted with a flex lead, either soldered to the plunger or screwed to it. Its action is then the same as that of the other type of switch; for in one position the flexible lead will connect with both the other circuit points (S, and S₂), but in the other position the three circuit points will be "open" and all disconnected.

TEST FOR A TRANSFORMER.

G. M. A. (Liverpool).—"How can I tell whether an L.F. transformer is working properly?"

If the L.F. transformer cannot easily be removed from the set for test, it can be tested for breakdown under working conditions by means of a pair of telephones.

Lift the two or more wires which go to the primary and connect a pair of telephones across this point. The output of the receiver to the transformer can then be checked. Good results in the telephones indicate that the primary terminals when connected were getting their correct input.

If now one side of the 'phones is connected to one of the primary terminals and the remaining side of the telephones goes to the wire which previously went to

"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.

this terminal, the telephones will be in series with the primary (the remaining side of the primary should be connected to its ordinary lead, thus restoring the set to its original form, except for the fact the telephones are now linked in as well). Weak or negative results will, of course, indicate that there is no connection through the primary. The shorting of the two primary terminals by a piece of bare wire, and the consequent 'phone signals will prove without a doubt that the fault lies at this point.

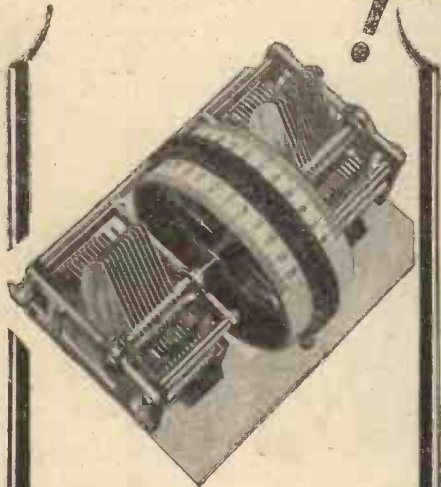
If, however, under this test the primary winding appears to be O.K., and the results are still good when connected in series with the primary, the 'phones can be taken out of that circuit and placed across the transformer secondary instead. Failure to get results here will be a clear indication that the fault lies in the transformer itself.

TURNING THE "TITAN" THREE INTO A PORTABLE.

J. M. (London, S W 10).—"How can I convert the 'Titan' Three into a portable? Am

(Continued on page 138.)

Huge Price Reduction!



CYLDON condensers, freely acknowledged by all to be the finest radio condensers in the world, are now within everybody's reach.

The famous Cyldon standards of quality and workmanship remain the same; Cyldon condensers at the new prices are absolutely identical with those already extensively chosen by designers and experts.

Use Cyldon condensers in your new set, they are mechanically as well as electrically perfect and are unconditionally guaranteed for five years.



Ask your local dealer for complete list of reduced prices.

| REDUCED PRICES | | SYNCRATUNE. | |
|----------------|-----|-------------|----------------------------------|
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| '0015 | 5/6 | '0005 | 52/6 |
| '0002 | 6/- | | LOG MIDLINE |
| '0025 | 7/- | | Square Law and S.L.F. Condensers |
| '0003 | 8/- | | '0005 10/- |

CYLDON

CONDENSERS

5 YEARS GUARANTEE

SYDNEY S. BIRD & SONS, "Cyldon" Works,
Enfield Town, Middlesex.



OF RADIO ON EASY TERMS

In addition to their own extensive range, PETO SCOTT offer YOU Every Known make of Receiver or Component, all on EASY TERMS!

Here is a selection, but please fill in the coupon below and state your requirements.

The "TITAN" THREE. Send only 10/- balance in 11 monthly instalments of 8/1.

The "TITAN" TWO. Send only 10/- balance in 11 monthly instalments of 6/7.

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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 136.)

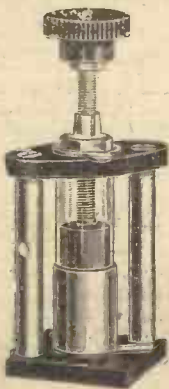


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obtaining splendid results, with complete set, including L.S. and batteries, in case measuring 15 in. by 15 in. by 7½ in., but cannot dispense with the earth as the connections are now.

"On March 10th, between 6.30 and 7.30 p.m., I received about thirty stations at very good L.S. strength. A three-valver to beat the 'Titan' has yet to be made. (London, 5 G B, Radio Paris, and Hilversum come in on the speaker with the aerial disconnected.)"

Unfortunately, it is not possible, whilst employing the present tuning arrangement, satisfactorily to construct a portable set from the "Titan" Three.

If the set is rearranged as per the first three stages of the "Transportable" Four (which was fully described in the February issue of "Modern Wireless"), an excellent portable set should be the result. The frame aerial in your case would consist of 20 turns of No. 22 D.C.C. spaced about ½ in. apart. The reaction winding has 7 turns (same wire in same direction, unspaced, against the "filament" end of the main winding).

FROM 20 TO 70 METRES.

C. M. (Stoke-on-Trent).—"Can you tell me of a good short-wave set that will work over the wave-band from about 20 to 70 metres in which I can use the following parts: Two valve holders, L.F. transformer, .00025 mfd. condenser, and potentiometer 400 ohms?"

An inexpensive receiver to cover the wave-band you mention is described in the "P.W." Blue Print Circuit No. 39. It is called the "Sydney" Two, and can be obtained upon application to the Query Dept.

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if a 6d. postal order is enclosed for same, together with a stamped, addressed envelope for return. The full list of parts required to build this set is given below, and it will be seen that all the parts you mention are included:

1 panel, 14 in. by 7 in. by ½ in.; 1 cabinet to fit, baseboard 10 in. deep and pair of brackets; 1 .0003 mfd. variable condenser, square law or S.L.F., with slow-motion or vernier drive; 1 .00025 mfd. miniature reaction condenser; 1 on-off switch; 2 baseboard rheostats to suit valves (usually about 6 ohms); 2 sprung valve holders; 1 grid leak and holder, (2 meg. upwards); 1 .0002 mfd. fixed condenser; 1 .0005 mfd. fixed condenser; 1 400-ohm. (200 will do) baseboard-mounting potentiometer; 1 L.F. transformer; 1 2-in. tube of any good insulating material, ¾ in. long, for H.F. choke; 1 piece of ribbed ebonite tube, 3 in. diameter and 3 in. long; 3 tapping clips; 1 terminal strip with 7 terminals; 1 terminal strip with 2 terminals; various pieces of wood, copper sheet, ebonite, etc., for series condenser ("air") and coil mounting; small quantity of No. 34 S.S.C. wire for reaction coil and H.F. choke (75 turns on tube), and a few yards of No. 18 plain copper wire for coll. ACCESSORIES: 1 valve, H.F. type; 1 valve, L.F. or power type; H.T. and L.T. batteries to suit valves, pair of 'phones, grid-bias battery.

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"Can you tell me of a back number of 'P.W.'"

(Continued on next page.)



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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

in which was given a way to put up a moving-coil loud speaker from the kit of parts supplied by makers?"

An article on this subject appears in the January 5th issue of "P.W.," No. 344. (Back numbers of "P.W." which are still in print can be obtained from The Amalgamated Press, Back Number Dept., Bear Alley, Farringdon Street, London, E.C.4, price 4d. per copy.)

NEUTRALISING THE "FANFARE" FIVE.

"The set is called the 'Fanfare' Five, and it was built from a description which appeared in 'P.W.' last November. In the article describing the set it said that neutralising would be described later, but I have not this copy of 'P.W.,' so can you tell me how the neutralising is carried out?"

Here is the procedure: When the set is finished and first put on test (or when valves are changed at any later time) you should set all the neut. condensers to minimum, and likewise the reaction condenser.

Then set the tuning dials to a mid-scale reading, and move the right- and left-hand ones a trifle either way, noting whether the set is oscillating. It probably will be, but if not increase the setting of the reaction condenser very carefully until it only just does when the three dials are in step.

Now increase each neut. condenser by an equal very small amount, and see whether oscillation stops. It almost certainly won't, so increase the neut. a little more and try again, swinging the tuning dials while you test for oscillation so as to make sure the circuits are in tune with each other.

If oscillation stops here, note carefully the setting of the neut., then go on increasing them and re-tuning until you find oscillation beginning again. When this

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happens turn the neut. back half way towards the setting you had previously noted and the job is done.

This method gives quite a good result, but it is as well to check up on a distant station when you have found one. Tune it in carefully and bring up the reaction as far as you can without making the set oscillate. Now see whether a slight re-adjustment of the neut. will make it more stable—that is, will enable more reaction to be applied before oscillation starts.

If so, make the new setting permanent, for it will enable you to make better use of the reaction on very weak stations. Of course, when you alter the neut. condenser settings you must remember to re-tune a little, to keep the station fully tuned in.

TESTING THE H.T. BATTERY.

S. A. (Bournville).—"Since purchasing a voltmeter I have noticed that the voltage of the H.T. battery varies a little according to whether it is tested when the set has actually been working, or just after it begins working, or after the battery has been standing idle for a time. Which is the correct voltage?"

The most satisfactory method of testing the battery is by means of a *high-resistance* voltmeter. The meter should be joined across the H.T. + and - terminals, after the battery has been in use for half an hour or more.

The reason for allowing such a period to elapse is that a battery recovers its voltage if left for a few hours when it is not "on load." When, however, current is taken from it, the voltage drops to a value depending upon the actual condition of the cells. This explains the advisability of taking the voltage reading after the battery has been in use for a period, as only in this way can a reliable indication of the state of the battery be obtained.

A CORRECTION.

We are informed by Ward & Goldstone, Ltd., that the price of the "Goltone" Plug-In Ultra Short-Wave Coils for the Melody Maker is 7s. 6d. per pair—not 6s., as stated in the advertisement on page 71 in "P.W.," March 23rd issue.

THE NOW READY
THE POSITELY MARVELLOUS
NEW
DARIO
SUPER H.F. AMPLIFICATION
VALVES

7/6
SUPER H.F. 3.5V. 1 AMPS
SUPER H.F. 11 VOLT 1.8V
1.8 AMPS

ALSO
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5/6

Radio-Micro's latest and greatest. These two remarkable valves are unique in that they are the only valves satisfactorily fulfilling the public demand for a super-amplification and economical H.F. valve.

Dario are the only valves at half price which are GUARANTEED LONG-LIFE.

NOTE THESE OUTSTANDING CHARACTERISTICS OF THE SUPER H.F.

Impedance, 25,000 ohms.
Co-efficient of amplification, 25.
Slope or Mutual conductance — 1 milliamp per volt.
Astonishingly successful

results on short waves, down to 10 metres (limit of present experiments).
R.C. Coupling Super Amplifier on lower stages of R.C.C. using 200,000 ohms as anode resistance.

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| Super H.F. & R.C.C., .18 amp. | 7/6 | Super H.F. & R.C.C., .1 amp. | 7/6 |
| Pentodion, .3 amp. | 21/- | Pentodion, .15 amp. | 21/- |

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TECHNICAL NOTES.

(Continued from page 124.)

Compensating.

Another arrangement is to connect two valves together in cascade and to connect the low-tension A.C. supply directly to the two filaments, a potentiometer, however, being shunted across the ends of the first filament. The fluctuations set up in the first valve are passed on to the grid of the second valve, and by suitable adjustment of the potentiometer the phase is controlled so as to be set against the A.C. fluctuations which arise in the second valve.

In other words, the A.C. fluctuations in the first valve are balanced against those of the second valve by means of the potentiometer. Under favourable conditions the balancing of these two effects may be brought very close, and the consequent A.C. hum, as reproduced finally in the loud speaker, can be brought to a very low minimum.

Record Tracking.

In some of the gramophones manufactured to-day, especially the cheap, portable models, the needle (or rather, the needle-holder on the sound-box) is set at a very wide angle against the record, that is, the needle when the machine is working is much nearer to the vertical than it should be. This means increased wear upon the needle and the record, and it is much better to have the needle at an angle of not more than 45-50 degrees. By this I mean the angle between the needle and the record or, if you take the angle between the needle and the vertical, this should be not less than 40-45 degrees. Some people recommend an angle of 30 degrees to the vertical (or 60 degrees to the horizontal), but in my opinion this is not the best angle. In some of the gramophones there is a "stop" fixed so that it is impossible to reduce the angle between the needle and the record below about 60 degrees. I think it tends to make the reproduction very scratchy and to wear out the records much more quickly than need be.

Life of Records.

Another point which deserves attention is the angular movement of the tone-arm across the record as the latter is being played. Of course, if the tone-arm is too long or too short, and otherwise badly designed, there is very little the user can do, but it is a good thing, so far as possible, to arrange the tone-arm so that when moved towards the centre of the turn-table the needle-point travels more or less tangentially to the grooves in the record.

If the tone-arm is too long or too short, you may get bad tracking owing to the track of the needle across the record being in the wrong relation to the sound-grooves on the record itself. Any bad adjustments in these respects detract from the quality of the reproduction and, what is equally serious if not more so, they tend to shorten the useful life of the records.

Beam Radio.

The beam system of long-distance transmission has many very important advantages, some of which are obvious to the layman, whilst others are clear only to the

(Continued on next page.)

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TECHNICAL NOTES.

(Continued from previous page.)

radio engineer. Almost everybody knows that one of the principal advantages of the beam system is that the energy is concentrated more or less into a definite direction instead of separating out in all directions, and therefore the amount of energy required at the transmitter to produce a definite amount of energy at the receiver is only a very small fraction of that which is required by ordinary long-wave transmitting methods. This means that messages may be sent by the beam system with an extraordinarily small amount of energy used in the transmitter.

Short Waves.

The concentrating of the energy into the form of beam, however, involves the use of comparatively short wave-lengths, and this remark applies not only to radio waves, but also to waves of other kinds, including sound waves, to which I shall refer again presently.

The use of the short waves in itself has certain advantages, and one of them is that the duration of the "dot" in Morse telegraphy may be reduced to a small fraction of that which is necessary with long-wave transmission. The "dot" signal has to be

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maintained over at least a certain number of waves and you will very easily see that on long wave-lengths the minimum duration of the "dot" signal must be correspondingly longer than on short wave-lengths.

Speeding Up.

The availability of a much shorter signal means that the sending of messages by telegraphy can be very much speeded up, and in practice it has been found that over the beam short-wave system the transmission can be enormously expedited. The wave-length used in the beam system is usually about 30 metres or even less.

Just as the use of long radio waves imposes limitations upon the signalling speed, so limitations are also imposed in cable transmission by the capacity and other properties of the cable, and the rapidity with which impulses may be sent over the transatlantic cable, for instance, was formerly apt to be very slow. Fortunately methods have been found for counteracting the effects just mentioned, one of the best-known methods being that of "loading" the cable at intervals by means of coils.

(Continued on next page.)

TECHNICAL NOTES.

(Continued from previous page.)

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METERS. Millimeters, all ranges, 15/-; 0 to 500 volts, 45/-. Weston Meters, to 1,600 volts; Weston 60/- Micro Ammeter for Grid Bias testing, 35/- only; Elliott and other Testing Sets, E.108, 4 ranges, amps. and volts, 45/-. G.E.C. Hot Wire, 1 amp., 4/-; Silvertown Galvos, 7/6. Relays, 7/6. **GUN TELESCOPES,** 25/-; Wind Speed Meters, 5/-; Torpedo Gyroscopes, 15/-.

WHEATSTONE BRIDGES. G.P.O. and Dial types, £7 10s. Mirror Galvos Reflecting Beam, by Paul, Gambrell, Sullivan and Tinsley, £3. Standard Resistance Boxes and Universal Shunts, 35s. Electrostatic Voltmeters £4. Capacity Bridges, £8.

TRANSMITTING VALVES. 6-volt, 40 watts, 4/6. **WAVEMETERS** by Townsend, Paul, Silvertown, Gambrell and Marconi, from 15/-. Heterodynes, 500/3000 m., 10/-.

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This has the effect of breaking up the cable (in the electrical sense) into a number of shorter cables in series and the rapidity of transmission may be very much increased. This method of loading has been largely developed by Professor Pupin, the well-known Radio engineer, and has been brought to such a state of perfection that it is possible even to transmit telephony over long distance cables in this way.

Sound Beams.

I referred above to the fact that short waves were more adapted for concentrating into a beam and that the same remarks applied to sound waves. This brings us to an important use of short sound waves and one which was developed largely during the war. If we have a source of high-frequency sound waves (in other words, a very high-pitched sound emitter) and this is immersed in the sea, the sound waves which it sets up can be made to travel roughly in the form of a beam and can, therefore, be directed in any required direction.

Depth Sounding.

If they are directed vertically downwards they will be reflected from the sea-bottom, and the sound will return in the form of echoes to the place from which it was sent.

MODERN WIRELESS

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The Leading Radio Magazine

By means of timing devices, it is very easily possible to determine accurately the interval between the sending out of a signal and the return of the echo and, knowing the velocity of sound in sea-water, we have an immediate indication of the distance from the sounding ship to the bottom of the sea.

This forms, therefore, a very simple and rapid method of taking "soundings." It is now known as "acoustical depth sounding" and has very much superseded the old-fashioned method of sounding by means of a weight and line. Moreover, it may be used at depths and in conditions where it would be impossible to use the mechanical method.

Locating Objects.

The fact that the sound can be formed into a beam also permits this method of sounding to be used for locating submerged objects, such as a submarine, the beam being sent out in different directions and the echo observed.

While on the subject of echoes, it is interesting to recall that Professor Stormer, of Oslo, has recently discovered, when working on 30-metre signals, that he got echoes occurring about 5 to 15 seconds after the signal. Stormer has been working on this curious phenomenon for some time past, and has come to the conclusion that the reflection takes place from an electronic layer at some distance beyond the Heavily-laver.

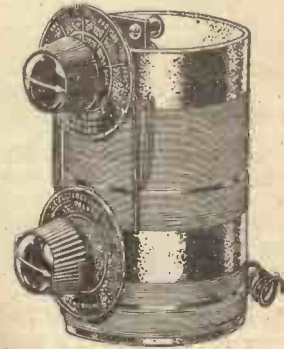
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In some ways a separate H.F. unit is one of the simplest of all circuits in which to incorporate wave-change switching, for there is no provision to be made for reaction, as a rule. True, there may be a little difficulty with neutralised circuits, but where a screened-grid valve is used it becomes an exceedingly simple matter.

The example chosen for this week's White Print is a good example of a design specially worked out to show how simply it can be done. There is no need even to use special coils if we are aiming, as in this case, at the utilisation of odd parts. It can be done quite well with plug-in coils of sizes which most people have at hand, and although it may not make so neat and easily built a unit as one with a "Titan" coil, we can still get our desired wave-change switching.

Quite a number of ways of arranging a wave-change circuit with plug-in coils have been devised, and different schemes have different advantages. The one illustrated is probably somewhere about the best for all-round convenience and simplicity, however. It is fully adjustable as to aerial coupling, i.e. selectivity, on both wave-bands, and it achieves its ends with only four coils in all.

Simple Wave-Changing.

If you take a look at the circuit diagram you will quickly see how the wave-change switching is worked, for it is a particularly simple method in this case. You will observe that there is a pair of plug-in coils forming the primary and secondary for the lower waves (L_1 and L_3), and another pair (L_2 and L_4) for the higher waves.

When working on the high waves both pairs of coils are in use, being connected in a series fashion, while on the lower waves the high wave pair are shorted right out by the action of the switch. Since they are well separated from the other pair any losses which might occur when they are shorted out in this way are so small as to be negligible.

Since we have in this scheme a separate primary coil for the low waves and a separate supplementary one for the long we obviously have a very good control of selectivity on both wave-bands. Since, further, the secondary coils (L_3 and L_4) are of the plug-in type, we can obviously work on any desired wave-lengths by choosing the correct sizes.

The usual pair of wave-bands, of course, are the 250-550 and 1,000-2,000 metre ones, and for these L_3 should be a No. 60 and L_4 a No. 200. The primaries (L_1 and L_2) require picking to give the desired degree of selectivity for a particular locality, but, as a rule, a No. 25 or 35 will be right for L_1 (low-wave coil). The smaller coil gives the higher selectivity, but the larger one gives slightly more volume as a rule.

THE "P.W." "WHITE PRINTS."

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This week we publish the eighteenth of our White Prints. This page may be easily and safely torn out—along the dotted line overleaf—and the "White Print" filed. In due course you will thus have available an encyclopaedic collection of the best circuits used in modern radio practice. A "White Print" will be published on the last page every week in "P.W." until further notice.—THE EDITOR.

For the long-wave control of selectivity we turn to the coil L_2 . Here the sizes required are usually slightly smaller than those for an ordinary circuit, because we have also the coil L_1 in series on the long waves. Suitable sizes, then, are generally Nos. 50, 60 and 75. A little testing is

COMPONENTS REQUIRED.

- 1 Panel, 7 in. x 9 in. x $\frac{1}{8}$ in. or $\frac{1}{4}$ in.
 - 1 Cabinet to fit, with baseboard 10 in. deep.
 - 1 .0005 mfd. variable condenser.
 - 4 Single-coil holders.
 - 1 On-off switch.
 - 1 Wave-change type switch (see text).
 - 1 Valve-holder.
 - 1 Standard screen, 6 in. x 10 in.
 - 1 H.F. choke (must be a really good make).
 - 1 Fixed condenser of .001 mfd.
 - 2 Mansbridge condensers of $\frac{1}{4}$ to 1 mfd. each.
 - 1 Terminal strip, 8 in. x 2 in. x $\frac{1}{4}$ in.
 - 7 Terminals.
- Wire, screws, a little flex, etc.

needed here, however, as in the case of L_1 , to suit your own particular conditions of aerial, and so on.

The Correct Switch Type.

Now about that wave-change switch. Be very careful to get the right type here, for the whole working of the unit may be upset by the wrong sort. Two types can

be used: the one illustrated is simply an L.T. on-off type of the kind with two side springs and a central metal plunger. A third connection is made with a little piece of flex soldered to the tip of the metal plunger, the other two leads going to the usual two terminals.

The other type is one specially produced to suit these circuits, and

has a metal plunger as before and three spring contacts instead of two. In one position all the contacts touch the metal end of the plunger, and in the other when the knob is pushed in they touch only an insulated portion of the plunger, and so are all separated. The action is exactly the same in each case, and either type can be used. With the second form, by the way, there is no need for the extra flex lead, since the switch has three terminals and the three leads go straight to these in any order.

Connecting Up to the Set.

The usual parallel feed output circuit is provided for the screened-grid valve (note that only the S.G. type can be used in this unit), and the output terminal is normally to be wired across with as short and direct a lead as possible to the aerial terminal of your set. (Keep it clear of all other leads.)

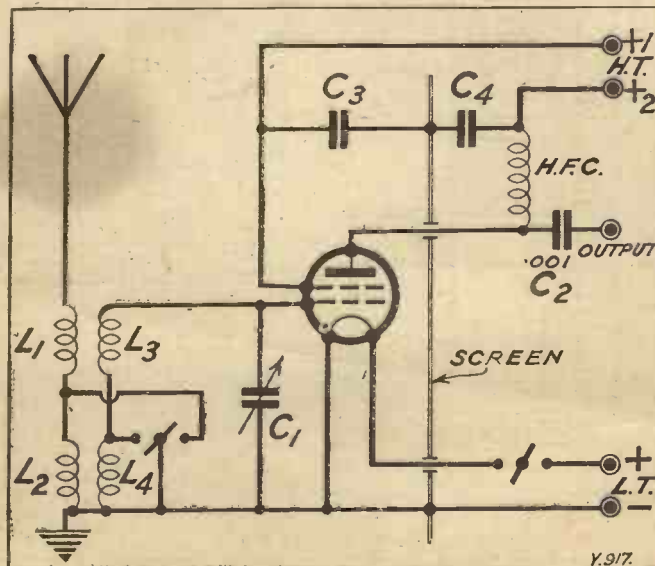
The battery connections to the unit are just the ordinary ones, but note that there is no H.T.—terminal, because you will presumably use the same batteries with the unit as with the set proper. This is just the usual scheme with amplifier units, of course, whether H.F. or L.F. The aerial goes to the A terminal on the unit and the earth to E instead of to the old earth terminal on the set.

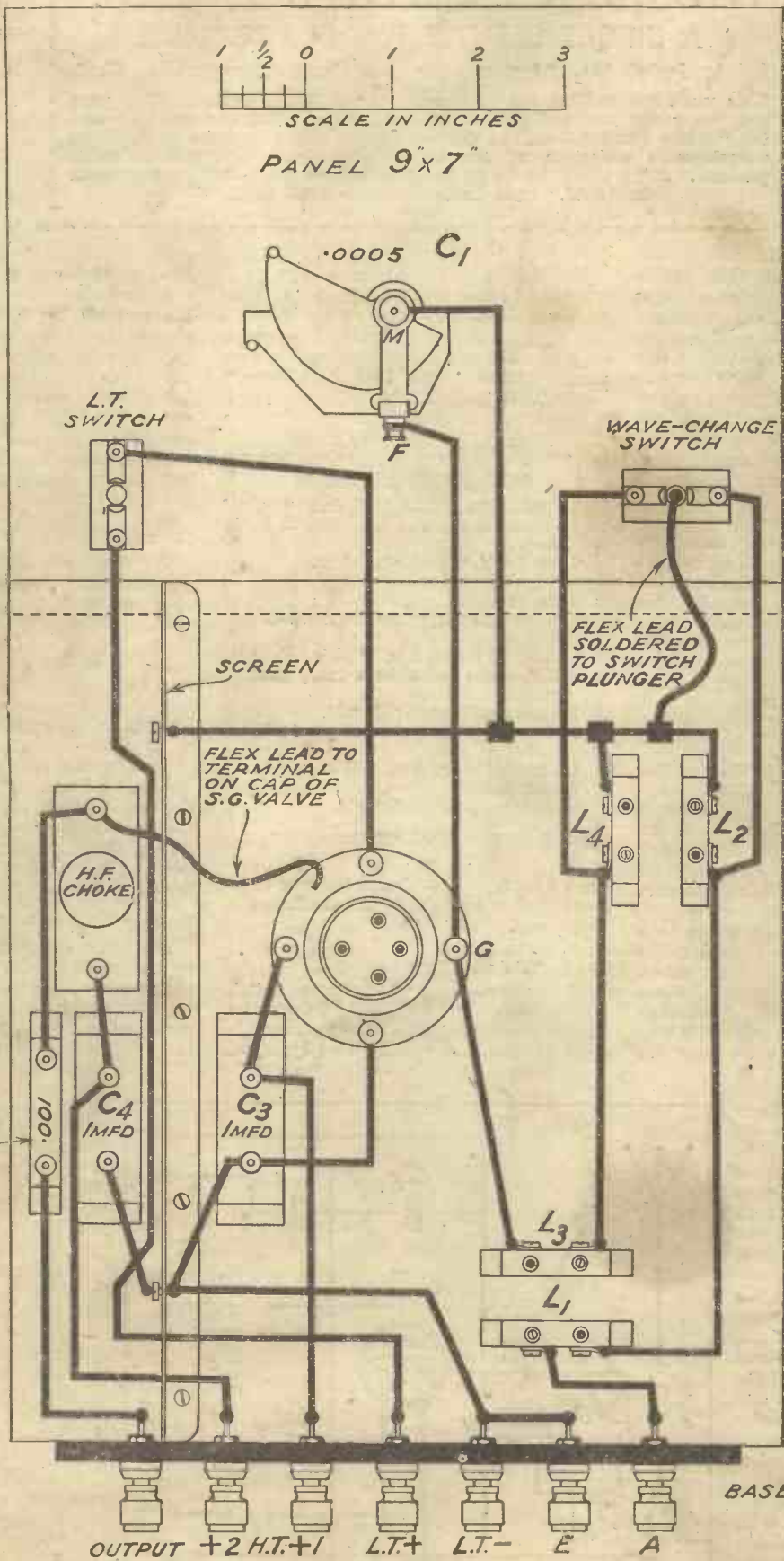
Working Voltages.

The L.T. voltage will, of course, depend on that used for the set, and you should choose a screened-grid valve of the appropriate filament rating. (The correct type is the one with the true anode connection to a terminal on top of the valve. It is now available in all filament voltages.) The H.T. voltage on H.T.+2 must be at least 100 volts, and preferably 110 or 120. This is most important. The best voltage for H.T.+1 (the screening electrode of the S.G. valve) must be found by trial, but it will usually be between 60 and 75 volts.

By the way, when the unit is working in front of your set, try "tightening" what used to be the aerial coupling. This simply means that if you have a plug-in "aerial" coil in the set you should try a size larger than before, e.g., a No. 35 or 50 instead of perhaps a 25.

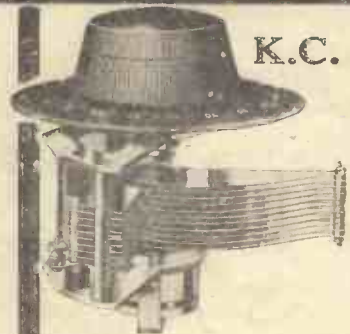
This will generally give you a very distinct increase of volume, and selectivity should still be quite good. Again, with a set having auto-coupling for the aerial, or a tapped primary winding, try the highest tap, and see whether this does not improve the volume.





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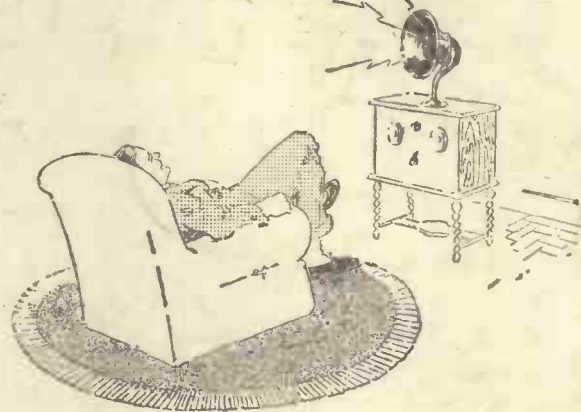
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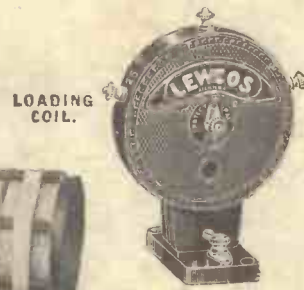
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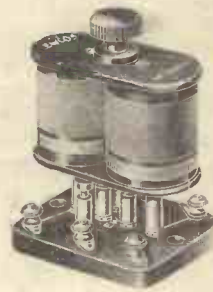
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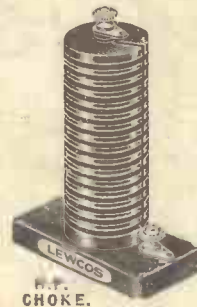
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