POPULAR WIRELESS, February 4th, 1928. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

ANOTHER GREAT GIFT NUMBER

Popular Wireless

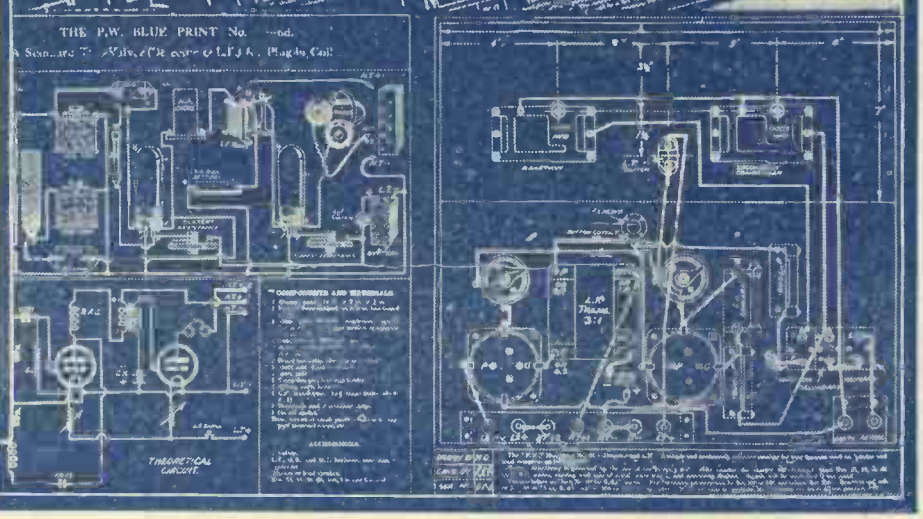
Every Thursday PRICE 3d.

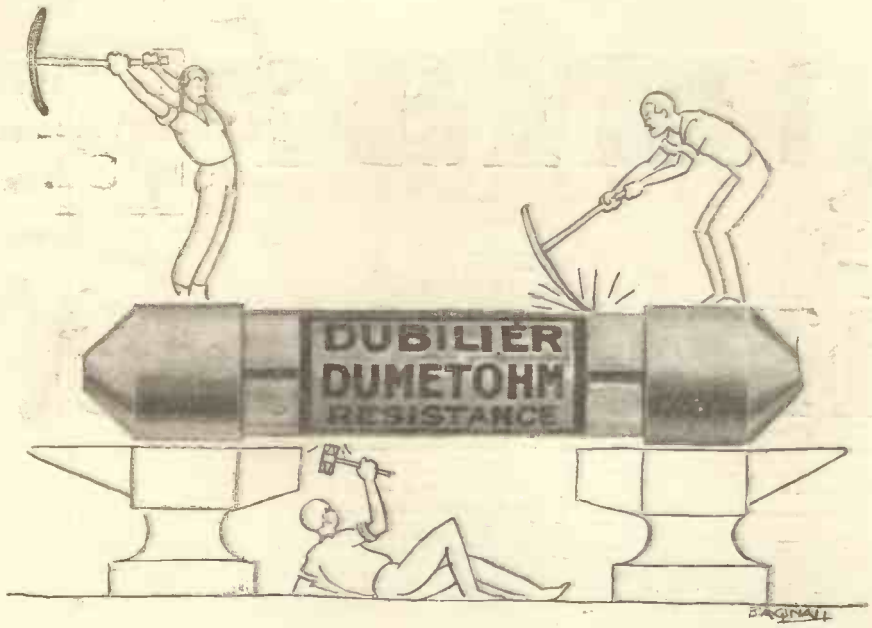
No. 296. Vol. XII. INCORPORATING "WIRELESS" February 4th, 1928.

Four More 6d BLUE PRINTS Free!

Add FOUR MORE BLUE PRINTS to Your Collection FREE!

Next week they will cost you 6d. each!





What would Happen?

THIS is not an invitation for you to have a Dumetohm broken up to find out what would happen "if the air gets in" or to see what's inside.

In the first place the air is there already—it was never taken out. And if you do break the glass you won't find any form of carbon resistance inside—that type went out when arks were popular.

All you will see is a straight golden rod which has been metallised by a very special process to give just that smooth, unvarying resistance so essential to clear Radio reproduction. Neither temperature nor voltage affects it appreciably, it has no self inductance, no self capacity and is *"easily the most popular resistance in the country"* as your dealer will tell you.

See that the Dumetohm figures in every set you build.

All Dubilier Products are fully described in the catalogue shown here. In addition there is a lot of information which you may find interesting. If your dealer has run out of copies we will forward you one free.

Dubilier Dumetohm Resistances. .25, .5, 1.5, 2, 3, 4, 5 and 10 megohms. Price 2/6 each.

Dumetohm Holders. Price 1/- each.

DUBILIER
REGISTERED TRADE MARK

DUBILIER DICTA

No. 6.

Have you Electric Light? If so why put up with an outside aerial which implies ladders, masts and much precarious scrambling on the roof?

The Ducon is simplicity itself to use. Plugged into a lamp holder and connected to the receiving set it forms a highly efficient and selective aerial, consumes no current is perfectly safe, eliminates risks from lightning and reduces morse and atmospheric interference.

"much precarious scrambling."

To meet all the variety of wiring systems and reception conditions with which we are blessed in this country it is only natural that provision should be made for connecting the Ducon in many different ways. Try them through according to the full instructions supplied with each Ducon.

For instance, your Ducon may give best results when the switch controlling its lamp holder is turned off. It may be found that reception is improved by connecting the Ducon to the Earth terminal as an auxiliary to the existing earth (it is tested at 2,500 volts!)

In short, there are numerous ways in which the Ducon will prove an invaluable thing to have by you if only as a "stand-by" in case your aerial carries away. Send us a P.O. for 5/3 to-day (or order C.O.D.), mentioning this paper. We guarantee you satisfaction—or your money back—and you will find it the best investment in wireless you have ever made.

Incidentally, if you only have one lighting point in the wireless room, your electrician can supply you with a two-way holder enabling you to use both Ducon and light.

Advt. of The Dubilier Condenser Co. (1925) Ltd., Ducon Works, North Acton, London, W.3.

T.C.112.

Your duty towards your neighbour!

ONE H.F. STAGE

There is a large Public who are content with reception from the local Station and Daventry, whose requirements can be met by the ordinary 3 Valve re-acted Detector Set of which there are so many varieties advertised with fanciful names. To get more than this inevitably means "oscillation" with consequent howling and annoyance to your neighbours.

The B.B.C. definitely state that one H.F. stage is essential at the following ranges, if loud speaker reproduction is to be anything but "indifferent":—

100-150 miles from	Daventry.	5XX.	4 Valves.	1 H.F. stage.
50-100 „	„	„	5GB.	„ 1 H.F. stage.
Over 15 „	„	Main Station		„ 1 H.F. stage.

These figures obviously allow for that factor of safety which is so necessary if consistently pleasing reception is to be obtained under all conditions.

One neutrodyned stage of H.F. will give that additional sensitivity necessary for more distant reception, with radiation reduced to a minimum.

The Met-Vick 4 Valve A.N.P. Constructor's Set is the ideal solution. With the additional H.F. stage, there is no need to force the set. Using A.N.P. coils the set is stabilised, screening is unnecessary and high voltage factor Valves can be used. Additional selectivity is provided by a Tuned loose coupled aerial circuit, brought into action when required. Delightful to operate and cheap to build, the parts with two sets of coils costing only £9.

The Met-Vick A.N.P. 4 is pre-eminently the 4 Valve Set of the Day.

If unable to obtain instruction book from your dealer, write for Publication No. 7117/5 or 7117/4 (the A.C. Valve Model) free on request.

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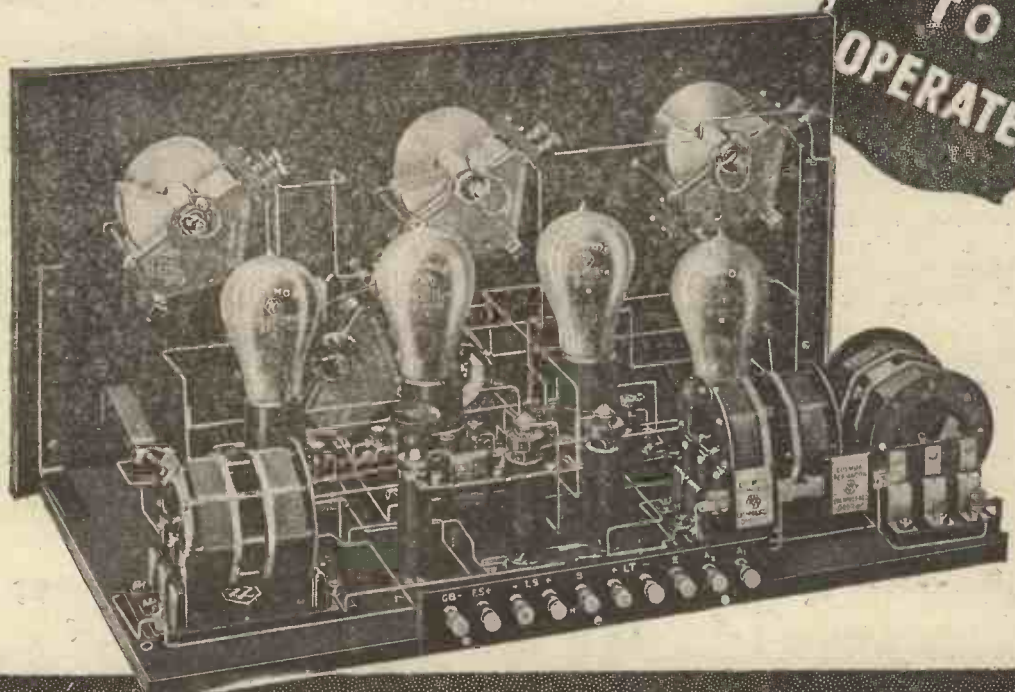
EASY TO OPERATE

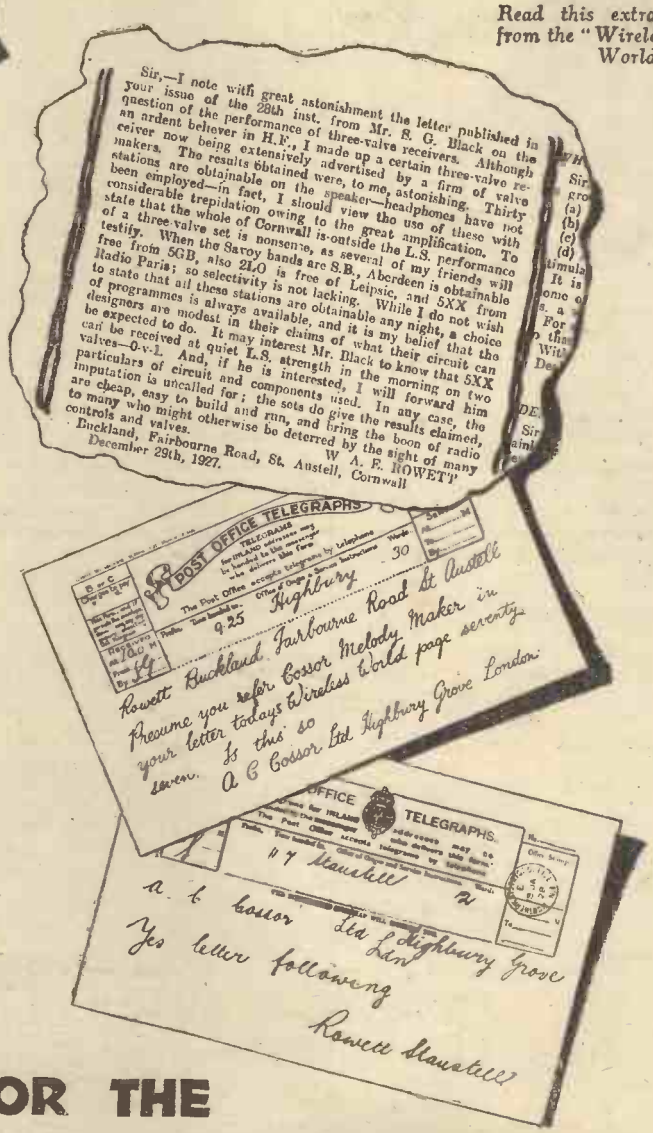


RP 104

METRO VICK SUPPLIES LTD 155, CHARING CROSS RD. LONDON. W.C.2.

MR. ROWETT SAYS WE'RE TOO MODEST!

Read this extract from the "Wireless World"



HE'S right. We *are* modest in our claims for the Cossor "Melody Maker." We do not believe in over-statement. We know that we can say, *truthfully*, that anyone who builds the Cossor "Melody Maker" according to instructions will, without difficulty, obtain broadcasting concerts from seven countries. That, in itself, is a remarkable statement. Yet Mr. Rowett, in a corner of England which is notoriously bad for Wireless reception, gets results which surpass all our claims. Nor is he alone. From Land's End to John O'Groats comes a daily stream of thanks from satisfied users. Each one tells of new stations heard—stations in all parts of the continent . . . even of American broadcasting. And every letter that comes is another link in the chain of evidence which proves the record-shattering efficiency of the wonderful Cossor "Melody Maker."

"Cheap, easy to build and run," says Mr. Rowett. Ask your Dealer for the free chart, "How to build the Cossor 'Melody Maker'", and see for yourself.

IN OUR CLAIMS FOR THE

COSSOR

"Melody Maker"

Advt. A. C. Cossor, Highbury Grove, London, N.5.

Popular Wireless

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RADIO NOTES AND NEWS.

Agony of a Die-Hard—Those Angel Voices—The Young Idea—Filadyne Fills the Log—(Human) Nature Note—Culchah for All—Sweated Songsters.

Agony of a Die-Hard.

JUST met a no-radio "die-hard" whom I stupefied with delight by means of giving him, almost against his better judgment, a B.B.C. National Concert out of my loud speaker. This poor man has a fine organ which is too loud for the house; a piano which he can play—but not from printed music; and he wants a gramophone, but is afraid his family will demand jazz records. He knows the answer is, "Get a broadcast receiver," but if he acts accordingly he will have to eat many, many of his words about radio. Rough!

Pronunciation.

A READER who was shocked by my use of the words "lallapalooza" and "sannakatowser" last month, asks me "not to do it." I confess that I put them in hoping that the B.B.C. authorities would tell us how they should be pronounced.

Polite Correspondence.

NOW for a juicy bit, the best I have struck since the Scots yowled round St. Paul's on December 31st-January 1st. A reader whose address is in the "Poultry," E.C., wrote to the B.B.C. asking whether that body approves and commends the pronunciation, by one of its Announcers, of lost (*lorst*), wireless (*wahless*), cricket (*crickit*), orchestra (*awkstrah*), and several other words. The B.B.C. replied, agreeing with *crickit* and one or two others, and suggesting that the distortion caused by the receiver was "largely responsible" for the other eccentricities observed.

Was it "Crickit?"

NOW, the B.B.C certainly delivered themselves into the enemy's hands, and I am bound to say that the enemy took full advantage of that, and smote them very hard indeed by pointing out that his receiver did not make *other* announcers say "lorst," or Sir Oliver Lodge, "wahless." He also asked the B.B.C to tell him the name of the dictionary which gives the pronunciation of cricket as *crickit*, and why they allow one particular announcer to disregard such a sacred thing as correct pronunciation.

The Oracle Speaks.

AS the B.B.C. was well aware that someone at 2 L O says "wiliss orkisstrah" they passed the buck to Mr. Lloyd James, their head pronouncer, who was to annihilate the impertinent inquirer. His letter strikes me as that of a cheeky boy trying to bring off a Johnsonian rebuke—a squib masquerading as a "Jack Johnson." He says, *inter alia*, that because the pronunciation of the announcer does not meet with the Poultry man's approval is no reason for removing the announcer. As I said before, the B.B.C. needs self-control—and its officials smaller hats. But I feel that the Poultry man has used a bludgeon where a pin would have served.

The Optimist.

MY habitual gloom was slightly pierced the other day by a little bit of joy supplied by a writer in "The News of the World." Writing about the dangers of controversial broadcasts, my Irish friend makes the following joke:—"For example, the father of a prominent public man died of apoplexy as a result of reading one of Mr. Lloyd George's speeches, while others *who did likewise, no doubt survive to this day.*" Personally, I should prefer to survive without first dying of anything.

"Those Angel Voices."

A PARIS radio journal—and what medium is better able to discuss the subject—has investigated the all-important question of lady announcers. It judges that they are popular and on the increase in Europe. In particular, there is, it seems, a Belle of Barcelona whose voice is her fortune, sir, she says. Gifts ranging from strings of Spanish onions and guitars, to offers of marriage, have rained upon her. I can foresee a lot of dial-twiddling Spain-wards, now. *And*—we don't care how she pronounces, either! I wish that Auntie Sophie and Rex Palmer were appointed announcers in perpetuity.

Now Then, Sea Lawyers!

HERE'S a pretty little problem. A man in Clinton, Iowa, U.S.A., was listening to W E A F (New York), when, he alleges, the vibrations from his loud speaker shattered a valuable vase. He wants to know whether an action would lie in this case. Now was it his fault for operating the loud speaker, or was it the fault of (*a*) the maker of the loud speaker, (*b*) the soprano who hit the high note, or (*c*) the proprietors of W E A F?

The Young Idea.

G. R. (Clapham) is 14 years old, but is already a deep-dyed "P.W." fan, and knocks off four-valvers as slick as you or I might roll a "gasper." This precocity is slightly terrifying. I remember

(*Continued on next page.*)

A RADIO-CONTROLLED TRAIN.

Major Raymond Phillips demonstrating his wireless-controlled train at a recent exhibition in London. With the transmitter contained in the box in his hand he can make the little train stop and start and travel in either direction without going near it. Older readers will remember that Major Phillips gave constructional details of his system in "P.W." three or four years ago, and will also recollect his music-hall turn with a wireless-controlled airship.

NOTES AND NEWS.

(*Continued from previous page.*)

that when I was his age I was experimenting with wet (and messy) batteries, and thought myself no end of a scientist. G. R. says he follows the theoretical diagrams more easily than the pictorial. Ah, lad, the pictures are put in for the use of experts; but if you work hard you'll be able to understand them some day. Meanwhile, follow "P.W." and don't neglect "physical jerks."

Still Younger Idea.

WE are now down to the age of thirteen, when one is proud of one's trousers, and washes almost voluntarily. R. N. Linell (W. Ealing) is thirteen, and on his last birthday was given by someone who knew his flair, a set of components for the "P.W." Hale One-valve Reflex. Hastily assembling the parts, our young friend proceeded to give Europe a thorough investigation, and, judging by the results, he got about all there is to get—forty-eight stations, twelve of L.S. strength. He is now prepared to defend his bantam-weight belt against all listeners of his class. He will be a Bart. before his father. I can read his writing without specs. or grunting. I like him.

"She Shall Have (Radio) Music," etc.

———wherever *he* goes. Yes, a fine radio "fan" was lost when Mr. Macomber, of California became rich enough to own the motor-yacht "Crusader," a vessel which almost amounts to a serious rival of Marconi's yacht "Elettra" in completeness of wireless equipment. It can pick up broadcasting practically anywhere, and nearly every room aboard has a loud speaker. Moreover, so that he and his guests shall not lack music when they are ashore chasing big game this very thorough gentleman has a broadcasting transmitter aboard.

"Bang Bang"; Likewise "Pom Pom."

THE hunting party will carry portable receivers, and the yacht will transmit for its benefit. One hopes that the programmes will not spoil the aim of the marksmen, especially if the quarry be charging lion or elephant, for these will not be found susceptible to talks on butterflies, and even Chamber Music cannot get through a rhino's skin, though it would probably take the nap off.

(Human) Nature Note.

ONE of the Governors of the B.B.C.—or, rather, the Governess—who has had a few words of criticism of the B.B.C. published recently, is reported to have said that in spite of her views she would not dream of resigning. I should think not! I never saw £700 per annum picked up so easily. Whilst I am on this subject I should like to ask, "What qualifications has the Comptroller of the Bank of England which fit him to help to govern the B.B.C.?"

The "Filadyne" Fills the Log.

A. M. (W. Bromwich) made up the "Filadyne" and caught an earful. He has not had a silent moment since. Some 32 stations have been netted by this wonder set, including Rome, Seville, Toulouse, Madrid, Barcelona, Cologne, and 13 stations in the British Isles. Our Mr. Dowding, the father of the Filadyne and others, gloated over A. M.'s letter till he fell into a trance, emerging an hour later with the complete lay-out of the "Filadyne 1928" in his mind.

The Favourite.

ACCORDING to the letters received by the B.B.C., the most popular special programmes broadcast by them during 1927 were the "My Programmes." Surely the B.B.C. can see the moral of this, for "My Programmes" were drawn up by human beings and not by specialists, or, at least, not on lines indicated by a Board of Governors who, however talented, are not fitted for gauging the tastes of the great mass of the people. The lesson to be learned from this "sticks out a mile."

SHORT WAVES.

A wireless wag remarks that there is no place like ohm. A confirmed meat-eater might retort that there is no plaice like ham.—"Bystander."

* * *

FLAMING YOUTH.

We hear that a certain Melbourne father has nicknamed his son and daughter "Sydney" and "Adelaide" because he can never get them in during the day and finds it very hard to get them in at night.

* * *

Broadcasting the time is a Big Ben-efit to people in the country.—"Daily Mirror."

* * *

Daughter: "And is the wireless set really mine, daddy, and the loud speaker, too?"

Dad: "Yes, my dear."

Daughter: "And when I marry I can take it away with me?"

Dad: "Yes, but don't broadcast the fact too much; it might spoil your chances."

* * *

"All inventions have their disadvantages. It's bad enough to listen to some sopranos on the wireless, without having to look at them as well."—"News of the World."

* * *

A TRYING TIME.

It has been reported that several ladies visiting the studios have remarked that the atmosphere of a broadcasting station depresses them.

Perhaps the notice "No talking allowed" has something to do with it.

* * *

"Tresses," (Morriston). No, the marcel wave is not yet made use of in wireless. It has been known, however, to be used for the capture of young sparks.—"Cambria Daily Leader."

* * *

Son: "Hey, dad, where can I see an example of remote control?"

Dad: "Ride in the back seat with your mother."—"Radio News."

* * *

Good wishes received by the B.B.C.:

"Congratulations. Your programme was the only dry spot in our house when the pipes burst!"

* * *

REVISED.

The Queen of Hearts, she made some tarts,
From a radio recipe—
The Jack of Hearts, he ate those tarts,
And suffered perceptibly.

Java.

MY Java expert, M. B. (Southport), has had confirmation of his reception of A N H. The letter states that they broadcast on Mondays, talking to Holland, from 14.00 to 16.00; also on Wednesdays and Fridays. On Saturdays they transmit music. Wave-length round about 17 metres. M. B. has received also a booklet from 2 X A F, which says that with 10 kw. they transmit on Tuesdays from 6 p.m. to 11.30 p.m; Thursdays, 6 p.m. to 12.30 a.m.; and Saturdays, 6.30 p.m. to 12 midnight; all E.S.T. Wave-length, 32·77 metres. The aerial is 40 feet of wire suspended vertically from a 50-feet mast.

Coming Gas Attacks.

THIS is our B.B.C. number, surely! Here I go again. Beside me is the "talks" prospectus for January to April. Gentlemen, it's a night-school run by a lady, with a few sweetmeats thrown in to keep the babies quiet. It's an University Extension Course served out to people who are too tired to extend universally, and need plain, common amusement. "Village Play Production" in six parts! By the time the next season arrives the students will have forgotten how Mrs. Penelope Wheeler produces village plays.

Culchah for All.

"OUR Interest in Good Government," also in six parts. Mr. Baldwin ought to add a couple of stages of L.F. and listen hard. "Women's Part in Village Life." Talks, of course! "Little Willie's Clothes." Ha! Baby's sock is now the "blue bag." "Carpets." Can you beat it? "The Age of the Despots." This refers to the Talks Department and Musical Cranks' section of the B.B.C. "German Talks." What about another committee to advise on spoken German? Lastly, "Talks by the Chief Engineer." The only expert of the bunch who has my sympathy. I'd like to hear him talk about "Talks."

Trade Organs.

I HAVE to wade through an unconscionable lot of "trade organs," or "House Organs," these being small periodicals issued by manufacturers to their dealers, but I find them on the whole to be of a very high class; very bright, brainy, and entertaining. S. G. Brown's "The Brown Budget" is well worth reading, and I can recommend the "Marconiphone," whose first issue I have seen in skeleton; these are intended for dealers, but I don't suppose the proprietors would say you "nay." They are most interesting productions.

"Ariel" Makes Excuses.

LOOK here, you fellows are fifty to one. You write very charming letters and I keep them all classified under such headings as "Valve Barts.," "Grousers," "Prodigies," and so on, but I have to use up so much space on the B.B.C.—what with Talks and Chamber Music—that I get behind with acknowledgments and my customary acute observations. This is to let you know that I propose to devote an issue almost entirely to my correspondents in the near future. And if it isn't good reading I'll eat my hat!

Sweated Songsters.

THE B.B.C. said that the songs of Gurra, broadcast on January 27th, could have been given to the public only by the B.B.C., because of the huge resources needed and the consequent expense. A singer who applied to the B.B.C. for work was offered a job in the male voice choir for the performance of Gurra's songs, at an inclusive fee of £2 for the performance and rehearsals—of which there were eight. What do the B.B.C. Governors do for £700 per annum? This singer was offered pay at the rate of about £4 per week!

ARIEL.

BE UP-TO-DATE!

Modernising an old receiver is cheaper than, and often just as satisfactory as, making a new one.

By R. W. HALLOWS, M.A.

THERE are in use at the present time large numbers of receiving sets purchased or constructed at home two, three or four years ago. Though these veterans—even a two-year old set is a wireless veteran—still continue to function to the best of their ability, they cannot compare with really up-to-date apparatus, and those who use them are not getting out of broadcasting all that it has to give. But there is no reason why in most cases the apparatus should not be modernised, for, as we shall see, this can often be done with very little trouble and at quite small cost. There are few old sets that cannot be considerably improved, whilst many can be made almost as good as the latest productions of the radio designer.

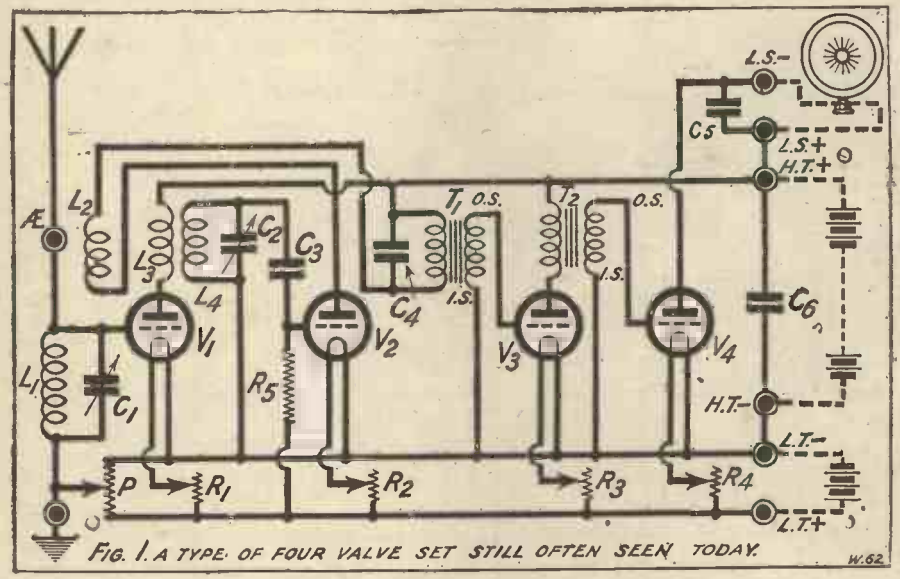


FIG. 1. A TYPE OF FOUR VALVE SET STILL OFTEN SEEN TODAY.

Better Reaction Control.

If we think for a moment of the departments in receiving apparatus in which the greatest improvements have been made in the last year or two, we shall realise in what respects old sets fail to come up to the mark. Not only do we get a much greater magnification per stage now than was at one time thought possible, and a far greater measure of selectivity, but we are also able to achieve perfect stability.

Sensitiveness and selectivity have been increased partly by the improvements made in high-frequency components and partly as the result of brilliant research carried out in radio laboratories in all parts of the world. Stability has been achieved mainly through the adoption of the many ways evolved of neutralising the feed-back in high-freqeuncy amplifiers due to inter-electrode capacities within the valve. The next point of importance is that which concerns reaction control. New circuits and new methods make for perfect smoothness, with the result that the set can always be maintained in its most sensitive condition without "plopping" suddenly into oscillation. This means that when a weak signal has been picked up it can be brought up to respectable strength with ease, and without any sign of howling. Only those who have used, or are still using, such an antediluvian contrivance as the three-coil holder with aerial and reaction coils variably coupled to the grid coil know how difficult a feat this can be made by fierceness and floppiness on the part of the reaction control.

On the low-frequency side of the set progress has been just as great. But a short time ago it was a matter of practical impossibility to build a two-stage note-magnifier which would reproduce speech and music at good strength without distortion. Modern components and modern valves enable us now to obtain all the volume of sound that we require with no trace of harshness, woolliness, or distortion.

In Fig. 1 is seen a 4-valve circuit of a kind that is still pretty widely used to-day. We have here a high-frequency valve, V_1, with single-circuit tuner, coupled by means of an H.F. transformer to the rectifier V_2. Magnetic reaction on to the aerial is provided by means of the coil L_2. The low-frequency valves, V_3 and V_4, are both transformer coupled, and in these stages only those of the general-purpose type can be used, since no provision is made either for extra plate voltage or for grid biasing.

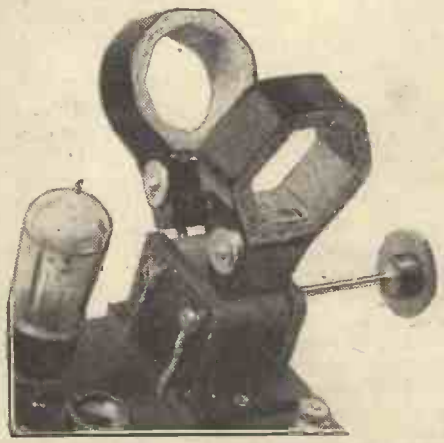
No matter how carefully it is handled such a receiver cannot possibly allow reproduction of good quality to be obtained, since distortion must occur in its low-frequency stages. The comparatively low H.T. voltage supplied by the common busbar to all valves means that the useful portion of the characteristics of V_3 and V_4 will be too short to allow the necessary grid voltage swings to be dealt with properly.

Adding Grid Bias.

Since the grid of neither valve is negatively biased both are practically at zero potential, which means that the positive half of each oscillation will carry the working point to the right of the zero line, causing a flow of grid current to take place, so that partial re-rectification will result. The first step in dealing with such a set must clearly be to improve the note-magnifiers.

At the back of the baseboard additional terminals may be fitted for H.T.+2,

(*Continued on next page.*)



A form of reaction coupling that, although undoubtedly efficient, has many decided drawbacks, not the least of which is the fact that any alteration in coupling necessitates retuning.

BE UP TO DATE!

(Continued from previous page.)

G.B.+, G.B.−1 and G.B.−2. The output positive terminal (L.S.+) is disconnected from H.T.+1 and connected to H.T.+2. (See Fig. 2.)

The second transformer in the original set may be replaced during the process of modernisation by an up-to-date transformer with a ratio of about 4 to 1, a component of really good quality being chosen. It would be quite possible as an alternative to use resistance coupling.

On the whole, though, I would rather recommend the combination of choke in the first stage, and transformer in the second, for extraordinarily good quality combined with big signal strength is easily obtainable in this way. When the H.F. side of the set has been modernised on lines to be described in a moment it will very possibly be found that the signal strength of the local station is too great. In this case plugs and jacks can be used for "cutting."

A simple means of stabilising the H.F. valve without making use of a potentiometer is indicated in Fig. 2, which shows the complete circuit of the modernised four-valver. For the original L_1 of the Fig. 1 circuit a centre-tapped coil is substituted, the centre-tapping being connected to earth. Between the bottom of the coil and the plate of the valve is connected a small condenser, N.C., whose function is to balance out the inter-electrode capacities of the valve itself.

Further Improvements.

One last point remains to be dealt with. It will be noticed that in the Fig. 1 circuit the loud speaker is connected directly between H.T. + and the plate of the last valve. In the Fig. 2 circuit a filter is shown. It is sheer folly to connect a high-resistance loud speaker into the plate circuit of a power valve or super-power valve, and no other should be used for loud-speaker working.

Besides protecting the loud-speaker windings by relieving them from carrying the steady plate current, the filter circuit ensures that the plate potential of the last valve is not unduly cut down by a big voltage drop across the loud speaker. The fitting of a filter circuit, consisting of a choke with an inductance value of about 30 henries and condensers of 1 or 2 microfarads apiece, makes as a rule an enormous difference to the performances of the loud speaker itself.

In this article I have endeavoured to show how the modernisation of an old receiver may be undertaken step by step as time and consideration of expense permit. Do not be content to continue using an out-of-date set. By doing so you are failing to take proper advantage of broadcasting, for the transmissions to-day are so good that something not far removed from perfect reproduction is obtainable. Once you have tasted the joys of using a modern or modernised receiver you will wonder how you have ever possibly been content to continue working with old-fashioned apparatus.

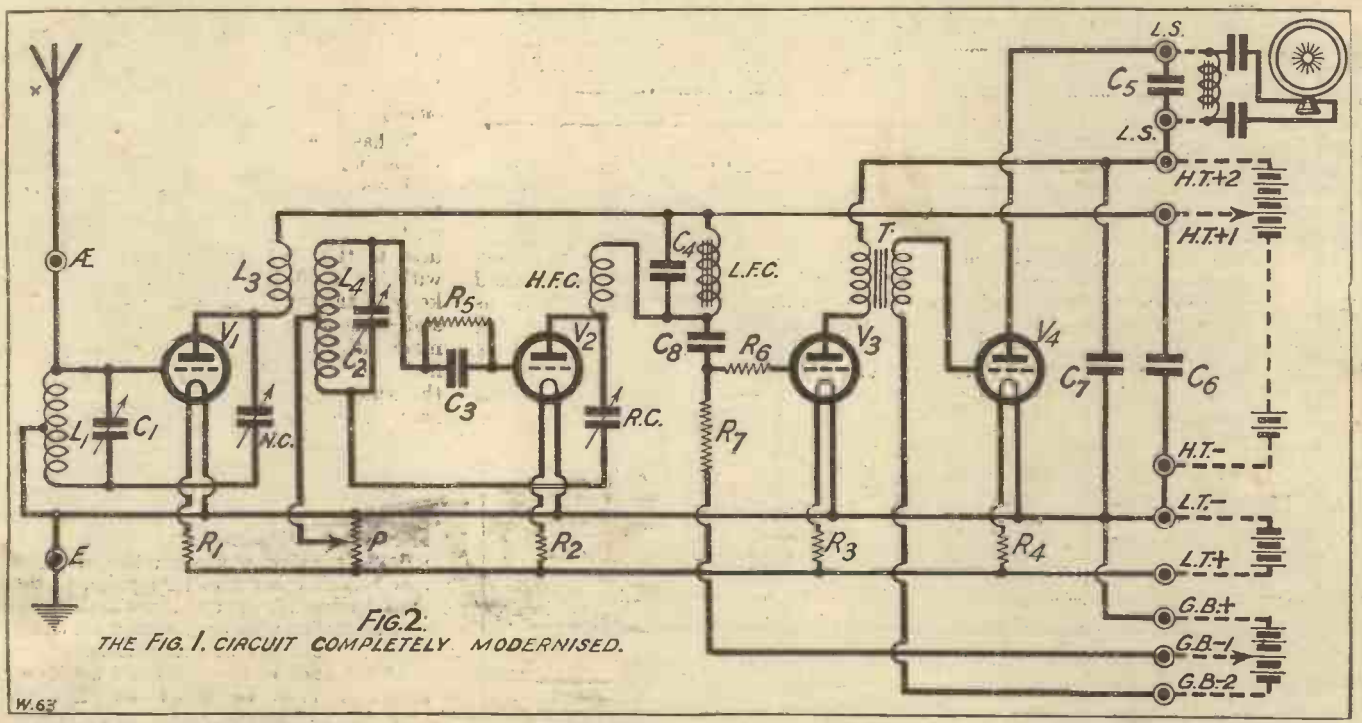


FIG. 2.
THE FIG. 1. CIRCUIT COMPLETELY MODERNISED.

COAL RECTIFIERS.

By A CORRESPONDENT.

FROM time to time readers of this journal have reported the obtaining of strong and clear signals by the simple method of using a small fragment of ordinary coal in the crystal cup of the detector in place of the usual galena or other type of crystal.

Now, reports concerning the use of unusual materials as radio rectifiers are always highly interesting, because, at the very least, they serve to indicate the fact that there are very large numbers of different substances and materials which possess within them some power of rectification.

The fact that a small lump of domestic coal will act occasionally as a radio rectifier has mystified many readers. However, the explanation of the phenomenon is simple.

When a fragment of coal acts in this manner, it will be found that its surface is covered with a yellow scale, and that this scale is so deposited on the coal surface that it reaches from the spot at which the cat's-whisker makes contact right to the inner edge of the crystal cup, or to the base of the latter.

The "Mystery" Solved.

Now, if a fragment of this yellow scale is taken and examined under the microscope, the scale will be found to consist of an exceedingly large number of yellow cubical crystals which are all closely joined, and sometimes even fused to one another.

Herein lies the mystery of the "coal crystal." In reality, these microscopic crystals, which have been deposited on the coal by natural agencies, comprise nothing more startling than crystals of iron pyrites, which, as the reader will be well aware, is one of the most sensitive natural rectifying minerals.

Thus, when a fragment of the coal is placed in the crystal cup of a detector, and the cat's-whisker brought to bear on its surface, it is not the coal itself which performs the work of rectification, but the iron pyrites crystals which are deposited upon its surface.

In some instances, the iron pyrites crystals, instead of being deposited on the surface of the fragment of coal, run in veins through the mass of the coal, thus forming a conducting and rectifying path in the material.

Careful examination of a fragment of coal which has been found to possess rectifying properties will elicit these facts, and thus clear up the former mystery of the "coal crystal."

THIS YEAR'S "CHITOS" ONE VALVER

One of P.W.'s most popular and successful receivers, which has been modernised and made absolutely easy to construct and operate. Designed and described by the Research and Construction Department.

THERE is always something rather fascinating about special ultra-sensitive single-valve circuits, particularly if one's equipment is limited. To be able to tune in a whole string of foreign stations with only one valve, even if the special circuit used has one or two objectionable habits, is a perpetual surprise and pleasure, and to nobody is it a greater one than to the experienced constructor, who is apt to think that at least one efficient stage of H.F. amplification is essential for long range work.

The whole question of the high sensitivity of such circuits seems to turn very largely upon the extraordinary amplifying powers of reaction: some circuits make better and fuller use of those amplifying powers than others, enabling us to get stronger signals without oscillating. An example of a circuit which enables this to be done very effectively, which the reader will probably remember is that of the "Variactor" Two receiver described in a recent issue. This set consisted simply of a detector valve with reaction, followed by a stage of L.F., and its remarkable sensitivity was based entirely upon the use of a special variometer scheme for adjusting reaction.

Probably almost the best known of these special detector-with-reaction circuits is the one which came to be called the "Chitos," and which has been used in the past two years by an extraordinarily large number of our readers (it was first described in "P.W."). In this circuit the main features were (a) the use of the tuning coil and condenser in series with each other in the aerial circuit, and the connection of the valve across the condenser instead of across the coil, as is customary, and (b) the use of a rather unusual anode circuit arrangement which, together with feature (a), enabled the desired reaction effects to be obtained.

A Well-behaved Circuit.

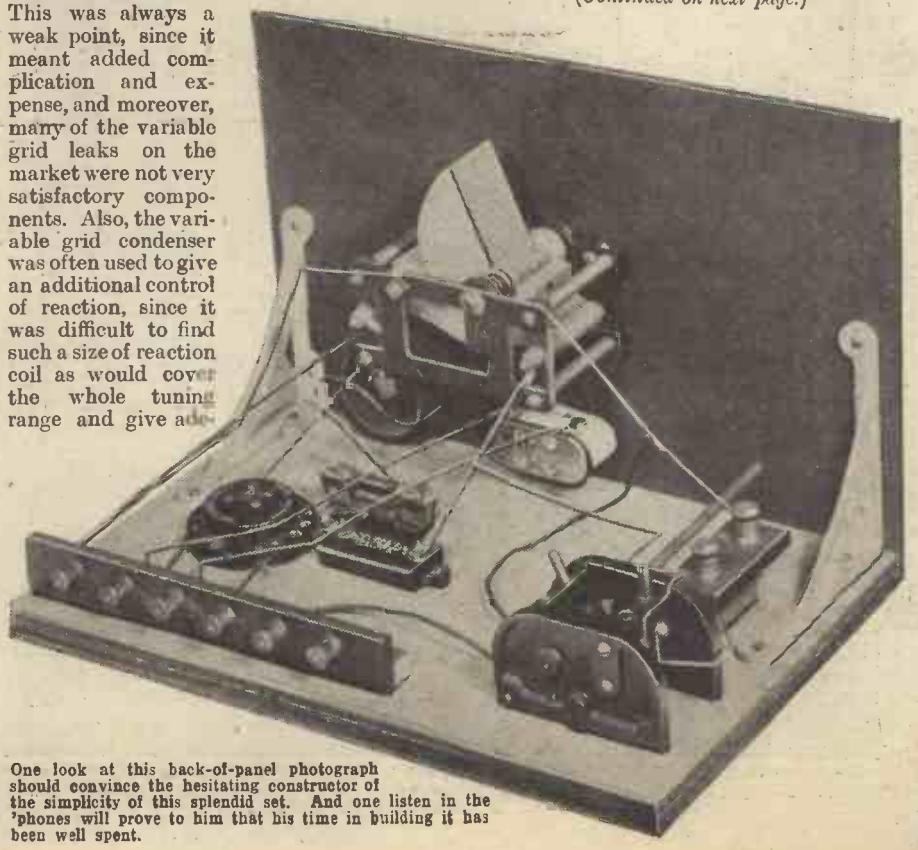
This circuit was singularly free from the usual vices of special stunt schemes, since it was easy to handle, did not make unpleasant noises unless reaction was much misused, and was not particularly critical as to valves or components. This probably accounts for a good deal of its popularity, when we remember that it gave a really very fine long-range performance in addition to docile behaviour. It had, however, one or two not very serious drawbacks, and in producing the 1928 revised version we have endeavoured to remove as many of these as possible, provided that it could be done without sacrifice of the special virtues of the circuit.

In the first place, there was the fact that a variable grid condenser and variable grid leak was called for. This was always a weak point, since it meant added complication and expense, and moreover, many of the variable grid leaks on the market were not very satisfactory components. Also, the variable grid condenser was often used to give an additional control of reaction, since it was difficult to find such a size of reaction coil as would cover the whole tuning range and give adequate control everywhere, merely by the adjustment of the coupling between the coils. This was not a very desirable method of adjusting reaction, and we have now tried to get round the difficulty in another way.

Simplification.

It has been found that with modern valves it is quite practicable to use a fixed grid condenser and leak and obtain the necessary extra control of reaction by putting a variable resistance of the kind used in H.T. battery eliminators in series with the anode circuit of the valve. By keeping this set at an intermediate value, and using about 60 volts H.T. (or a little more with some valves), it is quite easy to find a size of reaction coil which will cover the whole range with the aid of the slight extra control afforded by the variable

(*Continued on next page.*)



One look at this back-of-panel photograph should convince the hesitating constructor of the simplicity of this splendid set. And one listen in the 'phones will prove to him that his time in building it has been well spent.

THIS YEAR'S "CHITOS" ONE-VALVER.

(Continued from previous page.)

resistance on the panel. This resistance should not be of too high a maximum resistance (20,000 ohms is sufficient), and the one actually seen in the set is a "Bradleyohm," No. 5E (R. A. Rothermel, Ltd.).

These are the only real changes which we have found it necessary to make in the circuit itself, and if you look at the diagrams on the blue print you will see that it is still closely similar to the original, and you may rest assured that the original virtues have been preserved. (On a very poor aerial it has brought in 17 foreign stations in an evening.) The circuit remains of very high sensitivity, and is still more easy to work, and is a little cheaper and a good deal easier to build. Selectivity remains moderately good (if you live very near your local station a wave-trap is advised.)

Coils and Valves.

The remainder of the "modernising" is purely a matter of the lay-out and method of construction, and I think this will all be clear from the photos and blue print. Just two points, however, should be emphasised: a really good slow-motion coil holder is very important, and a vernier dial or slow-motion drive on the condenser is a great help.

There remains the practical questions of coil sizes and valve types. In the aerial socket you will require a rather large size, No. 75 or even No. 100 for the ordinary wave-band, with a No. 50, 60 or 75 for reaction (this depends a good deal on the valve, the efficiency or otherwise of your aerial, and other unknown factors). For 5 X X a 200 or 250 will be correct in the aerial socket in most cases (I am assuming an outdoor aerial of average size. An indoor one may require larger coils still), and a No. 100 or 150 for reaction.

The valve should be one of the modern H.F. type. Here are a few examples in the 6-volt range: P. M. 5 X., D. E. L. 610, S.S.6075 H.F., B.4 H., Cossor 610 H.F., etc. Similar types can be chosen from the 2-volt range, and work well in this set.

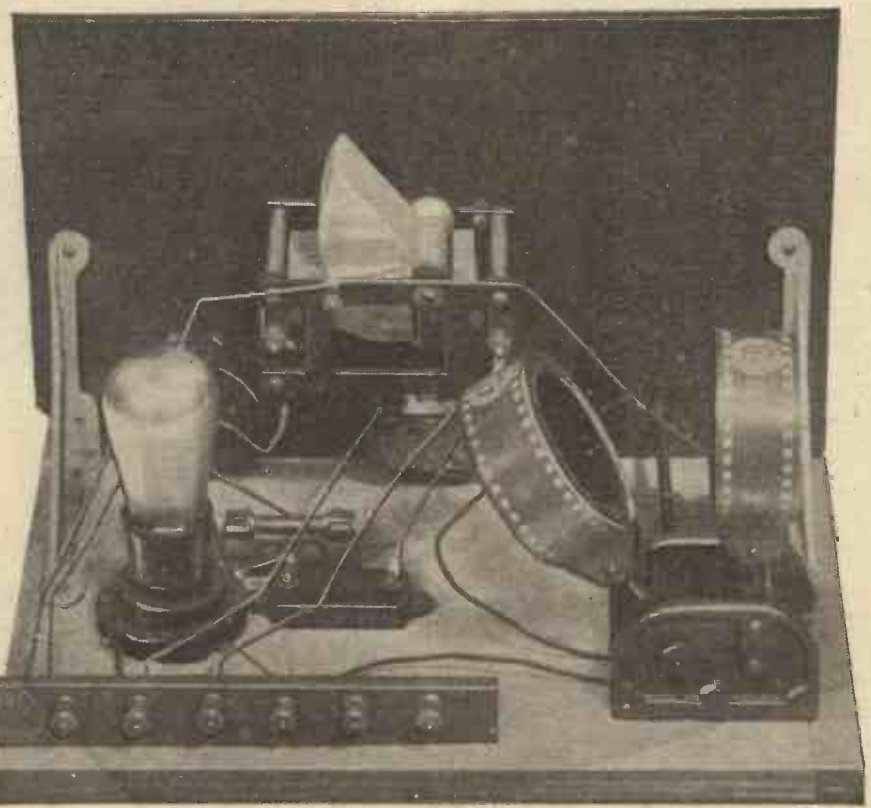
Working the new "Chitos" is easy, and a little practice will soon enable you to search for distant stations by turning the condenser slowly, and all the while keeping the reaction adjusted to a point just below self-oscillation. You will be surprised how many stations you can pick up in this way without ever actually oscillating. (That is really the test of a good operator, you know.) Of course, NEVER allow the set to oscillate for more than an instant when you are actually tuning in a station.

Reaction Control.

You will find that the variable resistance affords a very fine "vernier" effect on the reaction adjustment, and this is very useful indeed for bringing a weak station up to the maximum possible strength without oscillation. This resistance, however, is really intended to enable you to get a wider control on a given size of reaction coil.

Only a small set to look at is the "Chitos"—but it pulls the Continent of Europe down your aerial lead!

This is specially helpful with this type of circuit, where this point is a little critical.



The coil with the sideways tilt controls reaction, and is operated from a knob on the front of the panel. The upright one is the aerial coil. If you keep them too close together you will spoil your own reception and that of your neighbours'. Don't do it!

WHERE R.C.C. SCORES.

ONE of the standing subjects of discussion amongst wireless enthusiasts is the question as to the relative merits of transformer coupling and resistance-capacity coupling. The latter has many adherents who are prepared to overlook its slight inferiority in point of efficiency in favour of the greater purity of reproduction which it usually provides. Probably this question, like many others, will never be finally settled; it will, at any rate, remain an interesting subject for controversy.

There is one point, however, about resistance-capacity coupling which cannot be controverted—that is, that the components required are smaller and more compact than the corresponding components necessary for transformer coupling, at any rate if the transformer coupling is to be carried out with transformers of sufficiently robust and reliable design and construction.

With resistance coupling, in order to obtain satisfactory results, it is important that the resistances should be as truly as possible non-inductive and also that their capacity should be reduced as near as possible to zero. It was in order to meet these requirements, that a special type of resistance, sealed up in an evacuated glass tube, was recently introduced commercially.

These improvements were also carried considerably further in the Loewe "valve," designed and made by a German concern, in which four resistances and two coupling condensers are comprised within the same evacuated bulb. The resulting product is, in fact, a valve with its resistances and coupling condensers all complete in the same envelope.

Showing you the means of saving money when you hook up circuits.

By OSWALD J. RANKIN.

EVERY novice should acquaint himself with the fact that when two like condensers are connected in series as at A in Fig. 1, the total capacity is equal to one-half the capacity of *one* condenser. It will therefore be seen that if one possesses two idle ·004 mfd. condensers and requires a condenser of 002 mfd. capacity (which is not available), it is only necessary to connect the two ·004 mfd. condensers in series in order to obtain the required value. Now if the condensers are connected in parallel, as at B, the capacity of one is simply added to that of the other. Examples: ·001 joined to ·002 = ·003, ·003 joined to ·003 = ·006, and so on.

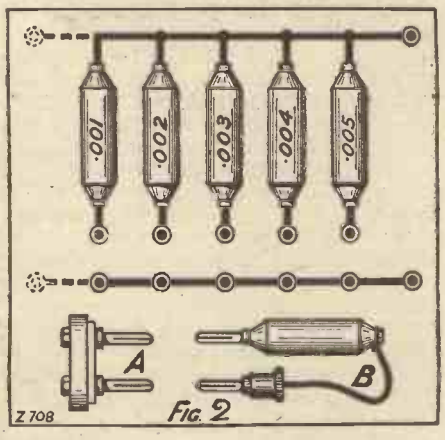


FIG. 2.

The method of connecting fixed condensers in series-parallel is seldom employed, but in accordance with the above rules this should work out as shown at C, since two ·002 mfd. condensers in series give us ·001 mfd., two ·004 mfd. condensers in series ·002 mfd., and ·001 in parallel with ·002 = ·003 mfd. But here we are introducing what often proves to be unnecessary complications.

Diagram D shows how two fixed condensers may be wired up to a series-parallel (D.P.D.T.) switch, and Diagram E shows one of the most useful variable parallel arrangements where only four fixed condensers are made to give fifteen different values.

A Tone Control.

It will be seen that the switch arms are made to engage any two adjoining studs, or any single outside stud.

The device may be used as a tone-control unit for a loud-speaker by providing extension leads and terminals (shown dotted) and joining these to the loud speaker, and the terminals T—T to the L.S. terminals on the receiver. With this and the Diagram D arrangement one is conscious of the fact that the condensers are more or less "tied up," or otherwise unavailable for other purposes when the device is not required.

Another useful arrangement is shown in Fig. 2, where one side of each interchangeable fixed condenser is connected to a common lead as usual, and the opposite sides to a row of ordinary valve sockets. A second row of valve sockets are joined by a common lead, and a two-pin plug, or link, A, with the pins connected together with a brass strip, is inserted or otherwise bridged across any one pair of sockets in order to tap off any one of the five different values.

Useful Capacity Unit.

As a further refinement a condenser of any desired value may be arranged as shown at B (Fig. 2), so that it may be connected in series with any one of the five condensers if desired.

This simple unit will be found of great practical value to the experimenter. The condensers, being interchangeable, may be replaced by others of different capacities, so that if provision is made for five or six condensers, one may obtain practically any useful value which, perhaps, could not be obtained otherwise. The device may be used as a tone-control unit by fitting two extra terminals as shown dotted.

We have seen that in order to "step up" the capacity of a condenser it becomes necessary to add another condenser and connect the two in parallel, and that in order to "step down" the capacity the added condenser must be connected in series. In the case of fixed resistances the rule is reversed, i.e. if two identical resistances are connected in series the total value will be equal to twice that of one, and if connected in parallel the value will be equal to one-half of one. Thus, for example, if we require a resistance of, say,

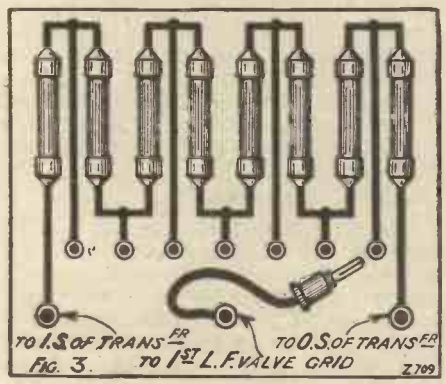


FIG. 3.

4 megohms, two 2 megohm resistances in series will do the trick; or, on the other hand, if ½ megohm should be the required value, we can connect two 1 megohm resistances in parallel.

A number of odd resistances (not less than six), each having a value of from 50,000 to 75,000 ohms, may be arranged, as shown in Fig. 3, to serve as a high-resistance potentiometer for use as a volume control for the loud speaker. The two outer terminals are, in effect, the ends of the potentiometer winding, and are connected across the secondary winding of the first L.F. transformer, the OS lead going to G.B. negative as usual.

More Difficult.

The centre terminal may be regarded as the moving arm of the potentiometer, and is connected direct to the grid of the first L.F. amplifying valve.

So far we have only dealt with series-connected condensers and parallel-connected resistances having like values. What happens if, for example, a ·001 mfd. condenser is connected in series with another of ·002 mfd. capacity? Or what value do we obtain by connecting a 2 and a 3 megohm resistance in parallel?

In both instances the value will be something less than that of the smaller component. But the calculations involved are rather intricate.

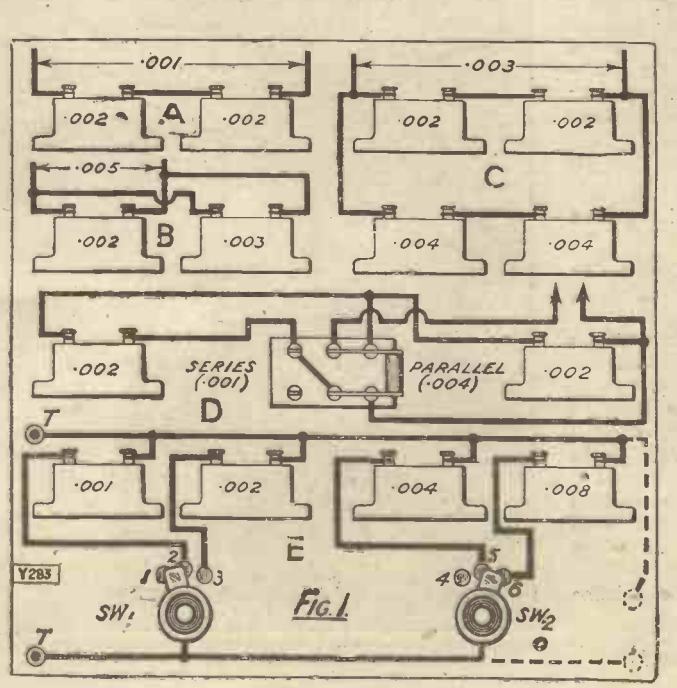


FIG. 1.

MANCHESTER AMATEURS RE-ORGANISE.

AN OBJECT-LESSON FOR THE R.S.G.B.

By THE EDITOR.

IN another part of this issue we publish a letter from a well-known Manchester correspondent, dealing with a subject to which we have already devoted some considerable attention, viz., the position of the radio amateurs' societies, and in particular the R.S.G.B.

It will be seen from our correspondent's letter that the Manchester wireless amateurs, always go-ahead and eager for progress and efficiency, have at last realised that association with the Radio Society of Great Britain, as it is at present constituted, will not benefit them. The R.S.G.B. has undoubtedly failed in the task it undertook some years ago—the task of joining and linking together the amateur societies in this country And because of this failure Manchester amateurs have decided to found a new association of British radio societies.

Centralised Organisation.

We say without hesitation that we wish their endeavour all possible success, for it is by such endeavour that the amateurs of this country will keep alive the radio society movement. Unless that movement is kept alive, and unless it is backed to the hilt by the amateurs in this country, they cannot possibly show a united front wherewith to withstand the onslaughts of unimaginative and officious officialdom.

It is easy to catch disjointed units in the meshes of red tape, but when those units band together and form a coherent, well-disciplined whole, then red tape is rendered impotent.

Mr. J. E. Kemp, a well-known Manchester figure in the world of radio, has been elected Chairman of the Association of British Radio Societies, and he recently pointed out that broadcasting in this country owed a very great deal to the amateur movement, and it would be a pity if amateur societies were allowed to go out of existence because of the lack of organisation.

Important Ambitions.

The aims of the new body have been agreed upon as follow:

To create a fellowship amongst the radio societies of this country for their mutual benefit.

To protect the interests of radio societies (members of the Association) in case of any dispute arising with the authorities.

To assist all associated radio societies in the organisation of lectures, and in the general acquisition of knowledge in radio science.

To foster and maintain the interest in organised amateur radio experiments, as conducted by radio societies in Great Britain.

To organise a comprehensive scheme for providing its members periodically with subjects to form the basis of discussions and experiments.

To organise radio societies of the country into locally governed sections or groups, which will elect members to the general committee.

To provide facilities for the general public interested in broadcast reception to acquire knowledge of the working of receivers, and to co-operate with charitable organisations in matters connected with radio.

To co-operate with the B.B.C. on all points of technical and entertainment interest.

To set up a standards committee in an endeavour to induce manufacturers to standardise components and accessories.

To promote and maintain the issue of "British Radio" as the official organ of the Association.

The Association asks for the co-operation of all radio society officials in compiling a list of "live" organisations. The secretary of the Association is Mr. L. A. Gill, of Hope House, South Redditch, Stockport.

We would like to assure this new society that if there is anything we can do in the way of making its intentions widely known to the amateur public, we shall be glad to assist, and at all times to do what we can to stop the rot (which undoubtedly becomes worse and worse as the weeks go by) among amateur radio societies, and once again to attempt to revivify the spirit of co-operation and energy which the Radio Society of Great Britain has so unfortunately allowed almost to expire.

It is good news to note that the B.B.C. is taking steps (according to the "Times"), to follow up its work in the development of simultaneous broadcasting from different stations of a single programme, and of transmission to the Empire by perfecting arrangements for the re-transmission to listeners in this country of broadcast items transmitted from foreign stations.

The B.B.C. has found by experience that transmissions over considerable distances are received more clearly if the medium used is a land line to a distant transmitter. This procedure seems better than if the programmes were allowed to travel all the way by wireless.

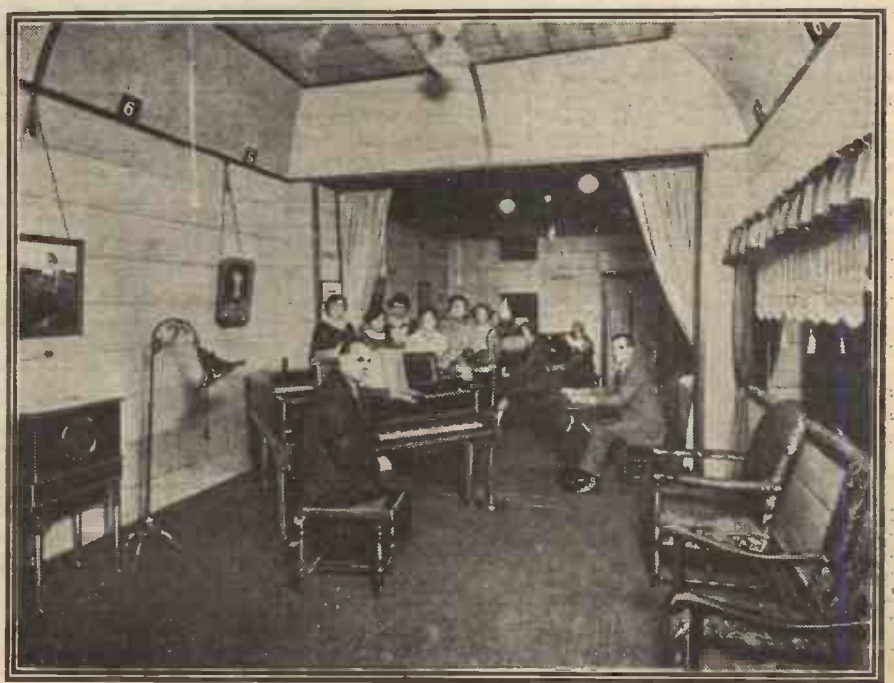
Trans-Continental Broadcasts.

The B.B.C. at present is dealing with a proposal to establish land-line communication between a number of foreign broadcasting stations and 2 L O. The idea is that transmissions from these foreign stations on their way to this country would pass through a repeater station where fading signals would thus be balanced and, in fact, "fortified" on their journey.

Tests have been going on for some time now and we understand that they have satisfied the B.B.C. engineers, so much so, in fact, that co-operation with the broadcasting authorities abroad is undoubtedly a foregone conclusion, and that by the end of the year it is quite likely that foreign programmes will be heard regularly via 2 L O.

The result of these experiments means, in short, that before another twelve months have passed we shall be able to hear through 2 L O programmes being given in Prague, Berlin and other well-known Continental centres, just as clearly and easily as we hear now a relayed programme from Manchester, Birmingham, or any other B.B.C. station.

Incidentally, of course, this arrangement will be on the "tit-for-tat" principle, and foreign listeners will be able to hear London programmes in just the same way.



The studio at W S O E, a broadcasting station operated for experimental purposes by the Milwaukee School of Engineering, a well-known American Technical Establishment.

"IT is an extremely difficult proposition to be able to broadcast an excerpt of a musical play so as to give justice to the average excellence of the show, assuming, of course, that the show is good entertainment." With these words, Leslie Henson, the famous comedian, contemplated the glowing ash of his cigarette.

"Broadcasting," he continued, "has always proved of interest to me. I often listen-in, and the general high standard of present-day wireless programmes astonishes me. There are two very difficult jobs in the world to-day in my opinion. One is compiling a wireless programme, and the other is the sometimes thankless job of making people laugh.

Jokes that Fail.

"There are some days when one is facing an audience which just won't laugh. Every amusing line, even a 'point' number fails to get even a responding smile. There must be some days like that, too, in the world of wireless."

Mr. Leslie Henson confessed to me that he would not like to be entrusted with the task of editing and collecting together the various items that go to an evening's wireless entertainment; but he was full of praise for the way in which, despite the enormous disadvantages and obstacles of broadcasting, a new and widely different programme of an interesting nature is produced by the B.B.C. each evening.

"Now that Daventry Junior is working they have the added worry, I suppose, of producing two different programmes. It is hard enough to find ideas for one show, let alone two whole programmes for nearly every night of the year.

"I'll be back in a minute," said Mr. Henson, rushing from his dressing-room at the Carlton Theatre, where he is playing in "Lady Luck." The successful musical comedy was broadcast to listeners recently, and proved very popular.

When he had returned I asked him for his opinion on the advisability of broadcasting excerpts of musical shows.

"It all depends on the show," he said. "You see, there are so many musical shows that seem to be produced solely for the benefit of the eye. That type of show fails miserably on the wireless, as does the show that relies entirely on its acting, and its comic situations."

An Elaborate Broadcast.

The broadcasting of "Lady Luck" was a most elaborate affair, about six microphones being used. Outside broadcasts have now almost reached perfection. Not a single sound on a big stage can be missed. The B.B.C. engineers believe in having several rehearsals beforehand. Theatre acoustics are not always a great help, but most of the difficulties can now be overcome by the skilful picking up from one set microphone to another. Running dialogue, while the artistes are in motion, no longer troubles the engineers who follow them as easily as the man behind the spotlights.

"Comparatively few shows are suitable hearing over the wireless," went on Mr. Henson, lighting a fresh cigarette. "It is not easy to be able to 'chip in' on a musical comedy and get the best. If the book happens to be complicated, listeners ignore the dialogue and settle down to enjoy the songs and music. Then if that happens to be weak, the result is a bad one. A bad broadcast of a good musical show can just as easily ruin it, as if even the show itself were bad."

Leslie Henson is of the opinion that the lighter side of wireless while well developed could do with some modifications.

More Fun Wanted.

"The funny side of broadcasting," he said, "should be developed to its fullest advantage. It is no easy matter to broadcast excerpts of funny plays and get the best results, but it is less difficult to have specially written items of a funny nature suitable only for broadcasting.

"Broadcasting should be a tonic in the home, and the very best tonic of all is laughter. If the loud speaker can provoke sufficient laughter it will never lose its popularity."

Mr. Leslie Henson, the famous revue "star," who, in the accompanying article, gives his views on the subject of radio humour.

The famous comedian off-stage is a very serious young man. While his smile is most disarming, one nearly always sees him in a serious mood. Of the educational and instructive value of wireless broadcasting, he is most enthusiastic.

"Broadcasting from an educational point of view can do more than any schooling can claim to accomplish. To listen to the world's events through the uncanny power of the ether is an education in itself."

Sunday Programmes.

In Mr. Leslie Henson's opinion, Sunday broadcast programmes are of infinite value in the education of the mind.

"No matter what one's religion may be, there is something stirring in the broadcast of a church service. The sermons, for instance, are of interest to every educated mind. One could stay for hours listening to speakers like the Rev. Dick Sheppard, whose wireless personality is something living, something that one cannot forget in a hurry."

"What do you think of broadcast talks?" I asked Mr. Henson.

He smiled.

"That all depends on what they are about. Personally I am not very interested in beetles, but somebody else might be. Considering that the average taste of the public in a matter of this kind is almost impossible to fathom, I think that a broadcast talk on any subject at all is always of the greatest interest.

"So much depends on the personality of the speaker. Some of the wireless speakers of to-day radiate their personality, while others, even experienced artistes of the theatre, lose everything by not being seen."

The Perfect Programme.

In conclusion I asked Mr. Henson what was his idea of a perfect wireless programme.

"I think that the average wireless programme that has been broadcast lately is a good specimen. It is certainly very near to perfection. I think, however, that there should be a great deal of humour in the wireless programmes. The popularity of a West End show depends not a little on its lighter moments, and it should be the same with the radio entertainments.

"Good music, plenty of humour and fun, a sprinkling of drama, some material of an instructive nature, and a widely comprehensive news bulletin—that is my recipe for the ideal wireless entertainment."

And as I left Carlton Theatre, having said goodbye to the famous revue "star," I found myself very much in accordance with his views.

ARIEL.

TECHNICAL NOTES

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

MULTI-ELECTRODE VALVES

WIRING-UP—HEATING SOLDERING IRONS—ANODE RESISTANCES.

Multi-Electrode Valves.

VALVES with duplicate electrode systems have been so often suggested that I should have thought it was hardly possible, at this date, to obtain patents on the same, except by way of improvements or modifications. I see that a British Patent has just been issued in connection with a valve of this kind in which a number of electrode systems are comprised, adapted to function in the successive stages of a wireless receiver.

One (or more) of the sets of electrodes has a high anode resistance (about 50,000 ohms) and a high amplification factor (about 30). The filaments of the remaining electrode systems, which are adapted to operate as detector and output stages, are connected in parallel inside the bulb and are designed to give a higher emission than the other stages. In the detector stage, for example, adequate power may be applied for efficient reaction, whilst in the output stage sufficient power is provided for the operation of a loud speaker.

Wiring-up.

It is much better to take care with every soldered joint as you go along, than to have to put right a defective soldered joint after the set is completed, because when the wiring is completed many soldered joints which were made in the early stages are not so "get-at-able" as might be desired.

I should say that the commonest causes of unsatisfactory soldering are, first, lack of cleanliness of the parts to be joined, and second, insufficient heat in the soldering-iron.

Heating Soldering Irons.

It is impossible to make a proper soldered joint unless the molten solder makes intimate contact with the surface of the metal which is to be soldered, and this cannot take place unless the surface is clean. A very convenient method of cleaning the surface automatically is by the use of a suitable flux; but even the best of fluxes cannot do its work if the parts are not at any rate reasonably clean to start with.

Of course, in wiring up a receiver only non-corrosive, non-sputtering flux should be used, and the minimum quantity which will serve the purpose.

The soldering-iron or "bit" should be hot enough to make the solder quite liquid and "lively" and to make a fairly quick joint. If the iron is not hot enough, it will take some time to get the solder to soften, and then the solder will remain in a kind of pasty condition which is altogether unsatisfactory.

A joint made with the iron in this condition may seem at first to be a sound job, but sooner or later it will spring apart, and it will then be seen that it was only a kind of mechanical joint and that the parts were not really metallically welded at all. A hot iron is, therefore, essential; but, at the same time, care must be taken not to overheat or burn the soldering-iron, as this will cause it to become scaled with oxide and very troublesome.

The best way in this, as in most other things, is to be patient: the iron, if a small one, should be repeatedly heated so as to keep it at about the right temperature and after it is obviously losing its heat, you should not try to continue the work until the iron has been re-heated.

Anode Resistances.

I have had a number of letters from readers on the question of wire-wound anode resistances, which I mentioned recently in these "Notes." Speaking generally, experimenters seem to be of the opinion that there is still room for a really efficient wire-wound resistance which can be varied to suit different conditions.

The ordinary fixed anode resistance may be obtained in ranges from 5,000 to 500,000 ohms, but it is a great advantage to have either a tapped or a variable anode resistance.

In this connection Messrs. R. I. & Varley, Limited, make tapped and variable anode resistances which are very useful, not only on account of the resistance values obtainable, but also for easy manipulation. The "tapped" resistance is provided with a number of small terminals to which the tapping-leads are brought out, whilst the "variable" type has a very simple switch device mounted upon the end of the barrel.

The tappings are brought out to a number of small rounded studs, spaced regularly around the end of the case, and the switch (which is virtually a small selector arm) can be shifted around to make contact with any of these studs. The "variable" anode resistance is also supplied in a double-ended type, in which a simple switch is mounted at each end of the barrel.

The single-ended type gives five different resistances from each unit, whilst the double-ended type gives fifteen. A particular sample of the single-ended variable type was rated for values of 120,000, 150,000, 180,000, 210,000 and 240,000 ohms, and on test I found the values of the resistances to be remarkably close to the rated values: in no case was the variation

(*Continued on page* 1171)

The studio of station W S O E, which is operated by the Milwaukee School of Engineering, a well-known American technical establishment.

NEWS FROM SAVOY HILL. FROM OUR OWN CORRESPONDENTS.

ROGER CLAYSON AT 5GB

MUSIC FROM GLOUCESTER—LORD CECIL'S TALK, ETC., ETC.

Roger Clayson at 5 G B.

IT will be welcome news to many listeners to learn that Roger Clayson, whose beautifully smooth quality voice transmits so perfectly and marks him out as one of the most artistic tenors who has ever sung before the microphone, is giving a recital from the Daventry Experimental Station at 9.30 p.m. on Thursday, February 9th. Mr. Clayson is happiest when singing songs of the German Lieder tradition, particularly those of Hugo Wolf, on his interpretation of whose music he has frequently been commended.

Music from Gloucester.

A concert by the Gloucester Orpheus Society, relayed from the Shire Hall, Gloucester, is to be broadcast from the London and Daventry stations between 8 and 9 p.m. on Thursday, February 9th. The programme includes glees, part-songs, and items for solo and chorus, the soloist being P. E. Underwood (baritone); pianoforte and violin selections by Madame Adila Fachiri and Mr. Bertram Harrison.

Lord Cecil's Talk.

The Rt. Hon. Viscount Cecil of Chelwood is to give the next of the monthly talks on International Affairs in the London studio at 7 p.m. on Wednesday, February 8th. Lord Cecil's great efforts in the promotion of international peace and security are so well-known that his talk is certain to have a big audience. Incidentally it will be interesting to note whether

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The "Q. and A." THREE

Before you lay out your money on a first-class long-distance loud-speaker set there are a good many questions to be considered. You will find them in this friendly article—with the answers. By the "P.W." TECHNICAL STAFF.

Q. "I say, old man, what splendid reproduction that set of yours is giving! How ever do you get such natural quality?

A. Oh, that is quite easy. It is just a simple three-valve set. You could make one like it if you wanted to.

Q. "I am afraid I shall never be able to make a loud-speaker set, for the only set I have made so far has been a little crystal set, and I suppose one needs to be pretty skilled to turn out a beautiful set like yours?"

A. No. It's a very easy job, really, provided you take reasonable care and stick to the directions. I'll show you how to build it, if you like.

Q. "Before you go to all that bother, are you sure that I should be able to make a successful set like that one?"

A. Oh, yes, there is no doubt about that. Look here, we'll just have a look at the inside and see how really simple it is.

A BLUE PRINT of the "Q. and A." Three and three other Sixpenny Blue Prints, are GIVEN AWAY with this copy of "Popular Wireless."

Q. "First of all, you might tell me what these dials are, on the front. I can see that the one on the left is apparently for tuning, but what are the other gadgets for?"

A. Yes, the left-hand one is the tuning condenser, the one in the middle is the reaction or volume control (just above that plug and socket arrangement for grid leak or anode rectification), and the little knob on the right is the on-off switch.

Is It Pure?

Q. "What is the "plug" thing, as you call it, then? As I don't know anything about wireless, what shall I do about that?"

A. Oh, you do not want to know anything about that, you can simply push the plug in right or left to find which you like better. For instance, if you want to get distant stations, you can use grid-leak rectification which is rather more sensitive than the other, while for best quality on the local station you use the anode bend. That's all there is to it!

Q. "I suppose the latter (anode bend) is not quite so good for long-distance work, then?"

A. No, that is rather less sensitive than the other.

Q. "Is it pure?"

A. Oh, rather. You just listen. I'll switch over from one to the other, and you can just judge for yourself.

Q. "Well, honestly, old man, they are both so amazingly good that I cannot say that I prefer one to the other. Even the grid leak, which you say is inferior in purity, is simply beautiful, and I certainly have never heard a set go like this one before. If you do not think it is going to take too long, or be too difficult, I am really very keen to try to make it. Will you give me a hand in the way of telling me what to do about it?"

A. That won't take a jiffy. I'll sketch you out a circuit diagram and then we'll have a look at the inside of the set, and run over the different points together. Here you are. Here's the diagram. (See the "P.W." Blue Print No. 42). That's the one I built the set from, although, as it is a theoretical diagram, you may not be able to make head or tail of that one at first. It's quite easy when you understand it, though.

A comparison between this photograph and the Free Blue Print of the "Q. and A." Three—which is given away this week to every reader—will show that the constructor need expect no difficulty in making the "Q. and A." set. In fact, he can't go wrong if the clear instructions are followed carefully.

Q. "Well, I can see which are the valves, all right, and I think these round loop things are coils."

A. Yes those three curly things on the left with the aerial sticking into one are the coils. Two for tuning and one for reaction. But that other one coming out of the top of the first valve is a choke. You won't have to worry much about that. Look here, let's go over the various points inside the set itself and you can see exactly how things map out.

Q. "Well, I see, anyway, that all the terminals are very clearly marked. I shall not be likely to go wrong with the connections, because, although I know nothing about it, I do know the difference between the H.T. battery and the accumulator."

A. Ah, that'll save you a few burnt-out valves, anyhow.

Q. "One thing I should like to know right away is what sort of wave-lengths will the set cover? Does it get all the broadcasting

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THE "Q AND A" THREE.

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wavelengths used in the British Isles, and those on the Continent as well, or what ?

A. Yes, it will do that all right. It covers practically any wave-length you want it to. You see, these coils pull out, and you can transpose them with other coils so that you can choose your range of wave-lengths practically as you like.

Q. "Does the set work equally well on all the wave-lengths ?

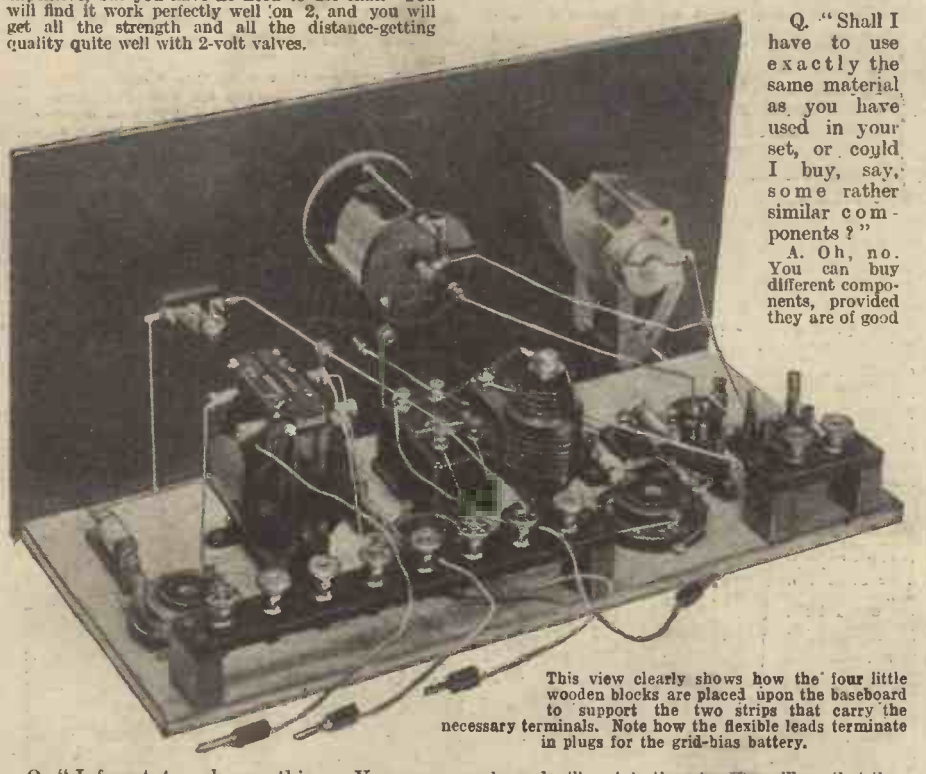
A. So long as you don't go down too low. It will work perfectly on all the broadcasting wave-lengths.

Q. "I certainly should like to build it, and if you don't mind explaining one or two more points, I think I should like to get practical details right away so that I can start on it as soon as possible."

A. That's right. Go ahead. What would you like to know about it ?

Q. "About the valves. Do I have to use a 2- or a 6-volt accumulator for them ? I understand that a 6-volt costs more money, so I should like to use the 2-volt."

A. Yes, a 6-volt accumulator is rather more expensive, but you have no need to use that. You will find it work perfectly well on 2, and you will get all the strength and all the distance-getting quality quite well with 2-volt valves.



This view clearly shows how the four little wooden blocks are placed upon the baseboard to support the two strips that carry the necessary terminals. Note how the flexible leads terminate in plugs for the grid-bias battery.

Q. "I forgot to ask one thing. You say it will get distant stations, but is it very hard to handle ? Do you have to fiddle about a lot with it; or is it fairly easy ?"

A. Oh, it is quite an easy set; you will soon get the hang of it. You simply twiddle that left-hand knob slowly, and the one in the centre you turn very gently and bring up the strength of the station you are getting. You will know quite a lot after half an hour's or an hour's practice with it.

Plenty of "Punch."

Q. "Just at first I should be using it chiefly for real good reproduction in the sense of good music, because my wife happens to be very fond of music, and it is for that reason that I am particularly keen on such a good quality set."

A. Oh, you will find this will suit admirably in that respect.

Q. "Do you think I could work two loud speakers from it ?"

A. You will discover it will work about half a dozen if you are not too far away from the station. What is your distance from the "local," by the way ?

Q. "Well, our house is nearly ten miles away, as the crow flies."

A. It will operate three or four loud speakers perfectly well, at that distance from any main station.

Q. "Well, I have decided to build it, and if you will be so good I will take down some of the particulars straight away. Would you mind explaining the different components to me ?"

A. I'll make you out a list of everything you require, and if there are one or two points on which you are a bit doubtful, we can go through them together right away. (See "P.W." Blue Print No. 42).

How Much H.T.?

Q. "You have already said I can use 2-, 4-, or 6-volt valves. How much H.T. shall I want ?"

A. Well, it will work on about 90 volts, but 120 is really best to get what I call "beefy" results.

Q. "If you think it is necessary for perfect reproduction, I shall certainly use it, for, although I believe H.T. batteries are rather expensive, it certainly is worth while, if one can get such splendid reception as this."

A. It is advisable for really perfect results. You will find it is not hard on the H.T. battery, though.

Q. "Shall I have to use exactly the same material as you have used in your set, or could I buy, say, some rather similar components ?"

A. Oh, no. You can buy different components, provided they are of good make and will go into the set. You will see that the things are not cramped, but there is not too much room, so you must be careful what you use.

Q. "What is the tall component with a shape rather like an egg-timer ?"

A. That is the thing I pointed out on the diagram, the H.F. choke.

Q. "Will any H.F. choke do ?"

A. Well, you have a wide choice, provided you get a good one. Don't go and buy a very cheap one at about 2s. 3d., or do anything silly like that, you know.

Q. "What is that little black box beside it ?"

A. Oh, that thing with the four terminals ? That is a resistance-capacity-coupling unit. You will find you have to have a fairly small one to get it in the space. Other makes will do provided you can get them in. That unit accounts for a large amount of the purity of the set.

Q. "The big thing at the end is a transformer, I believe ?"

A. Yes, that's right, and it's essential that it should be a good one, too.

Q. "One thing I notice about the set, it has not too many knobs on the front. Most of the sets seem to have such a lot of knobs that it rather frightens one, but this one has very few. Why is that ?"

A. Well a lot of the old sets have what are called variable filament resistances to control the lighting of the valves. We have done away with them in most of the sets, nowadays. We put in little fixed resistors as they are called. They are those little things rather like cartridges. You can see one right at the end where you are looking now, one in the middle and one nearer my end of the set.

Q. "Why are the valves wobbly ? I notice they shake in their holders."

A. That is to get away from vibration if anyone comes in and slams the door or knocks the set. In the old days a valve would then make a most awful howl in the loud speaker. After I have got this fixed up again I will give it a jolly good bang and you will hear that there is absolute silence, although that sounds rather Irish.

Commencing Construction.

Q. "Oh, I see the point. When one comes to look at it, the whole set really does look rather simple, after all. I think I shall not have too much difficulty in making it. Is that tall thing behind the choke near the 'R.C. unit,' as you call it, a condenser ?"

A. Yes, that's a fixed condenser. That is put in series with the reaction condenser, so that if anything should happen to the latter condenser, no damage will be done to set through the high-tension battery discharging. Run your finger over the path on the theoretical diagram and you will see what I mean.

Q. "Well, as you are giving me a list of the components, and I may not be able to see you again before I start building the set, let us suppose that I have all the components ready and am going to build the set. What is the first thing to do ?"

A. The first thing is to drill the panel according to the diagram which I will give you. If you wait a minute, I will just copy this one and give you the exact dimensions. (See "P.W." Blue Print No. 42.) You will notice there are only six main holes to be drilled, which is a very easy job.

Q. "In addition to the six main holes there are five others for the fixing screws then. I suppose that is just to hold the panel to the baseboard ?"

A. Yes, that's right. Those holes are drilled after the job is done, when the panel is being fixed on to the baseboard itself. You have the baseboard in its cabinet and press the panel up against it in the exact position, so that you are bound to get it right then. If you drill them first you may get them a little bit out and find the panel will not fit the baseboard.

Mixing and Fixing.

Q. "Well, I suppose when I have the holes made on the front of the panel, I can mount these condensers on them. Suppose the condensers I get are a little bigger or a little smaller. Would it matter much ?"

A. Not a bit, except that the aerial condenser cannot be very much larger or else it will get in the way of those coils. By the way, do not forget to get a condenser with slow-motion tuning, for you will find it a great help when searching for distant stations.

Q. "Why are the two condensers different ? One appears to be quite different from the other."

A. Yes, that one near the top of the panel, the reaction condenser, is quite a different capacity from the other one (but it can be of the same type if you wish it).

Q. "Well, I don't think I should have much difficulty in making the panel look all right. As there are only half a dozen holes on it, I can do that without much trouble, but how are all the other things fixed to the baseboard. Just by ordinary wood screws ?"

A. Yes, that is all. You just fit them in the approximate positions like I have, and then fix them down with wood screws. Use brass, you know; don't screw them down with steel screws. They only give trouble afterwards by rusting.

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Q. "Does it matter which way round I put the valves?"

A. Yes, as a matter of fact it does. You should have them the same way round that I have, that is, with the grid socket pointing to the left of the set. Then you can keep your wiring as short as possible, which is a point that makes for efficiency.

Q. "I think I will get you to sketch me out a wiring diagram of the set, so that I can see exactly how you have done yours. Would it be possible to show the directions of most of the actual wires, so that I can follow pretty closely the way you have got it here?"

A. Oh, yes, that can be done quite easily; but you must not forget that the diagram will be in one plane, and some of the wires may look a little bit different from the way I have got them. By the way, I'll send you some photos along of the set if you like, I can easily take some and they may help you. Oh, and another thing! Those terminal strips you can buy all ready, you know, from the dealers; but the little wooden blocks they are mounted on you will have to make yourself. It's quite a simple job, as you will see.

The Way to Wire-Up.

Q. "Well, supposing now I get all the components, as you say, and mount them in the same positions as you have here, as near as possible, how do I start about the wiring?"

A. Well, with regard to wiring, I think the best thing would be to tin all the points first, terminals, brass tags and so on, so that they will be all ready when you want to put the wires on.

Q. "I think I could do that all right, because I have mended a kettle or two and I do know just the first thing about soldering. So I do not think that part of the work would give any trouble at all. What I should like to know, however, is whether there is any particular order in wiring up to be followed? Where should I start and so on? Does it matter?

A. Well, it is not an important point; but if you want to make the wiring as easy as possible, you want to do the wires close down to the baseboard first. I should start with the filaments, if I were you. I should unship that terminal strip, to do the filaments, and just take the respective wires to the filament terminals along the edge of the set till you have got things spaced out a bit. (See wiring diagram.)

Q. "You mean this wire at the back here, near the terminal board? The wire running along by the three valve holders, and then to the earth terminal, and to the top of the coil?

A. Yes, to do that wire properly you will certainly want the terminal blocks out of the way.

Easily Done.

Q. "Then I suppose I join the other side of the filaments of the valve holders, to those little fixed resistances?"

A. Yes, that's quite right; and then join up the other side of those resistances and then that lead to the switch. The lead from the switch to the terminal (the L.T. plus terminal) can be done later on.

Q. "I see that that lead between the fixed resistances also goes to the anode-bend thing, or is it a grid leak. I forget what you called it?"

A. Oh, that's the lead for the grid leak. The grid-leak side is when you put the plug in the left, and anode bend when you put the plug in the right, which you see is connected on my set to a flexible lead going to the grid-bias battery. That gives the valve a slight bias and makes it act as an anode-bend detector.

Q. "It all looks pretty simple, I must admit, and so far I wonder how a set can work so well with so few wires. I suppose those flexible wires are put on last, aren't they?"

A. Oh, yes, that's the very last thing to be done.

Q. "When I have done the filament wiring, shall I put the terminal board back, and wire that up?"

A. No, I do not think I would yet. I would put that other little strip with the two terminals on, and then start on those aerial connections right at the end of the set.

Q. "The third terminal seems to be connected to a lot of places—would it be best to do that next?"

A. Yes, I should do that because you will see that is connected to the filament lead as well, and you want to get those filaments, except for the terminals, absolutely completed before you leave them, otherwise you may forget something later on.

Q. "As the wire from the aerial condenser seems to go underneath that lead, I'll do that at the same time, I suppose?"

A. Yes, I should get that condenser wired up, and also the reaction condenser.

Q. "By the way, this little thing underneath the aerial condenser that looks like a round block—what is the purpose of that?"

A. That's a small fixed condenser—the grid condenser, which comes into use when the valve is used as a grid-leak rectifier.

You will find the wiring diagram of the "Q. and A." Three on the Free Blue Print given away with this copy of "Popular Wireless."

Q. "Should I be able to use any type of plug-in coil in this set?"

A. Yes, provided they will go into the holders without jamming together too tightly. You see, I have got mine so that they just don't touch, which is about the right coupling.

Q. "I suppose I shall want a set of coils for the ordinary low waves and a set for the high waves?"

A. Yes, if you want to cover both wave ranges you will want three coils for each band.

Q. "To save expense I shall get just the lower range at first, I think. Do you reckon I should get other stations besides London if I only had the ordinary low-wave coils?"

A. Oh, yes, you will get London and 5 G B and possibly one or two other British stations, and you should get about half a dozen of the foreign stations at fairly good loud-speaker strength. Of course, if you use telephones you will hear many more.

Q. "I must say I am quite anxious to get home and start building it. May I trouble you to explain another point? Suppose now that we have finished the wiring near the earth terminal and I have got the coil holders connected up as on your set, what is the next thing to watch?"

A. Now you will wire up the grid of that first valve to the grid leak and to its little condenser. Then go on to the plate, and follow the wiring up to the choke on to that little fixed condenser, and then from the fixed condenser on to the third coil holder. Then you can go on with the lead to the choke (the thing like an egg timer) to the resistance-capacity-coupling unit.

Q. "I shall not make any mistake with those connections, because I see the terminals are plainly marked there; aren't they?"

A. Yes, you will find both this unit and the transformer are very plainly labelled, so you cannot go wrong there.

Safety First.

Q. "Are there any particular points to watch with regard to the spacing of the wires?"

A. Well, nothing very important, but keep them as far apart as you can, and get those wires coming from the grids and plates of the valve holders as short as possible; that's why those valve holders are spaced the way they are. And do not run any wires parallel, for a greater distance than can possibly be helped.

Q. "What is the objection to that, then?"

A. Well, you get electrical interaction between the wires then, and all sorts of troubles may result.

Q. "I must try and remember that. I must say the set as you have built it looks awfully neat, and the only thing is that I shall be rather afraid of wires touching one another. Would it matter much if they did?"

A. Oh, yes, the thing would not work then, and you might possibly get a little bonfire going if the high or low-tension wires touch each other. You see, those wires are bare and are not insulated in any way. You could use insulated wire if you would feel safer.

The Wire to Use.

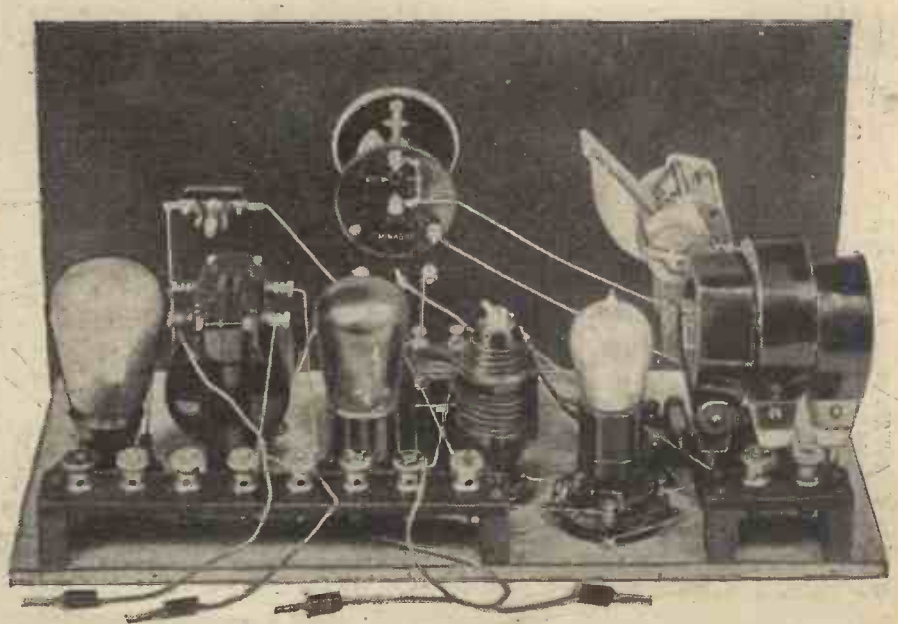
Q. "Well, as it will be my first valve set I think I shall use insulated wire. What kind should I get?"

A. That covered wired called Glazite would be quite O.K.

Q. "Well, we have got to the connection to this middle valve. By the way, is that the detector valve?"

A. No, the first one is the detector valve. That middle one is the first low-frequency amplifying valve.

(*Continued on page* 1147.)



Here the three coils are shown in position on the right, the one nearest to the edge of the baseboard being the aerial coil, or "primary." Beside it is the grid coil, tuned by the first variable condenser, and connected to the detector valve. The remaining coil is for reaction.

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You see, you have two low-frequency valves which give the set the full volume one gets on the loud speaker.

Q. "When one comes to examine it point by point, like this, it does seem easy, but there is one thing that strikes me. I notice this wire from the base of this first L.F. valve goes up to the transformer and that the other side of the transformer goes to H.T. plus. But there is another H.T. plus beside it. Why do we have two H.T. pluses?"

A. As a matter of fact you will find there are three H.T. pluses, so that each valve can have the H.T. voltage which best suits it. They could all have the same if you like, but the set would not have the same quality of reproduction or such distance-getting powers. It is much better to have three separate ones.

Q. "Does that make it at all complicated to connect up the H.T. battery?"

A. Oh, no, that's quite easy. You have three leads, one from each H.T. +, ending in three little red wander plugs, and you simply plug those into the H.T. battery just wherever you find they give you the best results.

Where to Plug In.

Q. "Why are there so many of those other black negative plugs? There seems to be several in the set. I can see three at this end."

A. They are the plugs which go into the grid-bias battery. One of them going to that little thing on the panel is for the anode bend, and the other two are grid-bias leads for the low-frequency valves. They are absolutely necessary if you want good quality of reproduction.

Q. "How do you know in what part of the battery to place them?

A. The valve makers will recommend the voltage according to the voltage of high tension you employ.

Q. "If I put them on the wrong one, how should I know?"

A. Oh, you will know soon enough. You will get inferior reproduction.

Q. And then you just alter them until it gets pure?

A. That's right, you simply move them up and down until you get the best results. I'll give you some idea of which ones to put in before you go.

Q. "Righto! In case I forget it I should like to make a note of those there. This one that goes to the panel, for instance, how many volts should that have?"

A. That will have about 1½ to 3 volts.

Q. "Does that grid battery use up very quickly, by the way?"

A. Oh, no. It does not supply any current, you know. It's life is practically "shelf" life, that means to say the life it would have if it were stored on a shelf all the time. All batteries have a certain amount of leakage inside them. You will find it will last about five or six months.

The Transformer.

Q. "How much voltage should I put on this first one? I see the lead comes from the R.C. Unit."

A. That will depend upon our H.T. voltage, but you will find about 1½ to 3 volts. The last valve will have a voltage of about 6 or 9 according to your H.T. Do not forget to put your grid-bias plus in at the other end.

Q. "Which one is that? I don't see that marked?"

A. Oh, that is connected to the filament of the second valve, to the little flex coming in underneath the terminal board there. It ends in a red plug. You see it, don't you?

Q. "Oh yes, I see what you mean. The one that comes from this filament terminal nearest to the terminal board."

A. Yes, that's the one.

Q. "Now suppose we have finished the wiring to this middle one, and have got along towards the other end of the set. The transformer wiring would not be very difficult. I suppose all transformers are marked like this, so that I shall not make a mistake?"

A. Yes, most of them are marked like that. There are one or two marked with OP and IP, IS and OS, however.

Q. "What do those letters stand for?"

A. IP and OP are the primary connections which correspond with the plate and H.T. plus of the one in the set, and OS and IS correspond to the grid and grid bias.

Q. "Does it matter which way round I connect them?

A. Generally the makers give you directions, showing which way to connect them. As a matter of fact, you will find usually that there is not very much difference, although if you have any doubt I should try changing them over.

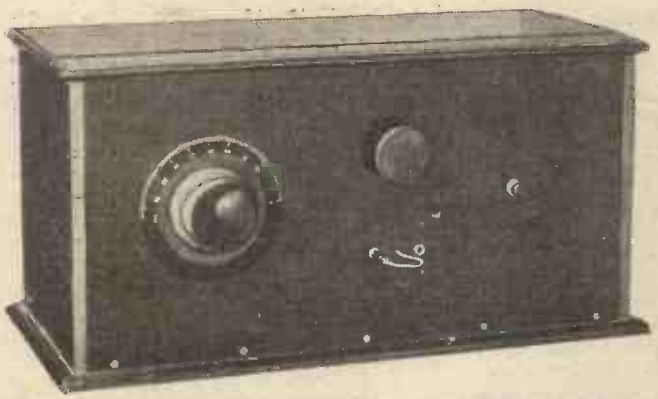
Simple Switching.

Q. "If I get any difficulty of that kind I suppose I shall write to 'P.W.' about it, or will you, perhaps, be able to give me a word of advice on the subject?"

A. Yes,—come round and see me if you have any trouble, or else drop a line to the Queries Department. They are always willing to help you.

Q. "There is one thing that strikes me, old man. It all looks so simple the way we are doing this now, but I am afraid I shall strike a snag when it comes to the actual wiring up. Do you think I shall?"

A. No, I don't think so. The only snag you could possibly strike would be due to your own fault, if I may put it bluntly. That is by doing bad soldering or something like that. Make sure, after you have done each joint, that it is strong. Give it a good tug to make certain.



A set to build and to be proud of. Tuning is done on the big dial, the knob near the centre of the panel being for the control of reaction. Below this is the plug that gives grid-leak or anode-bend rectification—extra long distance or extra purity, as desired—whilst to the right is the on-off switch.

Q. "I notice that a lot of wires go to terminals. If I am at all doubtful shall I use the terminals? Would that be just as good?"

A. Yes, that's quite as good, providing you screw the terminals up tightly with a pair of pliers.

Q. "I think I shall do that—it seems a good stunt. By the way, at what stage am I to put the terminal board in?"

A. I should put it back just after you have done the middle valve and the transformer leads; then you have got to put the H.T. plus lead on the transformer, and you can join up the L.T. leads. You must not forget those, or else nothing will happen when you connect up the batteries.

Q. "Well, we are getting down to this end of the set near this middle valve. I will get you to mark the terminals on the board starting like they do, with L.T.+ nearest to the earth terminal, the L.T.,— H.T.— next to it, and so on. By the way, are there any connections underneath this terminal strip?"

A. Yes, there are two. I should have told you about that. It was rather an omission on my part. L.T. minus is connected to H.T. minus, terminal to terminal, and the H.T. plus 3 is connected to the loud-speaker terminal underneath.

Q. "Why is one loud-speaker terminal red and the other black?

A. That is because loud speakers have a right and a wrong way of being connected up, you know. You will find that on nearly all the loud speakers, all the good ones anyhow, there are marks, or red tags and black tags, and you must fix the leads from the set accordingly.

Q. "I have never noticed any red on this loud speaker that I had thought of buying. I believe as a matter of fact, though, it is marked plus and minus. Is that the same?"

A. Yes, that's just the same. The plus lead goes to the red terminal.

Q. "There doesn't seem much room to spare, but I suppose that there will be enough room for any type of valve in this set?"

A. Oh yes, any type of valve will go in that set.

Q. "By the way, what is the idea of enclosing all the valves in one cabinet like this? The old sets used to have all the valves showing; wouldn't that have been more accessible?"

A. Yes, it was certainly more accessible as regards the valves, but, you see, if you have them all enclosed you keep dust away from them, and meddling fingers also. After all, the lid of the set opens and you can soon dive inside if you want to.

Q. "Does dust do any damage to a set?

A. Oh yes, it can cause no end of damage. It can cause serious leakage and loss of signal strength, and if it gets very bad, you know, you may find your H.T. battery leaking and running down very rapidly.

Q. "I remember a friend of mine had an awful crackling on a set, and he said he found it was dust on the condenser. How could that happen?"

A. Well, that happens by dust getting between the moving and the fixed vanes of the variable condenser, and so causing a partial short in the condenser each time it is moved.

Q. "Then there is not so much danger of dust with a set like this, I suppose?"

A. No, you will find it will keep absolutely spotless inside.

Q. "What I like about it is that it seems very accessible at the back, too. By the way, do you have to keep on undoing those terminals? is it necessary to disconnect any of them when the set is not in use?"

A. No, there is no need to touch anything else. You just push the button and that turns the set off, or pull it, and the set comes on again.

For the Family.

Q. "And then, if the family want to start up the set when I am away at any time, all that will be necessary is to put the aerial switch up and to pull out this little 'on-off' thing?

A. Yes, that's so. You can leave the set tuned in to the local station, or whatever station they want.

Q. "Would it be as good and as loud in daylight as it has been this evening.

A. I do not think you will notice much difference on the local station, but for distant stations, of course, night time is very much better.

Q. "Well, I must go now, and next week I'll come round again for a final word before I buy the valves. Cheerio!"

A. "Yes, come round for a final chat before you get the valves, batteries and so on. Cheerio, Old Bean!"

(The final hints on the "Q. & A." Three will be given in "P.W." next week.)

FINDING K D K A

Some practical suggestions which will make your fingers itch to get at the dials of your set.

By A. J. CAMPBELL.

THE advent of stable high-frequency amplification of the shorter wave-lengths and the rapid growth of interest in short-wave work are disclosing a disconcerting lack of information about the transmissions to be found on the 15–100 metre wave-band. It must frequently happen that fruitless attempts to pick up short-wave signals raise serious doubts as to the suitability of the circuit or apparatus employed—whilst the cause of a failure actually lies in the fact that the experimenter has little or no knowledge of where and when to search.

If a wave-meter is not available the tuning range of the receiving set should be calibrated. This requires but a sheet of squared paper and ordinary care; most people know how to prepare a simple graph. For our present purpose one of the co-ordinates is divided to represent condenser-dial readings and the other to represent wave-lengths (or, if preferred, frequencies).

Calibrating the Set.

The obvious question is, "How can you calibrate when the obvious trouble is to *find* the stations?" This difficulty is met quite adequately by ignoring all the short-wave transmissions and working on harmonics of the normal broadcast-band transmissions. Harmonics occur, for example, on one-quarter and one-eighth of a given wave-length, and the following table shows suitable harmonics of representative stations:

Station	Wave-length	Harmonic
Daventry Experimental (5 G B)	491·8m.	61·5 m.
Langenberg ..	468·8m.	58·6 m.
London ..	361·4m.	90·4 m. and 45·2 m.
Breslau	322·6m.	80·6 m. and 40·3 m.

Such harmonics are generally traced easily. Having identified three or four of them and noted the respective dial-readings, a curve can be plotted on the graph. From this curve can be read the approximate condenser readings required to receive transmissions on any wave-length within the range covered.

Perhaps the strongest transatlantic transmission just now is K D K A (East Pittsburg, Pennsylvania), and a few notes on his idiosyncrasies will show how easily the newcomer to the short waves may fail to hear even this powerful signal.

Irregular Transmission Times.

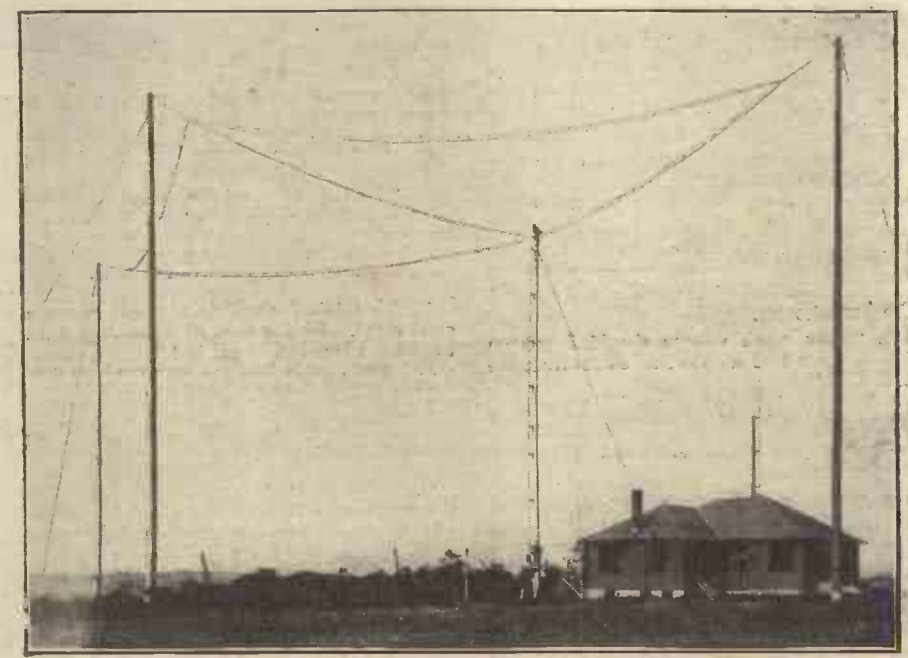
K D K A sends on 63·7 metres and 26·0 metres (as well as on other wave-lengths), but one cannot say exactly when he will begin sending on either or both. The 63·7 m. transmission provides me with the stronger and clearer signal, but not until after midnight can one be sure he is "on the air" on that wave-length. On most evenings the 63·7 m. carrier-wave appears about 10.55 G.M.T. (For searching it is well to remember that this wave-length is just "above" the 5 G B harmonic on 61·5 m.). Shortly afterwards there is generally heard the American accents so gratifying to every distance enthusiast saying, "Good-evening, ladies and gentlemen. This is K D K A the Pittsburg station of the Westinghouse Electric Co., East Pittsburg, Pennsylvania." There follow announcements about programmes, advertisements of theatre and music-hall shows. About 11 o'clock G.M.T. a gong is struck once to give the exact Eastern Standard Time, as supplied, one is told, by the Ducane Time Co.—11 p.m. G.M.T. is 6 p.m. E.S.T.

Unmodulated Carrier.

This seems straightforward, but the trouble is that although the carrier-wave appears before 11 p.m. G.M.T. no signals may be sent out on that wave-length until after midnight. An announcement may be made that between 6 p.m. and 7 p.m. E.S.T., K D K A's programme will be available on 26·8 m., but this information may not be given at all. The carrier-wave often continues unmodulated for over an hour. During this period one can hear the faint despairing oscillations of searchers on 63·7 m. They may have missed his announcement (if any), and no doubt they will blame their apparatus for the failure to "resolve" the carrier.

Soon after midnight telephony appears (or re-appears) on the carrier-wave. At times the announcer heralds the fact by making a suitable explanation—at others the music or speech just arrives suddenly, as though the engineer had remembered to put in some modulation.

The programmes between 7 p.m. and 8 p.m. E.S.T. are generally provided by Pittsburg studios, e.g., that of the Pittsburg Post Gazette. Lectures are given from Pittsburg University, and on Tuesdays (Wednesday mornings here) the hour is devoted to songs and recitations of a religious character. After 8 p.m. E.S.T. K D K A often switches in to the Blue Network, i.e., the eastern coast simultaneous-broadcast system, where first-class material is available from New York and elsewhere.



This is a view of that famous K D K A of East Pittsburg. It is located on the second highest point in Allegheny County. The aerial from which most of K D K A's short-wave transmissions are ejected is merely a copper tube 60 ft. high. It can be seen just behind the building.

"Dead-End" Effects in Radio Circuits

Although these effects are not frequently encountered in modern designs the subject is very interesting, and the following article will prove of great value to owners of older types of receivers.

By J. F. CORRIGAN, M.Sc., A.I.C.

IN dealing with the present subject, let us begin at the very root of the matter in order to grasp clearly the reasons why these dead-end effects are set up in oscillatory circuits. Consider, therefore, the diagram illustrated at Fig. 1. In that figure we have an oscillatory circuit comprising an aerial, an earth, a crystal detector, and a tapped inductance. It will be noticed, however, that the whole of the inductance coil is not utilised in the circuit. Only the portion of the coil (AB) is directly included in the electrical circuit, the turns of wire of the coil (BC) comprising those which are left over and which are not required for the purpose of tuning the oscillatory circuit to the frequency of the incoming waves.

Cause Considerable Losses.

Now, when we have this sort of arrangement it is found that the presence of the unwanted turns of wire in the inductance coil has a very detrimental effect on the strength of reception, particularly if the circuit be a crystal one. In short, the unused turns of wire in the inductance, although they are not directly in the electrical circuit, drain away or absorb a proportion of the electrical energy which flows into the circuit from the aerial system of the receiver, thus setting up a very definite electrical loss in the circuit.

This sort of happening, in brief, is known as the "dead-end" effect, and the electrical losses set up in the circuit owing to the presence of unused turns of wire in the inductance are accordingly termed "dead-end" losses.

Dead-end effects due to the presence of a number of unused turns of wire in a tuning inductance are set up in a number of ways. In the first place, the unused turns of the inductance, in virtue of their closely spaced formation, form a number of miniature

Fig. 2.—A practical illustration of "dead-end" effects.

condensers, each of which abstracts a small amount of electrical energy from the active portion of the inductance. Again, energy flowing into the unused portion of the inductance causes it to act as a small oscillating system on its own account.

The reader will, no doubt, be familiar with the fact that when a current is caused to flow through a number of turns of wire, the wire turns behave very similarly to an ordinary magnet. For example, the photograph, Fig. 2, will serve to illustrate this effect. Threaded through a sheet of wire cardboard are a number of turns of insulated wire.

The turns on the right of the photograph are directly included in the electrical circuit. They correspond to the part of the inductance coil (AB) in the diagram, Fig. 1. The smaller number of turns on the left of

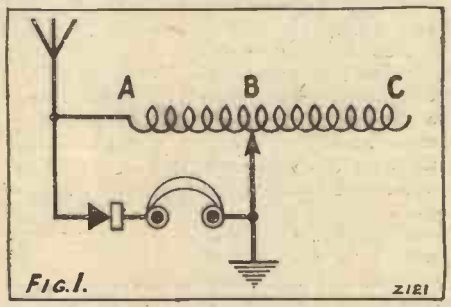


FIG. 1. Z181

the photograph (Fig. 2) are "dead-end" turns which are not directly in circuit, and which correspond to the portion of the diagram (BC) Fig. 1.

Now consider what is happening in this case. By sending a powerful current through the turns of wire on the right of the photograph (Fig 2), and by scattering iron filings over the cardboard sheet, the filings assume definite positions which clearly depict the presence of lines of magnetic force proceeding from the wire turns. Now, this magnetic energy is due solely to the presence of the current flowing through the coil. Anything which absorbs the magnetic energy will also use up a proportional amount of the electrical energy which created the former.

A Graphic Illustration.

Notice carefully in the photograph, Fig. 2, the unused turns of wire on the left absorbing lines of magnetic force which are radiated from the coil on the right. Here we have another cause of the dead-end effect graphically depicted. Although the turns of wire on the left of the cardboard sheet are not directly in circuit, they nevertheless absorb energy from the active portion of the coil. In fact, the whole arrangement acts as a sort of loose coupler, a proportion of the energy from the active turns of wire being transferred to the non-active turns of wire in the coil.

This is, perhaps, the most salient cause of the setting up of dead-end effects in tuners, and it will be obvious that if a tuner containing 500 turns of wire is employed for tuning a radio set to the wave-length of the incoming signals, a very large amount of electrical energy will be absorbed by the coil, if, say, only 40 turns of wire are actually included in the circuit. It is for this reason that the large cylindrical inductance coils which used to be so popular at one time for circuit tuning were very inefficient and productive of dead-end effects on small and medium wave-lengths.

Simple Remedies.

The dead-end effects are not proportional to the number of unused turns of wire in an inductance coil. In fact, the dead-end losses in such a coil are rather greater in proportion than the number of unused turns of wire on the coil. Also, the absorption of energy by the dead-end turns of wire on the inductance increases slightly with the number of active turns of wire on the coil.

Quite a ready means of keeping down losses in cylindrical coils, however, is the one illustrated at Fig. 3. Here a copper or zinc disc is moved along the inside of the former on which the coil is wound until it reaches a position approximately under that at which the active turns of wire in the coil divide from the unused turns.

The effect, of course, is one of screening. The metal disc prevents the magnetic energy of the active turns from spreading outwards to the inactive turns, and thus one great source of dead-end loss is avoided.

Apart from the use of this device in the case of specially constructed cylindrical

Fig. 3.—The action of metal screening illustrated.

tuning coils, the most radical method of overcoming any dead losses which may be present in a tuner is to scrap the coil entirely, and to make another. If the coil is a tapped one, keep the number of turns and tappings down to the utmost minimum. Users of plug-in coils, of course, do not generally experience dead-end effects in their receivers, owing to the fact that the whole of the turns of wire in the coil are in circuit at one time, the number of turns being governed by varying the size of the coil which is inserted in the holder.

WHICH IS BEST?

In this last article of the Series For the New Amateur Mr. Johnson Randall discusses the various methods of L.F. coupling, and differentiates between transformer, choke, and resistance coupling.

HOW can I get *natural* reproduction? What is the ideal method of coupling valves together? Which is best—resistance, transformer, or choke-coupling? In my last article I mentioned that there was a marked similarity between resistance and choke coupling.

In Fig. 1 I have shown a simple choke-coupled circuit. If you turn back to my last article in POPULAR WIRELESS (page 1045) you will see that the only difference between this circuit and the resistance-capacity circuit given in that article, is that the anode-resistance R_1 is replaced by an iron-core choke which I have called Z in Fig. 1.

Now this choke winding is much the same as the primary of an L.F. transformer. In fact, we can look upon it as being very similar to a transformer with the secondary removed. You will see that since there is no step-up effect, such as that which one obtains with a transformer, the total amplification cannot be very great. In practice it is slightly more than that which we get with a resistance stage.

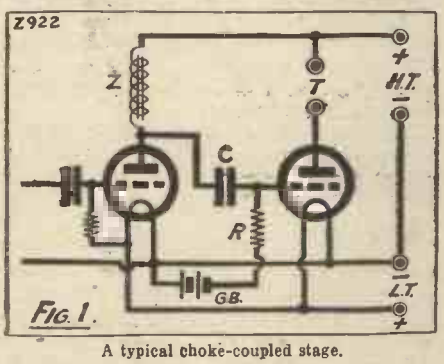


FIG. 1.

A typical choke-coupled stage.

Since a choke is similar to a transformer primary the same little troubles are met with in the effort to obtain pure reproduction. That is to say, a choke winding must have a great number of turns, i.e. a high inductance value, and care must be taken to choose a suitable valve if one wishes to obtain the best results. A good choke must be very carefully designed because its efficiency is dependent upon the current flowing through its winding. In addition, a choke is more expensive than an anode resistance, and this is a consideration when the design of the receiver involves the use of two or three L.F. stages.

A Popular Arrangement.

For the average broadcast listener I think that at the present time, resistance or transformer coupling, or a combination of the two, will give him all he needs in the way of high-quality reproduction and amplification. Fig. 2 is a good general-purpose circuit. A reaction detector valve is followed by one stage of resistance-capacity coupling and one of transformer coupling. For good all-round results the anode resistance may have a value of 100,000 ohms, the coupling condenser ·006 mfd., and the grid resistance 2 megs. This value of ·006 for the coupling condenser (used in conjunction with the grid-resistance value mentioned) will give excellent reproduction and practically even amplification down to about 80 cycles.

For this circuit, from the point of view of quality, I would prefer to use a low-ratio transformer in spite of the fact that one loses a little amplification. A ratio of about 3–1 is a good value, but I have personally obtained very excellent results with a 4–1 ratio, and I must admit that the difference aurally is not noticeable, although there is undoubtedly less amplification of the bass when using a higher ratio transformer in conjunction with similar valves.

The front part of the circuit is very conventional and, as will be seen, makes use of the popular Reinartz method of reaction. It is, as a matter of fact, the difficulty in obtaining really nice reaction control with the higher values of anode resistances which makes it so necessary for a comparatively low figure to be chosen.

Suitable Valves.

With a resistance of 100,000 ohms there is not much point in using one of the special R.C. valves, because this class of valve is only intended for use with very high anode resistances and would not give any more amplification in this case than an ordinary H.F. valve, which incidentally is a type I suggest could be employed.

Now in the case of the first L.F. valve, if the transformer has a moderately low ratio and plenty of turns on the primary winding, I think that one might employ another H.F. valve of similar type to that used in the detector circuit. If, on the other hand, a high ratio instrument is chosen, then one of the special valves intended for L.F. purposes would be most suitable from the point of view of reproduction. It must be remembered, however, that an L.F. valve will not give so much amplification as an H.F. valve, and if quality is not the primary consideration the H.F. type will give you more "beef."

In the last stage, that is to say, the third socket, one of the special "loud-speaker" or, as they are sometimes called small-power valves, should be used. If the volume is very great a "super" power-valve would give better quality but not such loud results. This is a point which is not generally understood. An ordinary power valve gives more amplification and should always be used if signals are not very strong in the first place. A super-power valve will not give so much amplification but will handle a much greater volume without distortion.

A Good R.C. Circuit.

Fig. 3 is another good circuit for pure reproduction. The only real difference from the Fig. 2 arrangement is that a resistance-coupled stage is employed instead of the L.F. transformer. The amplification with this circuit would be a little less than that obtainable with the resistance-transformer combination, but the quality would probably be slightly better.

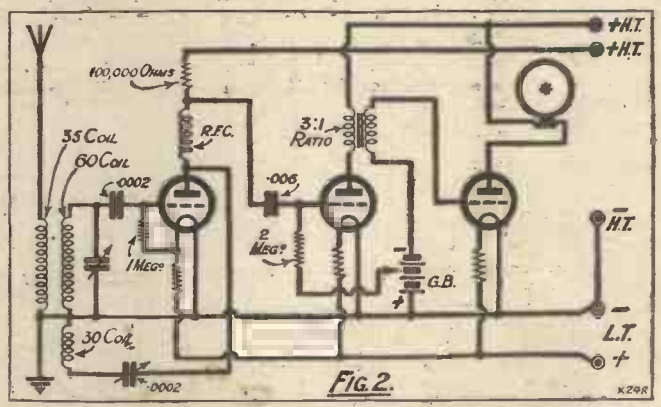


FIG. 2.

A very popular arrangement. The system of resistance-transformer coupling has been employed with great success in a large number of receivers.

In practice it is doubtful whether the difference would be noticeable with the ordinary type of loud speaker.

A suitable valve for the first L.F. stage in Fig. 3 would be one of the H.F. type

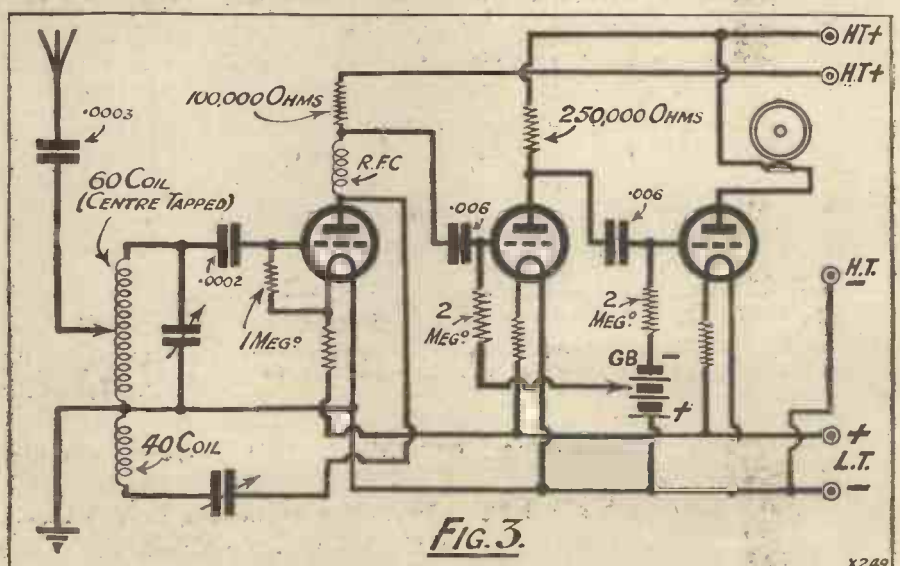
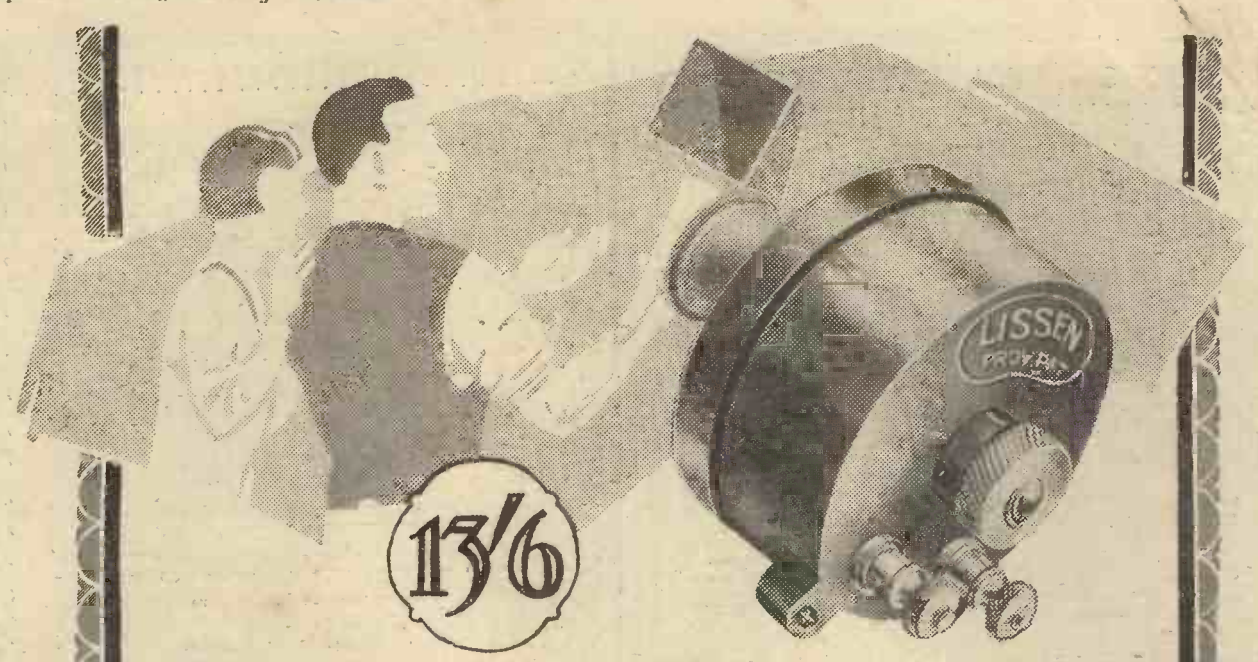


FIG. 3.

A circuit that will give pure amplification, though not quite so much volume as is obtainable from Fig. 2.



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A cone Diaphragm loud speaker can easily be constructed. The illustration shows one method of mounting.

Your dealer will gladly demonstrate and supply—or send postal order direct

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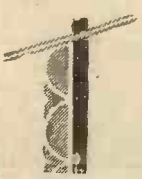

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AN ACTIVE ASSOCIATION.

The Editor, POPULAR WIRELESS.

Dear Sir,—Having read your appeal for greater interest to be taken in the wireless amateur, and particularly the reference to the R.S.G.B., I beg to draw your attention to the fact that the Manchester Association of Radio Societies has become so disgusted with the apathy and neglect on the part of the R.S.G.B., to which they were affiliated, that they resigned from that body before it announced its renunciation of its provincial commitments, and is now getting in touch with the amateur societies all over the country in order to form a new Association of British Radio Societies.

I beg to enclose you a copy of the aims and objects of the new association in the hope that you will give them prominence in your next issue (see the Editor's article), and will ask radio societies who are interested, and desire to be linked up with some national organisation, to communicate with Mr. L. A. Gill, the hon. secretary of the association, at Hope House, South Reddish, Stockport.

The aims and objects of the association were decided upon at a meeting of radio society representatives in Manchester, on Tuesday, January 17th.

Yours faithfully,

F. HORN.

(Radio Editor, Allied Newspapers, Manchester.)

Withy Grove, Manchester.

OBJECTS OF THE ASSOCIATION OF BRITISH RADIO SOCIETIES.

1. To create a fellowship amongst the radio societies of this country for their mutual benefit.

2. To protect the interests of radio societies (members of the association) in case of any dispute arising with the authorities.

3. To assist all associated radio societies in the organisation of lectures and in the general acquisition of knowledge in radio science.

4. To foster and maintain the interest in organised amateur radio experiments as conducted by radio societies in Great Britain.

5. To organise a comprehensive scheme for providing its members periodically with subjects to form the basis of discussions and experiments.

6. To organise radio societies of the country into locally-governed sections or groups, which will elect members to the general committee.

7. To provide facilities for the general public interested in broadcast reception, to acquire knowledge of the working of receivers, and to co-operate with charitable organisations in matters connected with radio.

8. To co-operate with the B.B.C. on all points of technical and entertainment interest.

9. To set up a standards committee in an endeavour to induce manufacturers to standardise components and accessories.

10. To promote and maintain the issue of "British Radio" as the official organ of the association.

H.T. ECONOMY.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have just finished reading your article in "P.W." No. 287, page 712, entitled "H.T. Economy."

Here is my advice to those about to buy entirely new batteries.

If using flash-lamp batteries (as I have always done) purchase twice as many as usual, and connect the two positives together and the two negatives together. This places the two batteries in parallel (not in series).

This gives the same voltage as would be usual, and doubles the CAPACITY. This capacity is ample to run a three- or four-valve set with power amplification without overloading the batteries.

I have had this method in use for the last eighteen months, and have just bought my third set of flash-lamps. As I listen on an average of six hours a day, you will agree that this is most economical for flash-lamps. And I would mention that I always buy the cheapest batteries, usually 3s. 6d. per dozen.

I have reckoned that my saving in H.T. current works out at at least a THIRD of what it used to cost me. I have recommended this to my various radio friends, and have never had a complaint that they have found it expensive.

If one goes in for the complete battery, then it is advisable to purchase two of the same make and voltage, and connect these in parallel.

If you could find room to include this idea in your valuable paper I am positive that those adopting the idea will be more than grateful. It is one of those simple things that escape the ordinary listener-in.

May I wish you continued success in this New Year. I have been a constant reader from No. 1.

Yours faithfully,

Poplar, E.14. W. H.

"TURKISH DELIGHT."

The Editor, POPULAR WIRELESS.

Dear Sir,—Further to my letter which you published in your issue of October 1, last, where I gave you results and full report of my five-valve neutrodyned set, it may now interest your readers of POPULAR WIRELESS to know that last night (December 28th) at about 10 p.m. (Eastern Time), that is 8 p.m. (G.M.T.) I succeeded in picking up Daventry and heard almost immediately Sir Harry Lauder singing popular songs. He ended his broadcast by singing "At the End of the Road" and "A Wee Deoch an' Doris."

This was followed by the Weather Forecast and News Bulletin given out so clearly by Mr. Rex Palmer, the London announcer. He then read reports on the Condition of the Roads issued by the Automobile Association and the Royal Automobile Club, and I gather from this that most of the roads in England are impassable owing to the heavy fall of snow.

Then I heard a talk about Diaries when the speaker advised all listeners to start a diary on January 1st, 1928. This talk was followed by a Tschaikowsky concert which was conducted by Mr. John Ansell. At 12 o'clock (that is 10 o'clock G.M.T.) I heard the six dots which is the time signal from Greenwich Observatory.

Reception was so good on the loud speaker with no fading and hardly any atmospherics that I could imagine myself listening-in somewhere in England while sitting by the fireside, and it was really with regret that I had to switch my set off for the night.

Wishing POPULAR WIRELESS every success for 1928 and thanking you for its useful hints, etc.

Yours faithfully,

Constantinople. NISSIM BEHAR.

CORRESPONDENCE.

AN ACTIVE ASSOCIATION

H.T. ECONOMY—A HOME-MADE LOUD SPEAKER.

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.

A HOME-MADE LOUD SPEAKER.

The Editor, POPULAR WIRELESS.

Dear Sir,—Having seen various types of loud speakers in your esteemed paper, POPULAR WIRELESS, I am enclosing herewith the photographs and particulars of a horn constructed by myself which you may consider worth insertion in your paper.

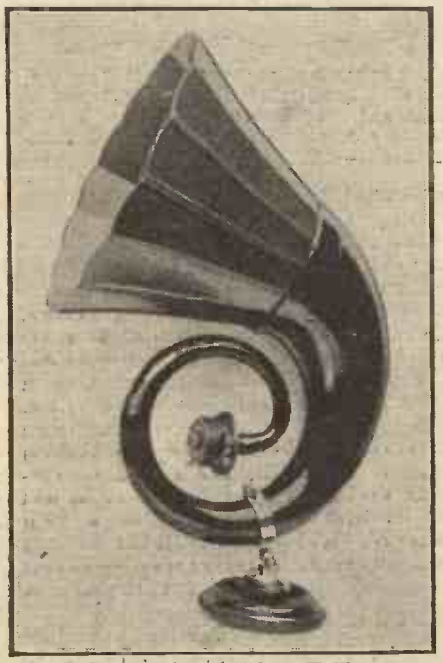
The horn has a true logarithmic taper of 10 per cent increase, being 63½ inches long by 17½ inches flare, with an overall height of 34 inches. As this is too long, if straight, for ordinary rooms—owing to reflection troubles, etc.—I have made it, as you will see from the photographs, so that it can stand on a 9-in. pedestal in the corner of a room.

The bend is composed of layers of brown paper pasted together on a wood mould, which is in two halves, up to a thickness of ¾ in.; then the two halves are joined together, the flare being made in ¼-in. three-ply wood.

As regards the tonal quality, it is very good, and, owing to the cut-off being in the region of 200 cycles, organ, orchestral and instrumental music is really life-like.

Yours truly,

Wallsend-on-Tyne. W. W.



The loud speaker constructed by W. W. has, as will be seen, a handsome appearance.

IS H.F. A LUXURY?

The Editor, POPULAR WIRELESS.

Dear Sir,—I notice at last one of our Reinartz enthusiasts has at last noticed yours or my error in the drawing of my suggestion. Of course the flex connection should be attached to the moving vanes of the tuning condenser.

Might I add a few hints that I have found the simplest way of getting stations with this suggestion.

For all ultra short waves from 20 to 200 and extra long from 1,000 upwards use all centre-tapped coils for the aerial and take the aerial straight on to the coil tapping and not breaking the connection with terminals. This slight difference makes all the difference in getting there.

I can strongly recommend the new Seaford coils; they are full value for money.

With the above waves in view I find the best results are obtained with the flex attached to the terminal my sketch shows.

For ordinary wave-lengths from 200 to 500 the standard connection (that is, the flex, and taken direct to the coil tapping) is the most selective.

I am using but a small aerial with a top of about 40 ft., and about 38 ft. high, and for this size aerial I find that a ready-made coil of sixty turns tapped at nine feet gives all the selectivity required.

Whichever valve I use, the best English or the cheapest 4/9 French seem to give equal results, and all require but 27 volts H.T., no more; less, if anything, for nearby stations.

With this combination it is astounding what results can be obtained, especially on those extra nights one can go round Europe with ease.

The number of stations coming in on the long waves over a thousand now is astonishing.

W.W.'s loud speaker in the course of construction.

This I find a blessing when the London H.Q. are playing all the same programme to amuse the knob twiddlers.

I should like to know why it is essential for the use of special coils of the binocular variety instead of ordinary plug-in old pattern standard coils when using the new screened H.F. valve. Personally, I find them unnecessary, but perhaps my limited knowledge of the matter requires toning up?

When shall we have one of these new valves for four-valve enthusiasts?

"IS H.F. A LUXURY?"

London, E.15.

THE "SIMMONDS' SHORT-WAVE."

The Editor, POPULAR WIRELESS.

Dear Sir,—It is with great pleasure that I can testify to the efficiency of the "Simmonds' Short-wave" set which was described in your journal some time ago. It is the most efficient short-wave, or, for that matter, broadcast receiving set, that I have constructed.

I have had the set working now for only just over two months, and have introduced one or two modifications as per "Modern Short-Wave Set" by Mr. Simmonds in "Modern Wireless," but have retained loose-coupled circuit as I find it suits my aerial better.

The "beat note" vernier is a great help on weak stations. A short aerial is used with a five-turn coupling coil and counterpoise, or no earth. Using a very cheap Dutch dull-emitter valve, the set goes down to just below 2 X A D, but with Cosmos S.P.18 G. it will go down to below 10 metres, which is not so bad, as the parts are not first-class, especially the transformer; but I find a choke not necessary until below 20 metres.

My log of short-wave stations is made up as follows: British, 53; French, 28; Belgian, 23; Dutch, 7; German, 6; Italian, 6; U.S.A., 5; Danish 2; Polish, 1; Swedish, 1; Australian, 2.

Nearly all the above were on telephony, some being fair loud-speaker strength, especially French and Belgian. Unfortunately, I have not yet been able to get the Australian stations at good strength here, they are never more than R3½.

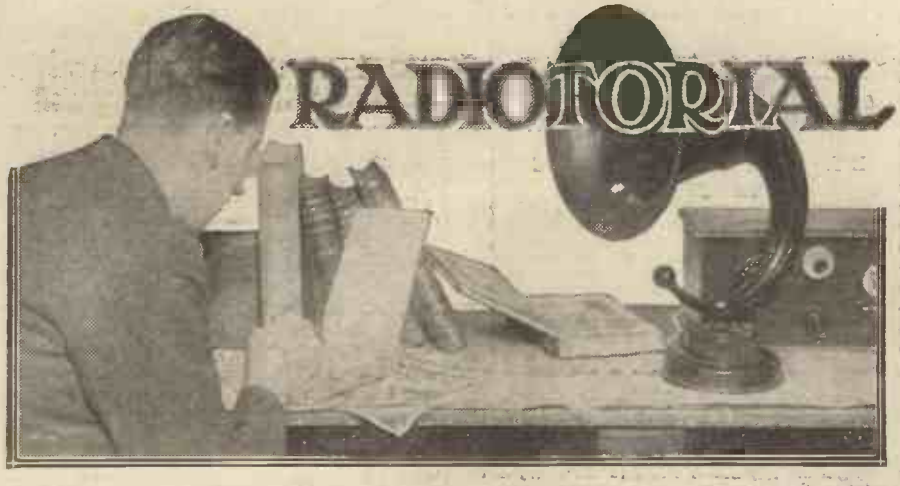
I never miss your short-wave corner, and would like to see more of it; could you not have a QRA section? I am sure this would be gratefully received by short-wave "DX-ites."

May "P.W." live long and happily.

Yours truly,

J. B. L.

Hampton-on-Thames.



All Editorial Communications to be addressed to The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon 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.

NO DISTANT STATIONS.

"NUCLEUS." (Ireland).—"Enclosed is a diagram of a two-valve set I built some time ago. It works well on high-power station; but I cannot get any other station, not even Dublin, 2 R N, and I am only roughly 100 miles from same. I can get no B.B.C. station but 5 X X.

"Would you kindly state the best circuit for distant reception. I have the following parts, and would prefer 2 H.F. and detector; three variable condensers, capacity ·001, ·0003, ·00075; one Marconi variometer, two fixed condensers, three valves, one telephone transformer, and one L.F. ditto, two filament resistances, (30 ohms,) three valve holders. Plug-in coils, Burndept, No. 200, No. 150, No. 75, No. 25.

From your diagram we note that you are using the ·00075 variable condenser to tune the anode coil (marked L_2 in your diagram). The correct value for an anode-tuning condenser is about ·0003 mfd., or at the very most ·0005 mfd., and the fact that you are using a tuning condenser twice as big as it should be is alone sufficient to account for your failure to get long-distance results.

Re your components, neither the ·001 nor the ·00075 variable condenser is suitable for tuning a long-distance set, but the rest of the components could be incorporated into a 2 H.F. and Det. receiver.

Frankly, we do not advise this, however, because to get anything like 3-valve efficiency from such a circuit the components need to be specially chosen, and not merely used up because you happen to have them on hand. It would not be a heavy expense to make up a really efficient and modern set with all the necessary new parts.

But if expense is the first consideration, and it is desired to get maximum long-distance range with a minimum of further expense, we suggest converting your present set into an H.F., Det., and L.F., which should give you plenty of programmes to choose from, with practically no extra components to buy.

If this meets with your approval, please write again and advise the Technical Query Department of your address (this became detached from your letter), so that the necessary diagram may be forwarded.

With an ordinarily good aerial in use we expect you could get, with the three-valver, from 12 to 24 stations (at strengths varying from very loud to clearly audible) without any difficulty—possibly dozens more.

As the absence of your address involves some delay, we suggest the following alterations immediately to improve reception with the two-valve set:

(a) Disconnect the ·0003 variable condenser from across the variometer, and use it in the position now occupied by the ·00075 variable condenser (across anode coil).

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Traders and manufacturers are invited to submit wireless sets to the "P.W." Technical Department for test. All tests are carried out with strict impartiality in the "P.W." testing-room, under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

THE "HOME BROADCASTER."

READERS will no doubt remember that some few weeks ago we illustrated on our front cover a microphone device for plugging into an ordinary receiver. The purpose of this was to enable telephone conversations to be held through radio set loud-speaker or telephone extension leads. The Rothermel Corporation Ltd. inform us that they are in a position to supply this microphone as illustrated, the list price being 37s. 6d.

PERTINAX PANEL MATERIAL.

We recently received a Pertinax panel from George L. Sutté Co., Ltd., of 69, Fleet Street, London, E.C.4. The makers state that they have been supplying this material to the electrical trade under this name since 1903, but that it is only recently that they have decided to bring it forward for wireless instrument panels, although privately it has been used for this purpose by many of the leading companies.

The material is by no means unknown to us for we have several times come into contact with it in the past mostly in connection with, as far as we remember, electrical measuring instruments. It makes a very pleasing alternative to ebonite and other such materials for set panels, for it has a highly-polished glossy brown surface. The panel sent us we incorporated in an eliminator with excellent results both in point of appearance and efficiency. Pertinax works just as easily as ebonite, and its insulating qualities are of a high standard. We are surprised it has not been brought forward for radio panels before as it appears to be so suitable for such purposes.

C.A.V. STANDARD LOUD SPEAKER.

Messrs. C. A. Vandervell & Co., Ltd., inform us that they have reduced the price of the above accessory, the tortoiseshell model, from five guineas to £4 10s., and the brown lacquer enamel model from £4 10s. to £3 15s.

NEGROLAC INDOOR AERIAL.

An indoor aerial can seldom be as good as an outdoor one, but listeners who are confined by force of circumstances to the indoor type, can, nevertheless, so long as they take reasonable care, obtain satisfactory results. The first requirement of an efficient indoor aerial as with the outdoor type, is that it should be erected at as high a point as possible and kept as far as possible away from walls and ceilings. If it can be fixed up in a loft or upper room of the house so much the better.

There is a definite advantage in using a stranded wire, and an efficient indoor aerial made up ready for use on these lines is produced by Messrs. Ward and Goldstone, of Manchester, and is called the Negrolac Indoor Aerial. This comprises an 18-ft. length of their well-known Negrolac wire, which consists of many strands of enamelled wire protected by a glossy black insulating covering.

At each end is a small porcelain insulator enabling the wire to be attached easily to hooks or other such devices, and there is also a junction terminal to which can be attached the wire leading to the set. The aerial undoubtedly has definite advantages over the ordinary kind of wire. This is owing to its large effective surface due to the use of many strands of insulated wire. On a careful comparative test we noticed that it provided a pick-up of about 30 per

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RADIOTORIAL QUESTIONS AND ANSWERS

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(b) Tune the aerial circuit by the variometer alone, and if the set is not "lively," try the effect of taking the grid leak to the L.T.— lead, instead of to L.T.+.

(c) If there is a difficulty in obtaining smooth reaction effects, try connecting the ·00075 variable (or the ·001) across the primary of the transformer.

REWINDING A SPLIT-PRIMARY TRANSFORMER.

"ECONOMY" (Wantage, Berks).—"I have an ordinary 6-pin coil and base, but the winding on the coil is of the Reinartz type, whereas I wish to use the split-primary transformer type. I therefore took off the original wire, and tried winding a split primary of my own on the former, but so far without much success. Have I done right in putting an extra former inside the ordinary one so that there are two formers in all, and if so what should be the windings upon these?"

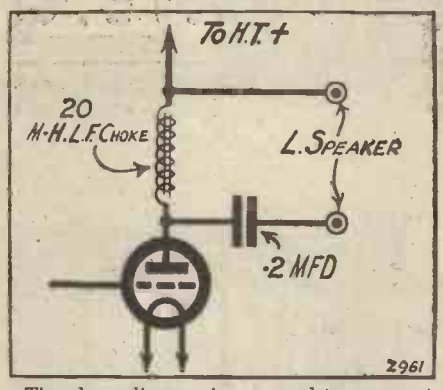
It is correct to use two formers, one fitting inside the other. The usual diameter of the inner is about 1¼ in. The primary and the neutralising windings are arranged upon the inner former, and they consist of 40 turns of D.S.C. wire, wound in one single coil and centre tapped. The centre tap is taken to the No. 4 pin and the ends of this winding go to 3 and 5. In effect, this forms a 20-turn coil between 3 and 4, and another 20-turn coil between 4 and 5, the latter being the primary winding and the former the neutralising winding. Upon the outer former is wound the secondary winding. It consists of 90 turns of No. 30 D.S.C. wire, spaced 40 turns to the inch. The ends of the secondary go to No. 1 and 2 pins. The reaction winding is joined to the No. 2 pin also. It is not, like the secondary, wound upon the outer former, but is wound below the primary and neutralising windings on the smaller (inside) former. No. 30 D.S.C. is usual for the reaction winding, this consisting of 25 turns. Before attempting to connect up make sure that you have everything correctly connected to the pins, as described above.

A 'PHONE LEAD TIP.

"CRYSTAL SET" (Camberwell, S.E.).—"We use three pairs of 'phones and are continually bothered by them becoming frayed at the ends. Do you know of a method of overcoming this difficulty?"

There are several ways in which this trouble can be overcome, one being to notice as soon as the fraying commences, and then to bind it neatly with very thin string or thread. Another easy plan is to take an ordinary valve-tube, (as used in bicycles) consisting of a thin length of rubber tubing, and clip this over the 'phone tags until it reaches half-way over the tag and half-way over the cord. This is a complete protection.

WHAT IS WRONG?



The above diagram is supposed to represent the connections of an "output filter" circuit. But it is wrong, and would not work properly.

Next week the correct diagram will be given, and, to test your skill, we shall continue to publish every week a diagram in which a mistake (or mistakes) has been inserted. The correction will be published the following week.

No prizes are offered, but by following this series and trying to solve the problems, week by week, the reader cannot fail to learn a lot about radio circuits.

ACID ON THE CARPET.

"CAREFUL" (Macclesfield).—"Is it a fact that if accumulator acid is spilt on a carpet the latter is completely ruined, but that it is possible, by powdering ordinary washing soda and spreading this on, to overcome the damage?"

It is quite true that acid should not be spilt upon a carpet or indeed upon clothes or any other fabric. Great care should be taken not to allow it to come into contact with anything outside its own container, as the sulphuric acid which it contains will eat into wood, rubber, leather, and, indeed, into most household articles, and completely ruin them if allowed to spread.

If acid is accidentally spilt, the best plan is to quickly powder some ordinary washing soda and apply plentifully over the patch of carpet, or whatever the article may be, spreading the powder freely and rubbing it well into the carpet until all the gassing has ceased. This neutralises the acid, and if applied immediately will prevent any damage from occurring. Ordinary baking soda, ammonia, and even soap, or soap flakes can all be usefully employed as neutralisers in an emergency.

MILLIAMMETER FOR MEASURING ANODE CURRENT.

W. J. R. (Paddington, London, W.)—"I recently purchased a milliammeter very cheaply, and was assured that it was a good instrument to mount permanently in my small valve set. Where should it be connected so that I can read how much anode current the whole set is taking?"

A milliammeter should be connected in the lead which goes from H.T. negative to the L.T. battery (either to L.T. negative or positive lead). You will find that its terminals are marked positive and negative, and you should be sure to connect it up correctly, as failure to do this will give most misleading

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readings and may damage the instrument. Its negative terminal should be connected towards H.T. negative and its positive terminal towards the L.T. supply.

HOLDING SMALL SCREWS.

W. N. (Petersfield, Hants).—"I quite enjoyed making up the set from the plan you sent me, except for one thing The cabinet was pretty small and the screws seemed to be minute and my fingers were like the feet of elephants, so there was a lot of fumbling and some bad language going on. I suppose you cannot put me wise as to how to hold a tiny little screw up into a crowded corner, can you? I should be very glad if you could, for if this goes on I shall soon be ashamed to look our parson in the face."

Sorry to hear about the "language," W. N. It is quite unnecessary. The best way to hold a small screw is to push it through the end of a strip of cardboard. The latter can then be held quite easily in position at a distance from the screw itself, leaving plenty of space for the screwdriver.

NO REACTION WITH R.C. UNIT.

C. B. O. (Forfar).—"The set is a Det., 2 L.F., and I took out the transformer which was formerly in the plate circuit of the detector valve and put in its place a cheap R.C. unit. It has certainly improved the quality, but what I cannot understand now is that I cannot get reaction. Why is that, and how can I overcome it?"

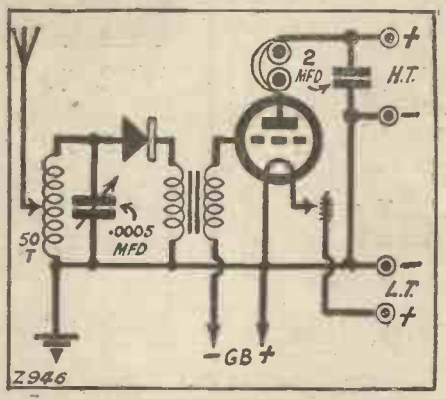
In order to get reaction effects you will need a small condenser, shunted across the resistance in the anode circuit, to act as a bypass condenser. Probably the unit you have purchased does not include such a condenser, so we advise you to try connecting any small fixed condenser across here, i.e. between the plate of the valve and H.T. positive. Generally a ·0001 mfd. condenser is sufficient, (and for quality's sake it is advisable to use the lowest value of condenser that gives good reaction results.)

WIRELESS LIGHTHOUSES.

"MARITIME" (Portsmouth).—"Are there any wireless lighthouses using directional wireless on the coast of Britain, and if so what are their wave-lengths, call signs, etc.?"

Wireless "beacon" stations, which send out distinctive signals so that ships can take bearings, etc., are to be installed at several points round the coast, and, in fact, one station is now in service near the Scilly Islands, operating on a power of half a kilowatt, a wave-length of 1,000 metres, with a call sign of G G G. The signals are sent out on interrupted continuous wave, I.C.W. The transmitter is automatically controlled and is capable of giving accurate bearings to ships within a range of 70 to 100 miles.

CRYSTAL DETECTOR WITH L.F. AMPLIFIER.



The correct connections for a Crystal Detector and L.F. Amplifier are shown above.

In the "What is Wrong?" diagram last week the grid bias was reversed, and was connected to the L.T.+ lead, instead of the L.T. negative. The tuning condenser was connected to the wrong side of the crystal detector, and the value of the H.T. condenser was given as "2 meg." instead of 2 mfd.

DISTORTION DUE TO H.F.

P. W. F. (Goole).—"I had a funny sort of distortion all the time, and a friend of mine told me he had the same trouble, due to H.F. getting through to the L.F. stages. He told me that all I needed was to connect a resistance of about 100,000 ohms between the coupling condenser and the grid of the following valve. A day or two later I tried this, and it certainly cured the trouble. But when my friend came round to look at the set, he pointed out that instead of the resistance being inserted between the coupling condenser and the grid of the valve it was between the coupling condenser and the plate of the preceding valve. As this seems to work all right, I do not think I shall alter it, but for curiosity sake I should like to know whether it would have gone better on the other side of the coupling condenser?"

The chief difference would have been that if it had been placed on the grid side it would have been, in effect, a part of the grid leak. But, as you are probably aware, it is often possible to use grid leaks which vary widely in value without affecting quality as judged by the ear. And the probability is that if you changed it over it would work no better and no worse than at present.

AN ACCUMULATOR CAPACITY INDICATOR.

G. L. A. (Ilford).—"I was very interested in the accumulator capacity indicator which was described in the "Apparatus Tested" columns in POPULAR WIRELESS dated January 7th, No. 292. What is the full address of the Fanshawe Mfg. Co. of Walsall, as I should like to get into communication with this firm?"

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(*Continued from page* 1158.)

The word Fanshawe was a misprint. Full details of the accumulator capacity indicator can be obtained from the Central Mfg. Co., Ltd., Crown Works, Birmingham Road, Walsall, Staffs.

WHEN THE H.T. BATTERY FAILS.

E. C. W. (Sth. Wales).—"I have constructed a three-valve set which has Reinartz reaction followed by resistance-capacity and a transformer-coupled amplifier. I am getting good results, but I have had the misfortune to run down a new H.T. battery of 100 volts in a fortnight. This I cannot understand and there is another thing I have noticed. When I pull the aerial coil out the set keeps on howling. Now my question is, what is the cause of the H.T. battery running down like that? I am sure I did not short it."

To deal with the second point first, the fact that the set howls when the aerial coil is pulled out is probably nothing to do with the shorting of the H.T. battery. It very often happens, especially in sets which have been made by inexperienced constructors, that there is a certain tendency to self oscillation when the aerial circuit is "open," though the set is O.K. when the aerial is attached. (Probably this tendency to howl would disappear if all the grid and plate leads in the set were kept short).

As regards the H.T. battery, we think that the only explanation of its running down so quickly is that it has been shorted. This does not mean to imply that its positive has necessarily been connected to its negative by a piece of wire or metal, externally, for the short may be a fairly high resistance one, taking part through a fault in the insulation of the set. For instance, if you are using a large fixed condenser across the high-tension battery we should certainly recommend you to disconnect this and test its insulation. (Details of a simple method of doing this are given below.)

If the condenser is not faulty, it is possible that there is a mistake in your wiring, or else that one of the insulators somewhere in the set is defective. The most likely component to give trouble of this kind is a fixed condenser, but faulty leads or a faulty switch, indeed any defective insulation, may give rise to the trouble. If you are unable to trace any fault of this type we suggest that you get the set overhauled by someone experienced in radio troubles.

Failing this, we are afraid you will have to make another application to the Queries Department, enclosing a diagram of the connections of the set, so that we may indicate upon it the likeliest places to look for this trouble. Finally, we would remind you of the importance of seeing that a new H.T. battery registers the full voltage when it is purchased.

"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 offer an *unrivalled* service.

Full details, including a revised scale of charges, can be obtained direct from the Technical Query Dept., "Popular Wireless," 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.

TESTING A CONDENSER.

O. Y. (Birmingham).—"Some months ago, in POPULAR WIRELESS, I read a short paragraph about how it is possible to test a fixed condenser. Although I have looked through all my back numbers, I cannot find this, and I should be very glad if you would tell me how a fixed condenser can be tested by an amateur without expensive apparatus.

"If I remember rightly, in the case I mentioned, the test was carried out with a pair of 'phones, and I am anxious to test a fixed condenser that I have, if possible, for I believe it is running down my H.T. battery too quickly."

A good rough and ready test of the insulation of a fixed condenser is to disconnect it from the set and to proceed as follows.

Fit up an H.T. battery with two rubber-covered flexible leads, one for positive and one for negative, and have a pair of telephones on hand. Then connect one of the leads from the battery to one side of the condenser, and the other lead to the other side, thus charging the condenser with the full voltage of the H.T. battery. Remove the battery leads from the condenser, taking care not to touch its terminals or tags in any way, or the charge which you have imparted to it will break away.

Leave the condenser standing for half an hour or so, and then test whether it still retains any of the charge which you gave it. The method of doing this is to put on the telephones, and then connect them simultaneously across the tags or terminals of the condenser under test. If that condenser is still charged up (and has not been touched, so that its charge has partly leaked away), there will be a loud click in the telephones when they are connected across the condenser; but if the fixed condenser is faulty, the negative and positive charges which you gave it will have leaked across the faulty insulation, there will be no charge in it to send a current through the telephones, and consequently there will be no click in the telephones.

A good fixed condenser will give quite a loud click in the 'phones, even if left for an hour or two, and if you have two condensers of the same capacity on hand you can charge them from the same battery, and by comparing the loudness of the clicks determine whether the insulation of one of them is faulty. It is, of course, necessary to take great care that the

(*Continued on page* 1162.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page 1160.*)

condenser is not touched in any way with the fingers while the tests are being carried out or otherwise the test is valueless.

GRID-BIAS CONNECTIONS.

"First Time of Trying" (Feltham, Middlesex).—"The blue print is very clear, but the only thing I am not quite sure of is the connection to the grid-bias battery. Do I connect the terminal on the set which is marked with a + to the plus end of the battery, and the terminal which is marked G.B. — to the minus end?"

The plus terminal on the set is always connected to the grid-bias plus end of the battery, generally by means of a red plug. The terminal on the set marked G.B. minus should be fitted with a flexible lead, having a black plug, and this should be plugged in, not right at the negative end of the grid bias battery, but at any one of the intermediate points which gives good clear reception.

You can soon find the best position by altering the adjustment, or if you tell us the valve and the H.T. voltage that you are using, we can tell you the grid bias negative voltage which is recommended by the manufacturers. Alternatively, any friend of yours experienced in radio matters would be willing to help you, if you showed him the chart which is supplied by the valve makers when purchasing the valve.

BACK NUMBERS OF "P.W."

E. J. (Poole)—"Where can I get back numbers of Popular Wireless?"

Back numbers of "P.W." which are still in print are obtainable on application to the Amalgamated Press, Ltd., Back No. Dept., Bear Alley, Farringdon Street, London, E.C.4, price 4d. each, post free.

THE CHAMBERS CIRCUIT.

F. A. C. (Aldershot).—"Where can I get details of the 'Chambers' circuit, which I understand is a distortionless circuit that does not employ either iron-core chokes or transformers?"

Details of this circuit were published in the December number of "Modern Wireless." Not only are there no iron-core inductances, but anode-bend rectification is employed, and no form of reaction is utilised, in order that the reproduction may be as faithful as possible.

CONTROL OF VOLUME.

C. V. B. (Wanstead).—"My set is a Det. and 2 L.F. (the first resistance coupled, followed by transformer coupling). It gets programmes galore, but is too strong for London, so I want to fit some form of volume control, and have been told to use a high resistance potentiometer. How many ohms should this be, and how is it connected up?"

The potentiometer should have a maximum resistance of about the same value as the grid leak in use. To connect it in circuit, remove the lead that goes from the grid of the first L.F. valve to the grid leak and to the coupling condenser. Then connect the grid to the slider on the potentiometer. The ends of the potentiometer are now connected up in place of the grid leak (i.e. one end to the coupling condenser and the other end to the grid bias negative lead).

In this way, the potentiometer will take the place of the present grid leak, with the advantage that the voltage passed to the grid of the first L.F. valve will vary according to the adjustment of the slider.

NEXT WEEK

Full supplementary details of the "Economy" Five and the "Inexpensive" Four will be published in POPULAR WIRELESS. You have 6d-blue prints of these sets (presented free with this week's issue of "P.W.") but you will also want to read about them.

ORDER YOUR COPY NOW

"PICKED UP A 'PICK-UP'."

J. R. A. N. (Bournemouth).—"I picked up a 'pick-up' cheap, and should like to fit it up to make my four-valver play the gramophone, if it can be done easily. It is of the high-resistance type, and the set is a straight H.F., Det., and 2 L.F. What alterations are necessary?"

All that is necessary is an extra S.P.D.T. switch, placed near the grid of the detector valve, and connected as follows. Centre of switch to grid of detector valve. One outer contact to lead from H.F. valve, so that when switch is over to this position ("Broadcasting") the set is restored to the original circuit. The remaining outer contact of the switch (which will only come into use when the arm is thrown over for "Gramophone" reception), should be joined to the electrical pick-up, the other side of which goes to L.T. or to grid bias, as the case may be.

HOW MANY VALVES?

"Daventry Only" (No address).—"Although the set is not for Continental reception, there seems to be a big diversity of opinion about the number of valves required for perfect quality. It will be used at 148 miles from Daventry, and to save change-over and oscillation troubles it has been decided to make it tune only to 5 X X. How many valves ought to be necessary, with an average sort of aerial?"

To get "perfect quality" you will have to rule out the use of reaction, using a high-frequency amplifying valve instead. Following this, the standard "quality first" arrangement would be an anode-bend detector and resistance-coupled low-frequency amplification. At the distance named, two L.F. stages would be required, making four valves in all.

Needless to say, if quality were not of first importance, fewer valves could be employed.

APPARATUS TESTED.

(*Continued from page* 1154.)

cent superior to that of a similar length of aerial consisting of ordinary single-stranded wire. We have no hesitation in drawing to the attention of our readers this Negrolac aerial.

BURNDEPT SCREENED VALVE HOLDER.

The new screened-grid H.F. valve requires a special type of holder, as it has three pins at one end and two at the other, and these two ends are generally located at different sides of an intervening screen. A specially designed holder for these valves has been produced by the Burndept people, from whom we recently received a sample. This holder consists of two separate brackets, made of polished bakelite, which are fitted with spring clips to take the valve pins.

These spring clips are continued at their bases to form soldering tags to enable efficient connections to be obtained. Additionally, screw terminal devices are supplied. The two brackets which form the holder are supplied mounted on a wooden baseboard bearing full details for their fixing. As is stated, the baseboard serves to indicate the distance apart of the two pillars, or, alternatively, can act as a template for those who require an ebonite panel on which to mount the two halves of the valve holder.

A practical point in the design of this Burndept holder which will appeal to constructors is that the holes in the brackets provided for mounting purposes, are slotted. Thus, after the component is screwed down, any slight discrepancy in the distance between the two brackets can be very easily rectified. The holder is excellently moulded and produced and takes the valve very snugly. The price is 4s.

T.C.C. ELIMINATOR.

The Telegraph Condenser Co., Ltd., have issued a second edition of their popular book, "How to Build Your Own Eliminator." The author is W. James, and H.T. eliminators for both D.C. and A.C. mains are described. The book is available free to applicants, upon receipt of 1d. per book to cover cost of postage.

THE "SUPRA" H.T. BATTERY.

The advertisement for "Sure-a-lite" High Tension Batteries, in our issue of January 21st, quoted the price of the new "Royal" 100-volt battery as 14s. 9d. The correct price is 14s. 3d. In addition, it has been found that there are difficulties which prevent the use of the name "Royal" so it has been decided to give the new battery the name "Supra."

THE "FORMO-DENSER."

The Formo-Denser used in "The Long-Short" Crystal Set, which was described in our January 28th issue, is a "·0005 Max, Type C." and the exact price is 2s. 6d.

SHORT-WAVE NOTES.

By W. L. S.

SHORT-WAVE broadcasting is truly developing! 2 X A D and our 5 S W can now be heard very frequently carrying out two-way working like a frisky couple of amateurs on low power, and they often do duplex work! One night this week the writer heard them on the latter tests, and each station was apparently reproducing the other on a loud speaker in the studio, so that by listening to either of them you could hear the whole conversation.

This probably means very great improvements in future attempts at transatlantic relays.

It is significant that the two biggest broadcasting stations using anything under 200 metres are both in the twenties and not in the overcrowded 45-metre band. The latter certainly has excellent carrying properties, but it is rendered almost unusable at times by the appalling number of stations crammed into one or two metres.

A Short-Wave Attraction.

One of the joys of short-wave reception, from the point of view of many, is the fact that it is usually quite unnecessary to use an outdoor aerial. A good length of wire across a room above the ground floor is usually all that is needed to give perfectly satisfactory results, and the most mediocre kind of earth seems to suffice. It is significant that many amateur transmitters have really excellent aerials erected for the transmitters, and yet for the sake of convenience use their receivers in conjunction with small indoor affairs, and find that they work perfectly well.

It is rather amusing sometimes to reflect on the early days of short-wave reception, when it was emphatically stated that really first-class earths were necessary, or the set would be unworkable on account of hand-capacity effects, etc. The writer has an old article in which it is stated that "it is necessary to use chokes in the leads to the accumulator, or it will be found that movement of the feet under the table has an excellent effect as a vernier control!" And the writer, it might be mentioned, is now using a short-wave set without a choke of any kind, and with *no earth*. Hand-capacity effects—nil!

The "Ham's Paradise."

Then came the craze for long extension handles, and so on, which helped to prevent the timid from taking any interest in short-wave reception. Now we have commercial sets like the Igranic which have to be examined fairly carefully before one is sure that they *are* short-wave sets!

Which part of the globe might be termed the "ham's paradise"? Several countries "boast" of the bad radio conditions prevailing, presumably as an excuse for the inability of their representatives to establish records, but we seldom hear of one which claims extraordinarily good conditions. The writer is inclined to favour New Zealand, with Australia as a possible runner-up. Will readers afar off please let us have their views?

LOUD SPEAKERS

	£	s.	d.
Mullard P.M.	5	5	0
Mullard, Model E ..	3	5	0
Edison Bell	2	2	0
Marconi Popular ..	2	2	0
Sterling Primax ..	5	5	0
Marconi, Model 75 ..	3	15	0
Marconi, Model 105 ..	5	5	0
Whiteley Boneham Bakelite	4	4	0
Whiteley Boneham Oak	3	3	0
M.P.A. Plaque	2	2	0
M.P.A. Cabinet ..	4	0	0
M.P.A Table Grand ..	5	5	0
B.T.H. C2	2	10	0
Dundas	1	10	0
Little Sparta	2	15	0
Lissenola Cone ..	1	9	6
Amplion A.C.1	2	12	6
Amplion A.C.2	1	17	6
Amplion A.C.3	3	15	0
Amplion A.C.4 M. ..	4	4	0
Amplion A.C.5	6	0	0

HEADPHONES

	£	s.	d.
Ridley Headphones ..	0	5	11
Ultra Non Adjustable ..	0	9	6
Adjustable	0	12	6
Ericsson Headphones ..	0	12	6
Brown Featherweights	1	0	0
B.T.H. Headphones ..	0	15	0
Telefunken	0	13	0

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	£	s.	d.
Igranic	0	16	0
R.I.-Varley Straight Line	1	5	0
R.I.-Varley Popular ..	0	15	0
Ferranti A.F.4	0	17	6
Ferranti A.F.3	1	5	0
Ferranti A.F.5	1	10	0
Croix	0	3	6
Dundas	0	4	6
Lissen	0	8	6
Formo	0	10	6
Brandes	0	15	6
Eureka	1	1	0
Marconiphone	1	5	0

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·0005 Devicon Square Law .. 6/-
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·0003 Condensers of the above make in stock.
3/9, 5/9, 5/9, 10/6, 15/6, 5/6, 6/9

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2 Terminal Strips ..		0	8	2 Terminal Strips, 2½ by 2 by ½		0	8
4 Terminals		1	0	4 Terminals		0	4
1 Coil Base, 6-Pin ..		1	0	1 Coil Base, 6-Pin ..		1	0
1 ·0005 Condenser S.L.F.		6	0	1 ·0005 Condenser S.L.F.		3	9
1 ·0003 Condenser S.L.F.		5	9	1 ·0003 Condenser S.L.F.		3	6
1 H.F. Choke, R.I. ..		9	6	1 H.F. Choke		4	6
3 Valve-holders ..		6	0	3 Valve-holders ..		3	0
1 Cabinet	1	0	0	1 Cabinet	1	0	0
1 Pair Brackets ..		0	8	1 Pair Brackets ..		0	8
1 6-Pin Coil, B.B.C. ..		5	6	1 6-Pin Coil, B.B.C. ..		5	6
1 6-Pin Coil, Daventry		5	6	1 6-Pin Coil, Daventry		5	6
1 ·2 v. 40-act. Accumulator		16	0	1 2 v. Accumulator D.F.G		8	6
1 P.M. 1 A Valve ..		10	6	1 P.M. 1 A Valve ..		10	6
1 P.M. 1 L.F. Valve ..		10	6	1 P.M. 1 L.F. Valve ..		10	6
1 P.M. 2 L.F. Valve ..		12	6	1 P.M. 2 L.F. Valve ..		12	6
2 60 v. H.T. Batteries ..		19	0	1 100 v. H.T. Battery ..		8	6
1 9 v. Grid Battery ..		1	0	1 Grid Battery		1	0
1 R.C. Unit, R.I. ..	1	0	0	1 R.C. Unit Lissen ..		4	0
1 L.F. Transformer, R.I.		15	0	1 L.F. Transformer, Formo		10	6
1 ·0003 Condenser and 2 Meg. Leak		5	0	1 Cond. and Leak, Fixed		2	0
				1 Switch, Benjamin ..		1	0
1 Benjamin Switch ..		1	0	2 Spade Terminals ..		0	2
2 Spade Terminals ..		0	2	8 Wander Plugs ..		0	8
8 Wander Plugs ..		0	8	1 Panel, 18" by 7" by 4"		5	3
1 Panel 18 in. by 7 in. ..		5	3	3 Yds. Red and Black Flex		0	5
	£8	18	2		£6	3	11

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	£	s.	d.		£	s.	d.
2 S.L.F. Variable Condensers, ·0005 ..		9	0	2 Panel Switches ..		1	6
2 Slow Motion Dials ..		5	6	1 Variable Resistance for B.B. mounting ..		0	9
1 ·0001 Fixed Condenser		1	0	9 Terminals		0	9
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1 ·002 Fixed Condenser		1	6	1 yd. Systoflex Covering		0	3
1 ·001 Fixed Condenser		1	6	1 Black Panel, 21 in. by 7 in.		3	6
1 2-microfarad Condenser		2	3	1 Black Terminal Strip, 21 in. by 1½ in. ..		1	6
2 Grid Leak Clips (Lissen)		1	0	1 Cabinet, 21 in. by 7 in.	1	0	0
1 Grid Leak, 4 megohm (Lissen)		1	0	1 210D "Cossor" Valve		10	6
1 Grid Leak, ·25 megohm (Lissen)		1	0	1 210RC "Cossor" Valve		10	6
1 Grid Leak, 3 megohm (Lissen)		1	0	1 210P "Cossor" Valve		12	6
3 Valve-holders ..		3	0		£5	1	3
1 Lissen Transformer ..		8	6				

Wonderful Offer of COSSOR MELODY COILS, remarkable value, offered at 4/6 each.

Electron Aerial Wire, 100-ft. coils, 1/8 each.
Superial Aerial Wire, 100-ft. coils, 2/6 each.
Edison Bell Fixed Condensers, ·0001 ·0002, ·0003, ·001., 1/- each.
Benjamin Rheostats, 6 and 30 ohms, 2/9 each. Lissen panel type, 7 and 35 ohms, 2/6 each.
Microstats, baseboard type, 3/- each.
Resistance Capacity Coupling Units, Ediswan, 7/-; Lissen, 4/-; Cosmos (unit only), 8/-; with Valve-holder, 10/-.
Coil Plugs, wedge type, nickel connections, per doz., 4/-.
Coil-holders, Lissen 2-way, 4/6.
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Edison Bell Lows Loss Coil-holder for baseboard mounting, 1/-.
Benjamin Filament Switch, 1/- each.
Colvern 6-pin Bases, 1/6; Formers, 4/-.
Basket Coil-holders, 9d. each.
Neutralising Condensers, Colvern panel type, 3/6; baseboard, 3/6.
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I have just bought a number of well-made Oak Cabinets, highly polished, with hinged lids at top, size 21 in. by 7 in. I am offering these to buyers of complete parts only at actual cost. EACH **15/-**

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72-yd. COILS RED AND BLACK FLEX, usually 10/6. **My Price, 6/9.**
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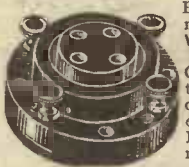

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Voltmeters, single reading, 2/-.
Hydrometers, 2/- each.
Grid Leaks, 6d. each.
"Sovereign" Coil-holders, 9d. each.
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Basket Coil-holders, 9d. each.
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·0003 Condenser and Grid Leak, 2/- each.
Scrap Ebonite, 8 square inches a 1d. (in 5/- parcels only).

Write for complete catalogue Post Free.

'Phone: 1366 M'bro.

NEWS FROM SAVOY HILL

(*Continued from page* 1140.)

he takes any freedom with the "mike" to criticise the Government from which he recently resigned on a policy difference.

The Prince of Wales: Two Forthcoming Broadcasts.

It will be welcome news to millions of listeners that they will hear the Prince of Wales on two occasions during the next few weeks. The Prince has a fine voice and style which are particularly suited to the microphone, and the B.B.C. is to be congratulated on making arrangements to broadcast parts of the proceedings of outside functions at which the Prince will be present. The first is on Thursday evening, February 23rd, when he is to propose the toast of "The Shipping Industry" at the annual dinner of the Chamber of Shipping of the United Kingdom, at the Guildhall, to which Sir William Seager, D.L., J.P., is to respond, and the second, on Wednesday evening, March 21st, is in connection with the annual banquet of the Company of Master Mariners at the Mansion House. A speech by the Prime Minister will also be broadcast from the banquet. The transmission in each case is timed to start at 9.15 p.m., and will be heard from London, Daventry (5 X X) and other stations.

A Bristol Programme.

Listeners in the West will recall that in November, Cardiff Station broadcast a special week of Bristol programmes. On Saturday, February 11th, Bristol has arranged to give another programme entitled "Bristol's Hour of Old Favourites," which has been arranged by Leigh Woods. The items have been selected by well-known citizens, including the Lord Mayor, the Sheriff of Bristol, Sir John Swaish, Sir W. Howell Davies, Sir Frank Wills. One song, "The Cottage by the Sea," was chosen by Bristol's oldest resident—Mrs. Miller, of Southmead, aged 105. The artistes include William Parsons, John Collinson and Kathleen Wills, and the hour will be packed with favourites.

Sir Henry Wood's National Concert.

A programme that is a mixture of the familiar and the strange will be found in the National Concert which Sir Henry Wood is to conduct in the Queen's Hall on Friday, February 10th. The ordinary listener will welcome such favourites as the "Bridal Procession" from "Lohengrin," Berlioz' Overture to the "Roman Carnival," and Strauss' Symphonic Poem, "Don Juan," but he will be inclined to regard as novelties the Fantasy Overture by Edward Mitchell, which is in the Carnegie Collection of British Music, and a new Sinfonietta by Janacek. The latter composer is the famous Czecho-Slovakian musician who received recognition in the B.B.C. chamber concerts at the Grotrian Hall last year. He is generally regarded as the most significant figure among contemporary Czecho-Slovakian composers, and this Symphony will be anticipated with the greatest interest by all who watch the trend of modern music.

(*Continued on page* 1170.)

PANEL PLATE TUNER

NEWS FROM SAVOY HILL.

(*Continued from page* 1168.)

A Mabel Constanduros Play for Liverpool.

A play entitled "The Strutham Amateurs Present;" which is certain to make a special appeal to all those who take part or are interested in amateur theatricals, will be given by the Liverpool Radio Players on Wednesday, February 8th. It is a farcical sketch by Mabel Constanduros, whose contributions, particularly of the last few months, to the wireless programmes both in the parts she has taken, and by several delightful little plays which she herself has written, have made her one of the most popular artistes of the day. The incidental music will consist of famous Viennese waltzes. The same evening Liverpool listeners are offered an interesting variety programme, when the artistes taking part are Foster Richardson (bass), Ralph Collis and Wilson Redding (entertainers), and Pursall and Stanbury, whose original syncopated songs are always enjoyed in Merseyside homes.

An M.C. Broadcast Preacher.

A well-known Wesleyan minister, the Rev. Albert S. Hullah, M.C., Superintendent of the Leysian Mission, is conducting the London studio service on Sunday, February 5th. Mr. Hullah spent five years in the Army during the war, and was awarded the M.C., after which he acted as Chaplain to the Polytechnic, Regent Street, where he was intimately associated with the after-war work of reconstruction. His appointment as Superintendent of the Leysian Mission, the largest Public School mission, in the City Road, London, E., dates from September, 1927. At the present time 1,500 young people are associated with it, and much social and relief work is carried out in one of the most needy districts of the city. The bulk of the financial support comes from old scholars of Leys School, Cambridge.

TECHNICAL NOTES.

(*Continued from page* 1140.)

more than 2 per cent, and one or two of the values were within less than 1 per cent of the rated figures.

Filament Resistors.

In very many types of circuit it is unnecessary to use variable rheostats for the different valves, and it be comes a matter of convenience to use the fixed, or semi-fixed, resistors which have been on the market for, I suppose, the past two or three years; owing to the convenience and compactness of these resistors as compared with variable rheostats they are becoming very popular with constructors and many set manufacturers use them exclusively.

At the same time, like many convenient devices, they really represent no more than a compromise. It is obvious that the fixed resistor, even though it is made on a special compensating principle, does not entirely compensate for variations in the low-tension voltage, and if the voltage is for any reason raised above its proper value the resistor will allow more current to pass through the filament.

Excess Voltage.

A freshly charged accumulator usually reads considerably above the conventional 2-volts per cell—it may even give a voltage in the region of 2½ volts per cell, although, of course, this voltage drops very rapidly towards the 2-volt standard when current is drawn from the accumulator.

Nevertheless, when this freshly charged accumulator is connected to the filaments there is, for the first few seconds, or even for a few minutes, an unduly large filament current passed. The fixed resistors, no matter of what compensating type, are not able entirely to prevent this temporary overloading. I do not suggest that all types of valves are likely to be seriously damaged, but with some types of filament, which are operated in rather a critical condition, there may actually be serious deterioration of the filament due to this temporary over-running.

Master Rheostat.

The simplest solution in these cases seems to be to employ a master rheostat, that is, a rheostat which is in series with the low-tension accumulator and which, therefore, feeds the current to the various valves, each valve, of course, having its own fixed resistor. This master rheostat, since it is in series with the various valves in parallel and since it carries the combined filament current for the whole set, will usually be of a fairly low resistance. Generally speaking, you will find that a rheostat with a maximum resistance of 5 ohms will meet the case. An important point to notice is that the resistance element of this rheostat should be capable of carrying the total filament current for the whole set without overheating. In the case of a multi-valve set, the total filament current may be as much as 1 ampere, or in some cases even considerably more.

Replacing the Switch.

It is a further advantage if the master rheostat has definite "on" and "off" positions. In this case it can be used as

(*Continued on next page.*)

TECHNICAL NOTES.

(Continued from previous page.)

an L.T. battery switch and if a simple L.T. battery switch has previously been installed, this may be removed and replaced by the master rheostat, so that there is nothing to duplicate or to add to the controls.

Obviously, when a freshly charged battery is put in, the master rheostat should be turned to the "off" position and then it should be turned "on" and the resistance gradually reduced until the voltage applied to each valve-with-resistor is of the correct value. As the voltage of the freshly charged battery gradually falls to normal, the resistance in the master rheostat can be reduced accordingly.

Connecting an Amplifier.

When connecting a separate amplifier to a receiver it is important to take care with the battery connections of the two; I mean where the amplifier is to draw its current from the H.T. and L.T. connections of the set. As is well-known, the negative H.T. terminal is sometimes connected to the negative L.T. terminal, whilst in other cases it is connected to the positive L.T. terminal.

It may be that the connections in the amplifier are the same as those in the receiver, in which case all will be well, but if it should happen that the receiver and the amplifier have opposite connections, and they are thus connected up to the same battery, the latter will be short-circuited (since in one the H.T. negative is connected to the L.T. positive and in the other to L.T. negative).

Care should therefore be taken that the connections are the right way round. If connections are not the same way the H.T. negative connection from the amplifier may be left disconnected, since the H.T. negative is already earthed in the receiver. In this way the danger of damage to the L.T. battery is avoided.

I am referring here, of course, to the case where the amplifier is connected to a valve set, and where a common battery is used for the two, but if the amplifier is added to a crystal set, or if the amplifier has separate batteries, the danger does not arise, though, on the other hand, the H.T. negative connection of the amplifier must, in the latter case, be made as usual.

THREE DIALS IN STEP

AND ALL EUROPE COMES IN LIKE THE LOCAL

Analyse the test report on the Raleigh P.M. No use of reaction made during the whole evening. Stations printed in Black face were received with one L.F. Stage in circuit only.

STATION.	Aerial	1st H.F.	2nd H.F.
Unidentified	76·5	75	76
Radio Paris	71	68·5	65·5
Daventry	64	59	58
Berlin	44	44·5	44
Unidentified	34·5	35	36·5
Unidentified	31	32	33
Unidentified	26·5	29	28
Hilversum	25	24·75	25
Budapest	94·5	92	93
Munich	88	89	89
Vienna	85	86·25	86
Brussels	33·5	85	85
Daventry (5GB)	81	82	83
Langenberg	77	78·5	78·5
Oslo	75·5	77	77
Rome	73.25	75	75
Breslau	71·5	73·5	73·5
Frankfurt-on-Main ...	69	71·25	71
Cracow	68	70	70
Berne	65	68	67·5
Glasgow	63	67·5	67
Plymouth	62·5	66	66
Hamburg	62	65	65
Toulouse	60·75	64	64
Manchester	58·5	62·5	62·5
Stuttgart	58	62	62
London	56	59	57
Koenigsburg	45·5	50	50
Bournemouth	44·5	49	49
Paris	44	48	47
Dublin	43·5	47·5	46·5
Breslau	42	47	45·5
Newcastle	41	45	45
Belfast	38	44	42
Nuremburg	37	43·5	40·5
Liverpool and Hanover ...	36	41	41
Innsbruck	34·5	40	39
Edinburgh	34	37·5	38
Sheffield and Cassel ...	31·5	33·5	32
Lille	28	31	29·5
Toulouse	27·5	28·5	27·5
Bremen	26	27·5	25
Gleiwitz	25	26	25
Muenster	23	23	20
Orebro	22·5	20·5	19
Halmstad	10	8	·8

IT is extremely impressive to be able with no more mental or physical effort than maintaining three dials in step to produce a log of stations such as that on the left and receive each one as perfectly as the local. Few sets, if any, could boast of a performance equal to that!

Has not the vision of such a set filled your mind's eye from time to time? Would not radio be just your greatest joy if you owned a set such as this?

Contrary to usual experience the long wave tuning curve is dotted with stations to no less an efficient degree than the broadcast waveband.

On the 200 to 550 metre waveband performance of this receiver is remarkable. Stations such as Langenberg, Brussels, Frankfurt-on-Main, Nuremburg, 5 G.B., Bruenn, Stuttgart, Toulouse, Munich, Muenster, Berne, Hamburg, Rome and Madrid, simply break through like an immense volume from a suddenly-opened swell-box of a great cathedral organ.

This is an experience which occurs over the whole tuning range of the condensers. Mark you, it is not confined to those stations which are known to be working on very high power but is also extended to such transmissions as are not often heard, for reasons of their limited power.

If you want a radio set to provide your family with a variety of distant programmes at a volume as intensive as the local, build the Raleigh P.M.

Fill in the coupon to-day.

THE MULLARD RALEIGH P.M.

The PUBLISHERS, 63 Lincoln's Inn Fields, London, W.C.2. Please forward free, complete instructions, blue print and No. 4 RADIO FOR THE MILLION, to build this master receiver.

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Mullard

MASTER · RADIO

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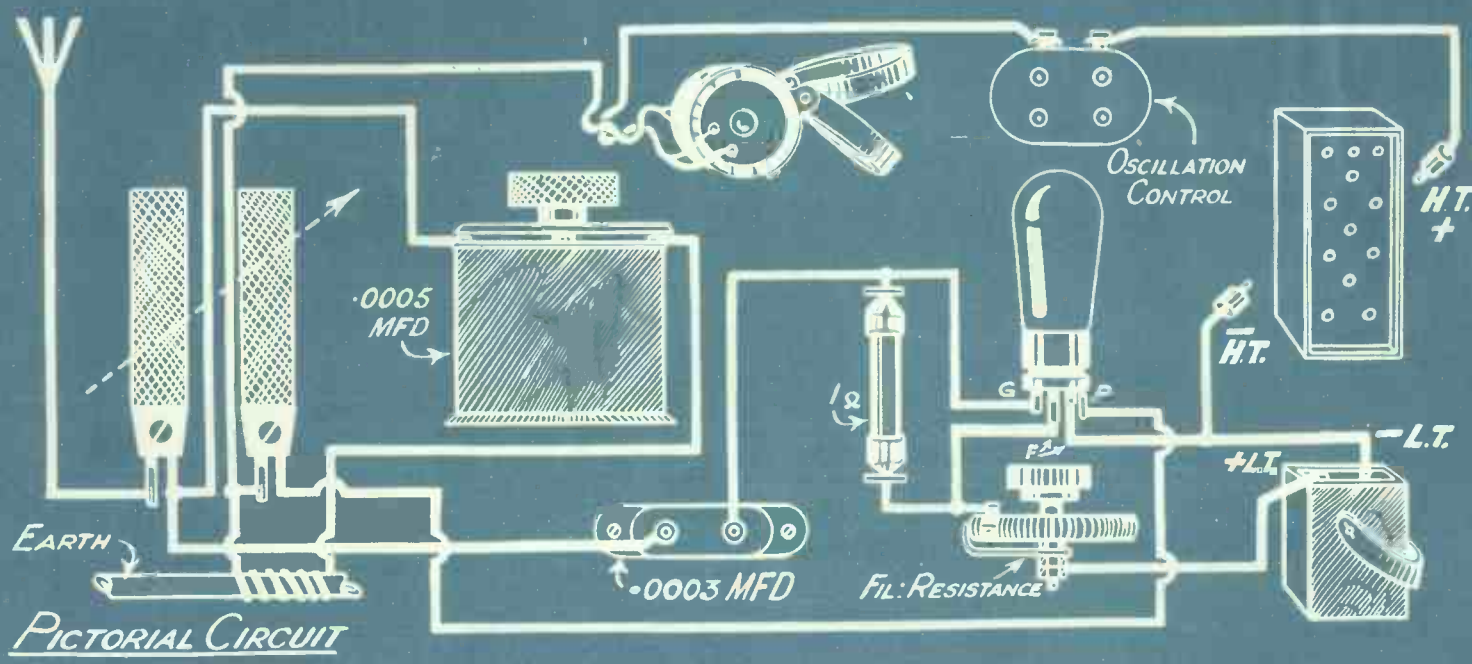
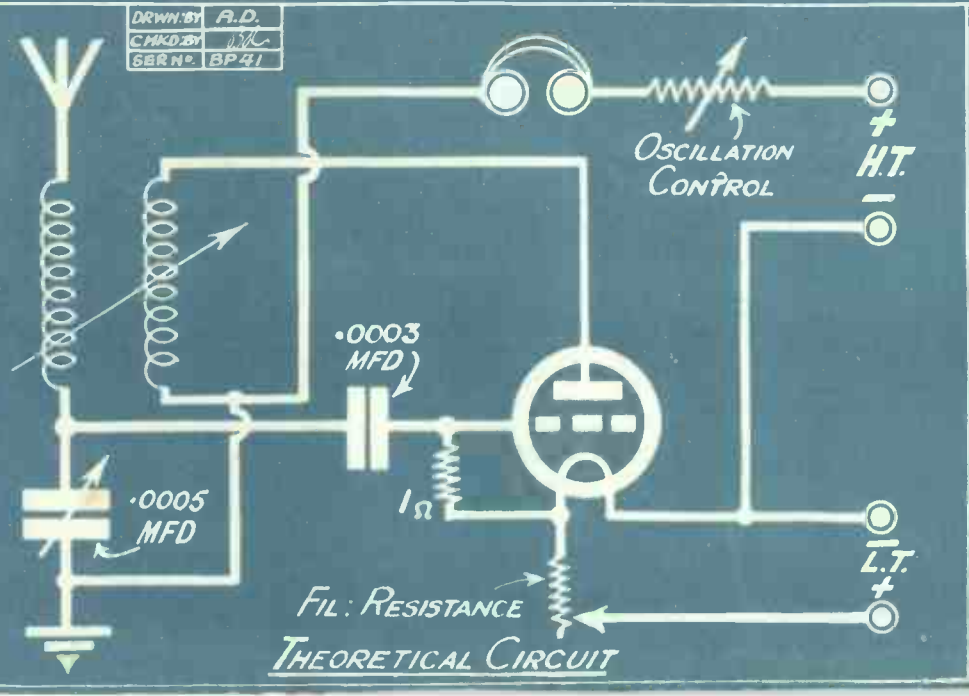
R/B

BLUEPRINTS

THE P.W. BLUE PRINT No. 41
This Year's "Chitos" One-Valver



PICTORIAL CIRCUIT



THEORETICAL CIRCUIT

COMPONENTS

1 Panel, 12 in. × 8 in. × ¼ in.

1 Cabinet to fit, with baseboard 8 in. deep, and pair of brackets.

1 ·0005 mfd. variable condenser, preferably with slow-motion or vernier dial.

1 Panel mounting filament rheostat.

1 Variable high resistance for reaction control. Maximum needed is only 20,000 ohms, but higher value will do if capable of adjustment to this low figure. Such types as are used in H.T. eliminators are suitable.

1 Baseboard-mounting 2-coil holder with long handle.

1 Sprung valve socket.

1 ·0003 mfd. fixed condenser.

1 1-meg. grid leak and holder.

1 Terminal strip, 7 in. × 1 in. × ¼ in., with 8 terminals.

1 Terminal strip 2 in. × 1 in. × ¼ in.

Wire, screws, etc.

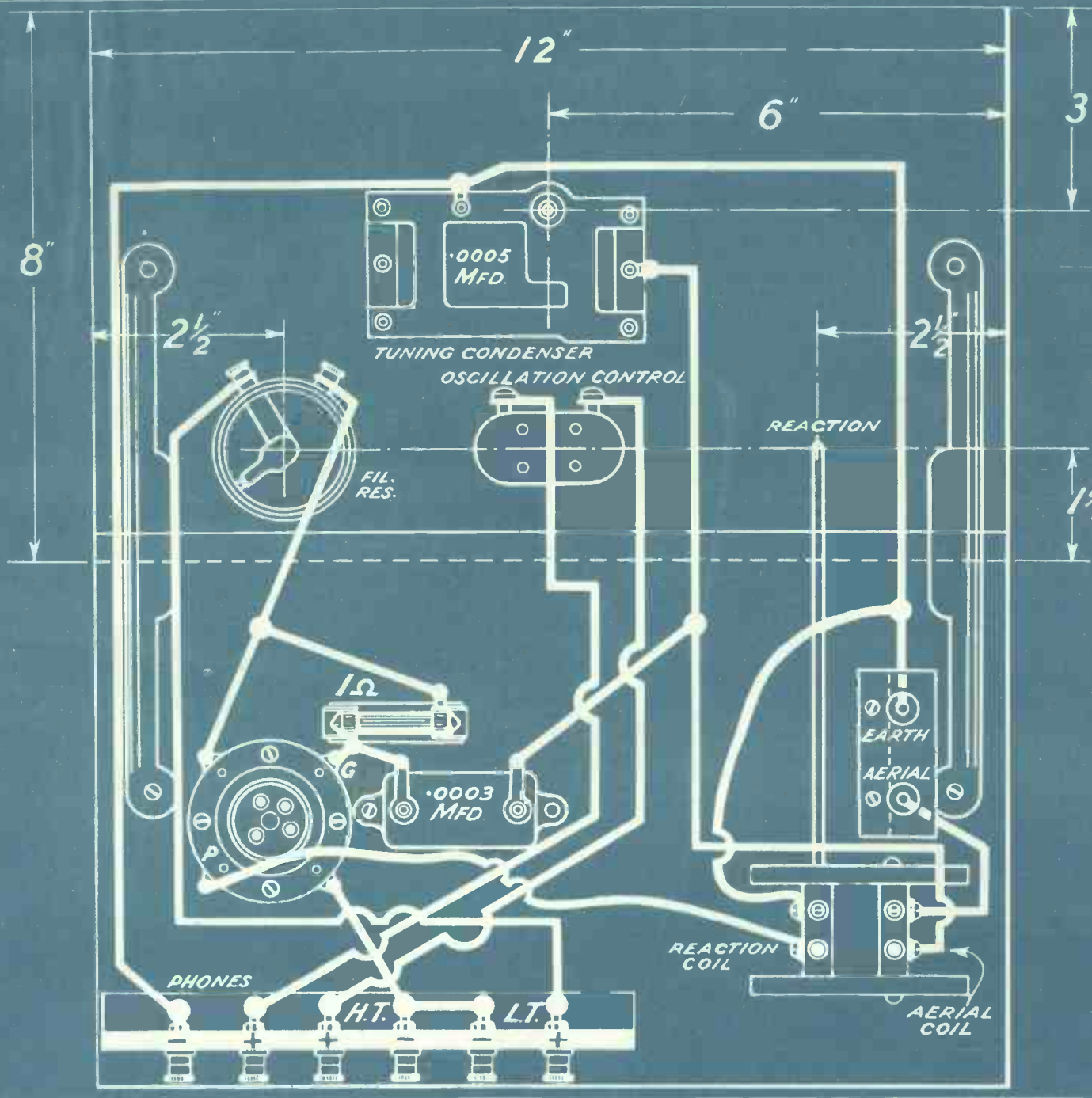
ACCESSORIES

1 H.F. type valve.

1 Pair 'phones.

Coils Nos. 50, 75, 100 (also 150, 200, and 250 if 5 X X is required).

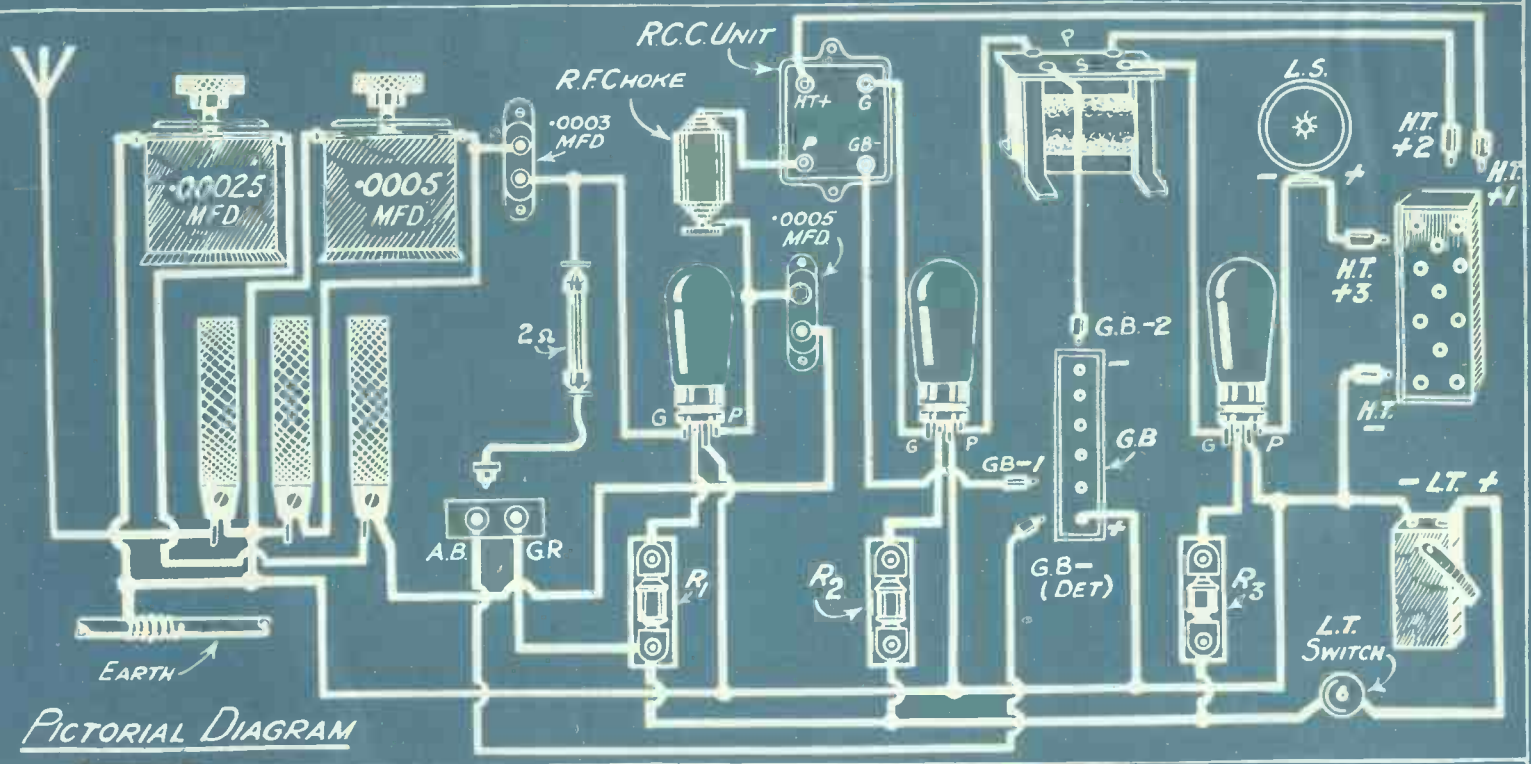
H.T. and L.T. batteries to suit valve.



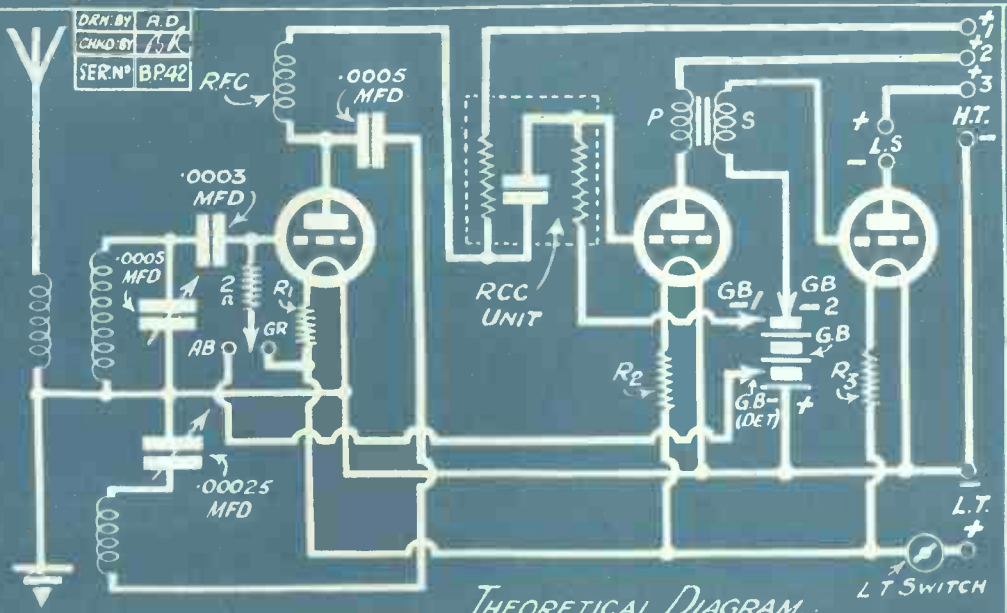
DRAWN.	EL.
CHECKED.	[illegible]
SERIAL Nº	BP.41.

This year's "Chitos" receiver. A highly sensitive one-valver for long range headphone reception. Aerial coil will be No. 75 or 100, depending on the aerial, etc. Reaction, No. 50 or 75. For 5 X X. aerial No. 200 or 250 (on small aerials), reaction No. 150. Keep "oscillation control" resistance at a fairly low value (screwed inwards in most cases) and adjust reaction chiefly with coil holder. Additional control can then be obtained on the variable resistance.

THE P.W. BLUE PRINT No. 42
The "Q. and A. Three"



PICTORIAL DIAGRAM



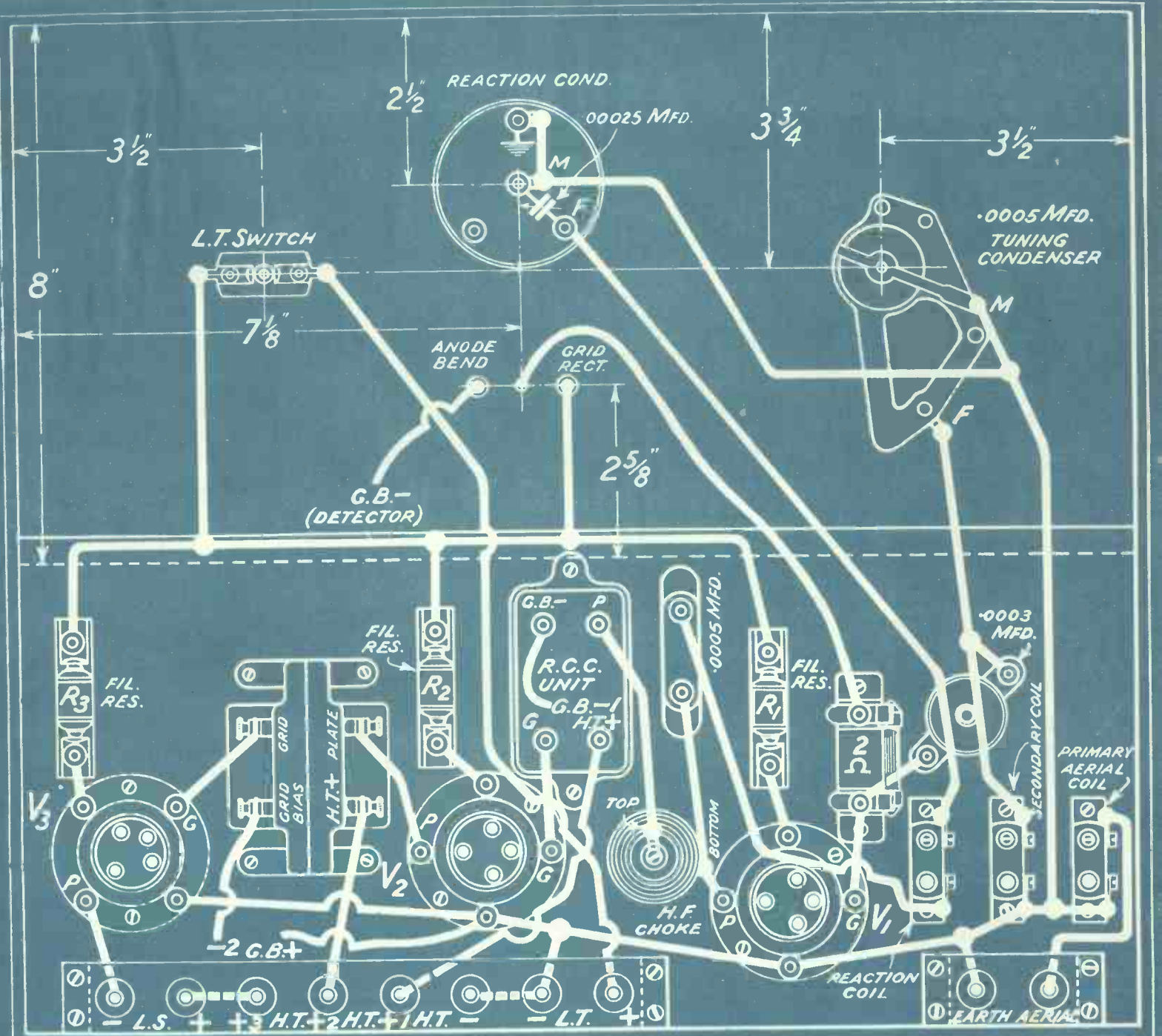
THEORETICAL DIAGRAM

COMPONENTS

1 Panel, 16 in. × 8 in. × ¼ in.
1 Cabinet to fit, with baseboard 7 in. deep.
1 ·0005 mfd. variable condenser, preferably slow motion (or with vernier dial), square law, or S.L.F., according to preference.
1 ·00025 mfd. midget or miniature type variable condenser
1 On-off switch.
2 Small sockets and 1 plug.
3 Board-mounting single-coil sockets.
1 ·0003 mfd. fixed condenser.
1 ·0005 mfd. fixed condenser.
1 2-meg. grid leak and holder.
3 Sprung valve holders.
3 Baseboard rheostats or resistors.
1 H.F. choke.
1 Resistance-capacity coupling unit, any make in which the anode resistance does not exceed about 250,000 ohms.
1 L.F. transformer of fairly low ratio.
1 Terminal strip, 8½ in. × 1 in. × ¼ in., with 8 terminals.
1 Terminal strip, 2½ in. × 1 in. × ¼ in., with 2 terminals.
Wire, screws, flex, etc.

ACCESSORIES

1 H.F. type valve for detector.
1 L.F. (or H.F.) type for 1st L.F.
1 Power or super-power type for last stage.
H.T., L.T., and grid-bias batteries to suit valves.
Set of coils.
Loud speaker.



DRAWN	EL.
CHECKED	
SERIAL No	BP42

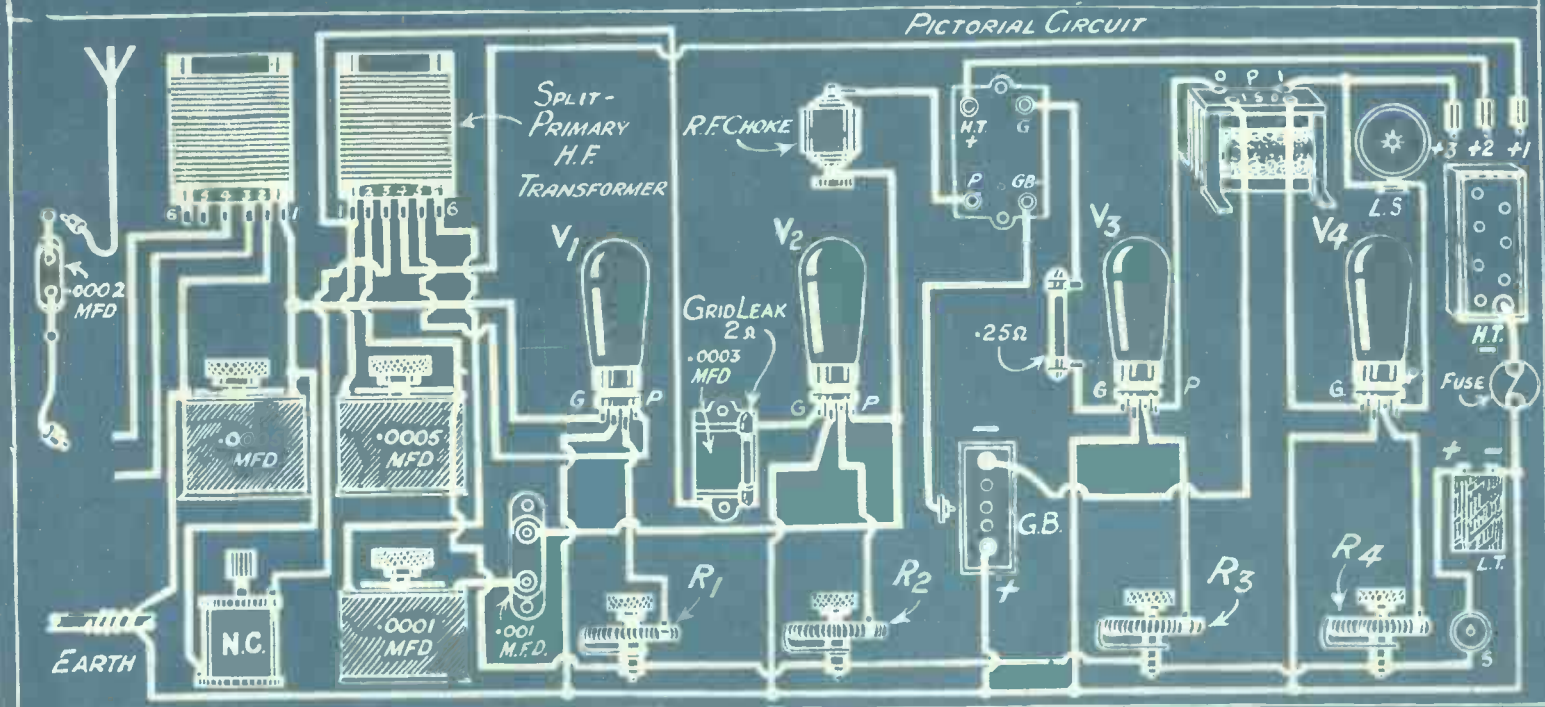
The "Q. and A. Three." A simple set (Det. and 2 L.F.) to give full volume on the local station, with a possibility of long-distance work when a little skill in handling has been acquired.

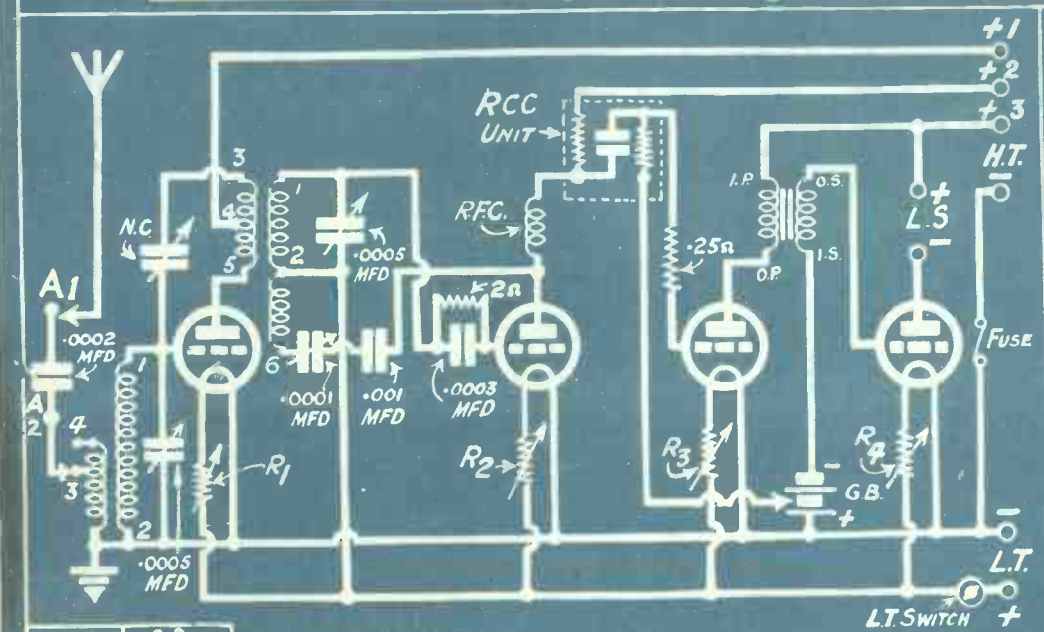
Insert plug on front of panel in "Grid Rect." socket for leaky grid rectification, and in the other for the anode-bend method.

Aerial coil will be a No. 25, 35 or 40 for shorter wave band, and 75 or 100 for 5 X X, etc. Secondary, No. 60 (250 for long waves), reaction, 50 or 75 (150 for long waves)

THE P.W. BLUE PRINT CIRCUIT No. 43

The "Inexpensive Four"





THEORETICAL CIRCUIT.

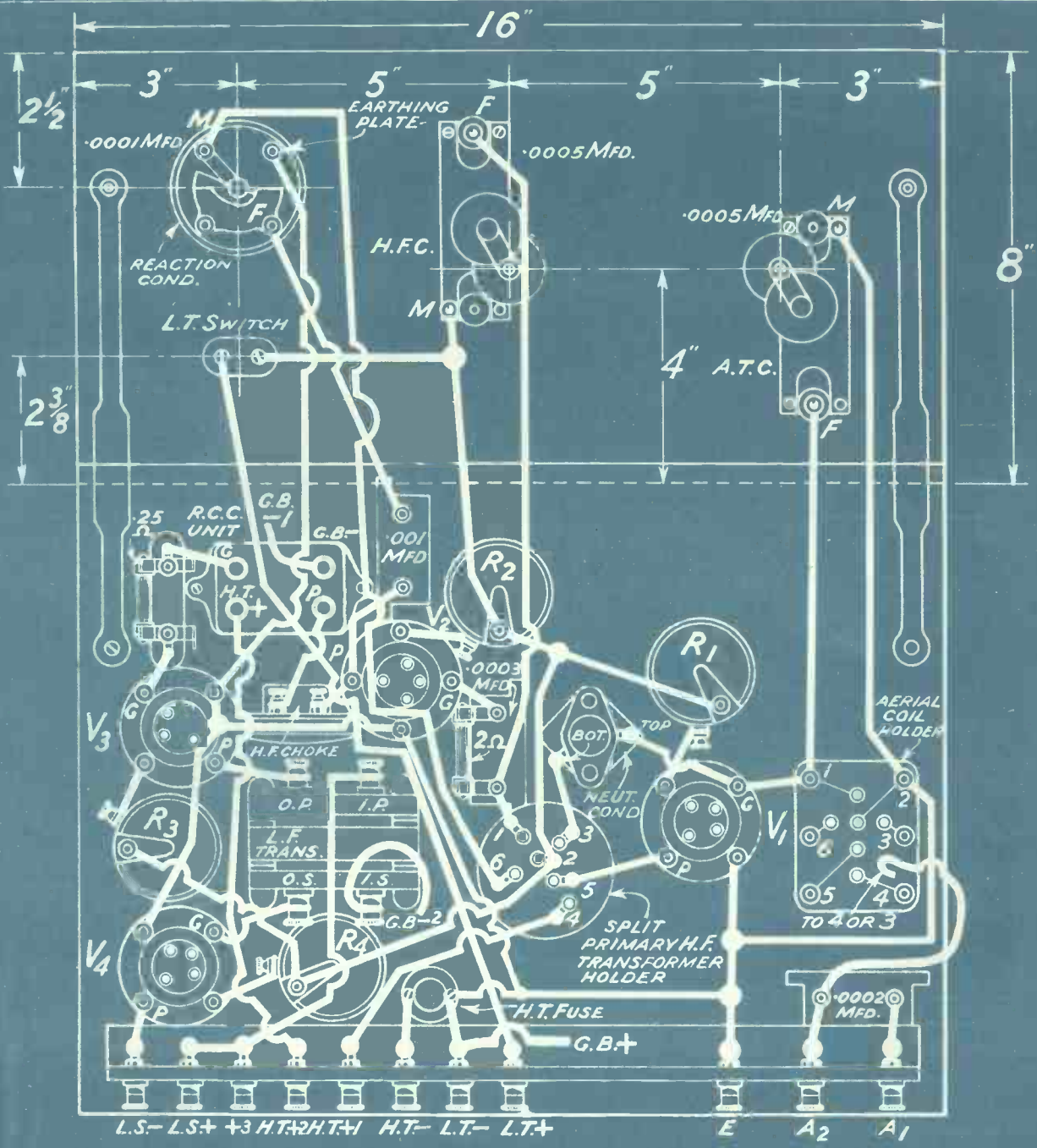
DRWN: BY	A.D.
CHKD: BY	[illegible]
SER: No	43 B.P.

COMPONENTS AND MATERIALS

1 Ebonite panel, 16 in. × 8 in. × ¼ in.
1 Cabinet, 16 in. × 8 in. × 12 in. deep, complete with ½-in. thick baseboard and brackets.
1 Ebonite strip for terminals, 15 in. × 1½ in. × ¼ in.
2 6-pin bases, baseboard mounting.
4 Sprung valve holders.
4 Baseboard-type filament resistances.
1 L.F. transformer, fairly low ratio.
2 ·0005 mfd. variable condensers, slow-motion type, or with vernier dials.
1 ·0001 mfd. miniature type variable condenser.
1 L.T. on-off switch.
1 R.C.C. unit (1st stage type).
1 ·0003 fixed grid condenser, complete with 2-meg. grid leak and clips.
1 ·0002 fixed condenser.
1 ·001 fixed condenser.
1 H.F. choke.
1 ·25-meg. grid leak, complete with holder.
1 Neutralising condenser.
1 H.T. flashlamp bulb fuse.
11 Terminals.

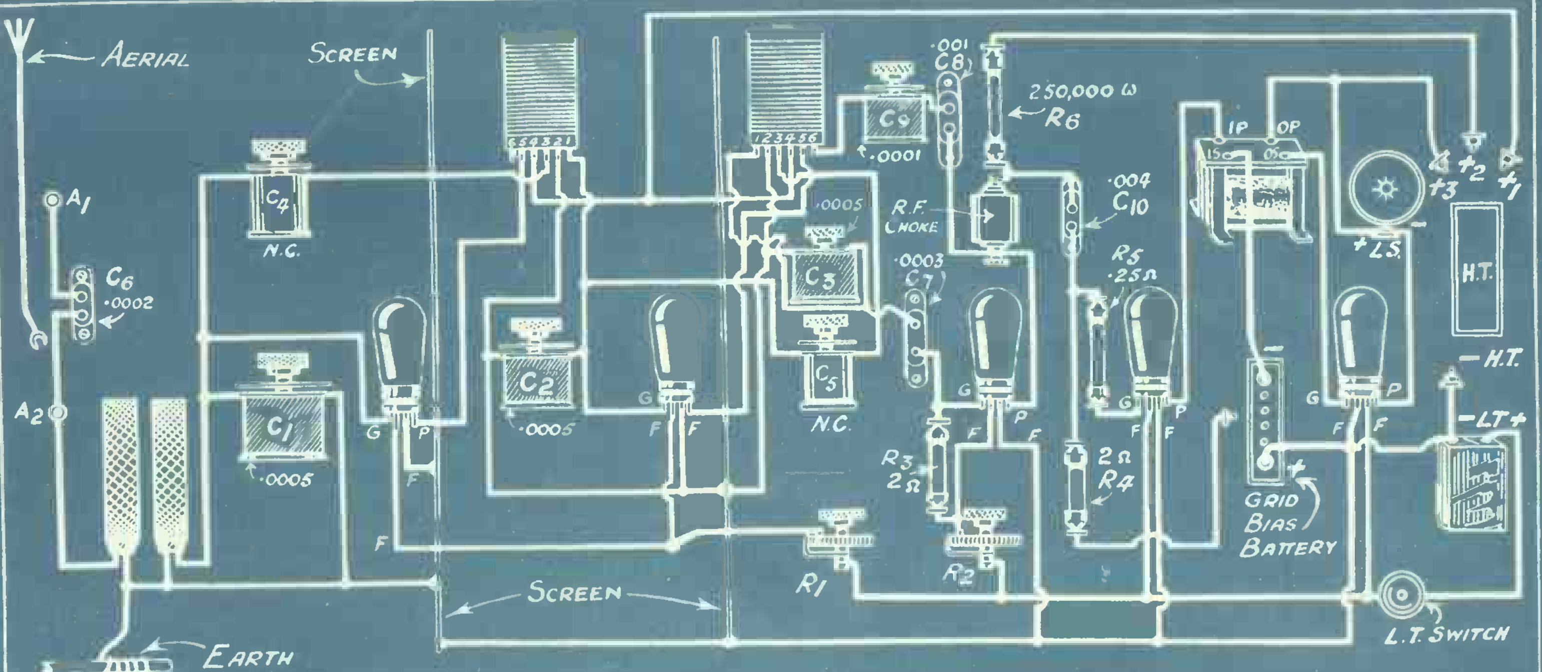
ACCESSORIES

3 H.F. type valves.
1 Power or super-power valve.
1 Split-primary H.F. transformer for B.B.C. wave-lengths and 1 for 5 X X.
1 Binocular aerial coil for B.B.C. and 1 for 5 X X, if desired.
H.T., L.T., and grid-bias batteries to suit valves.
Loud speaker.

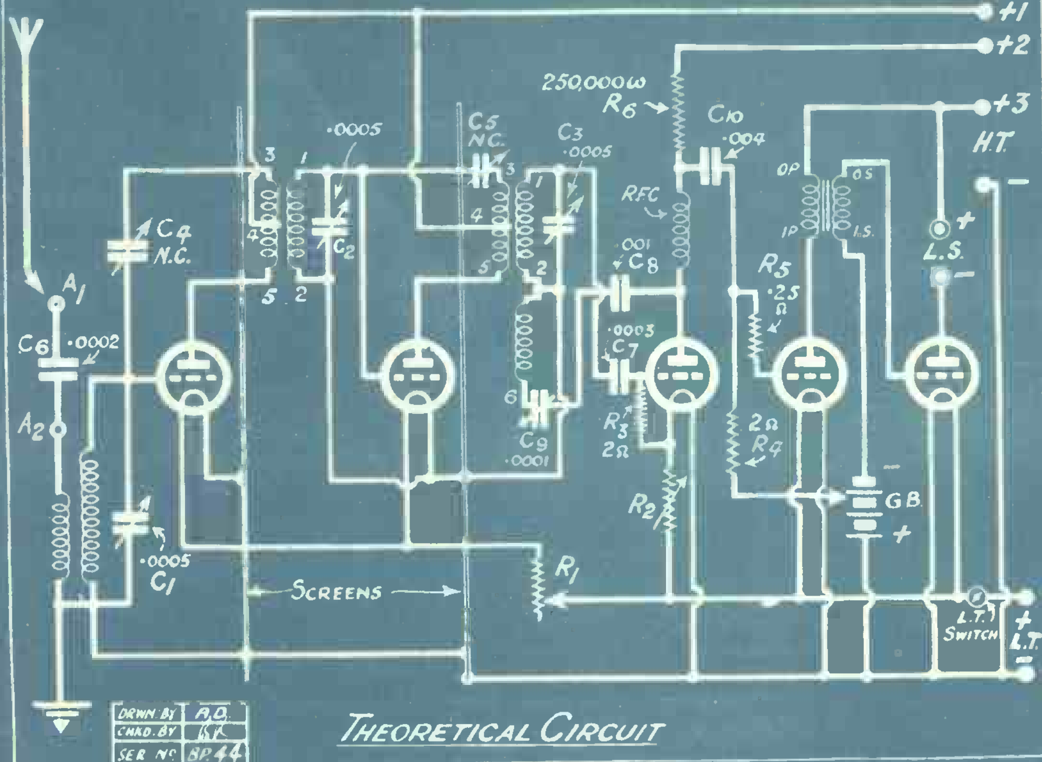


DRAWN	
CHECKED	
SERIAL Nº	BP43A

The "Inexpensive Four." A simple and easily-built four-valve set (H.F., Detector, 2 L.F.) for long-range loud-speaker work. H.F. stage is split-primary transformer-coupled and neutralised. L.F. stages are resistance and transformer coupled. Neutralise by turning out filament of H.F. valve and adjust neutralising condenser until local station is practically inaudible in spite of re-tuning, or by means of "reaction demands" method as given at intervals in "P.W."



PICTORIAL CIRCUIT



THEORETICAL CIRCUIT

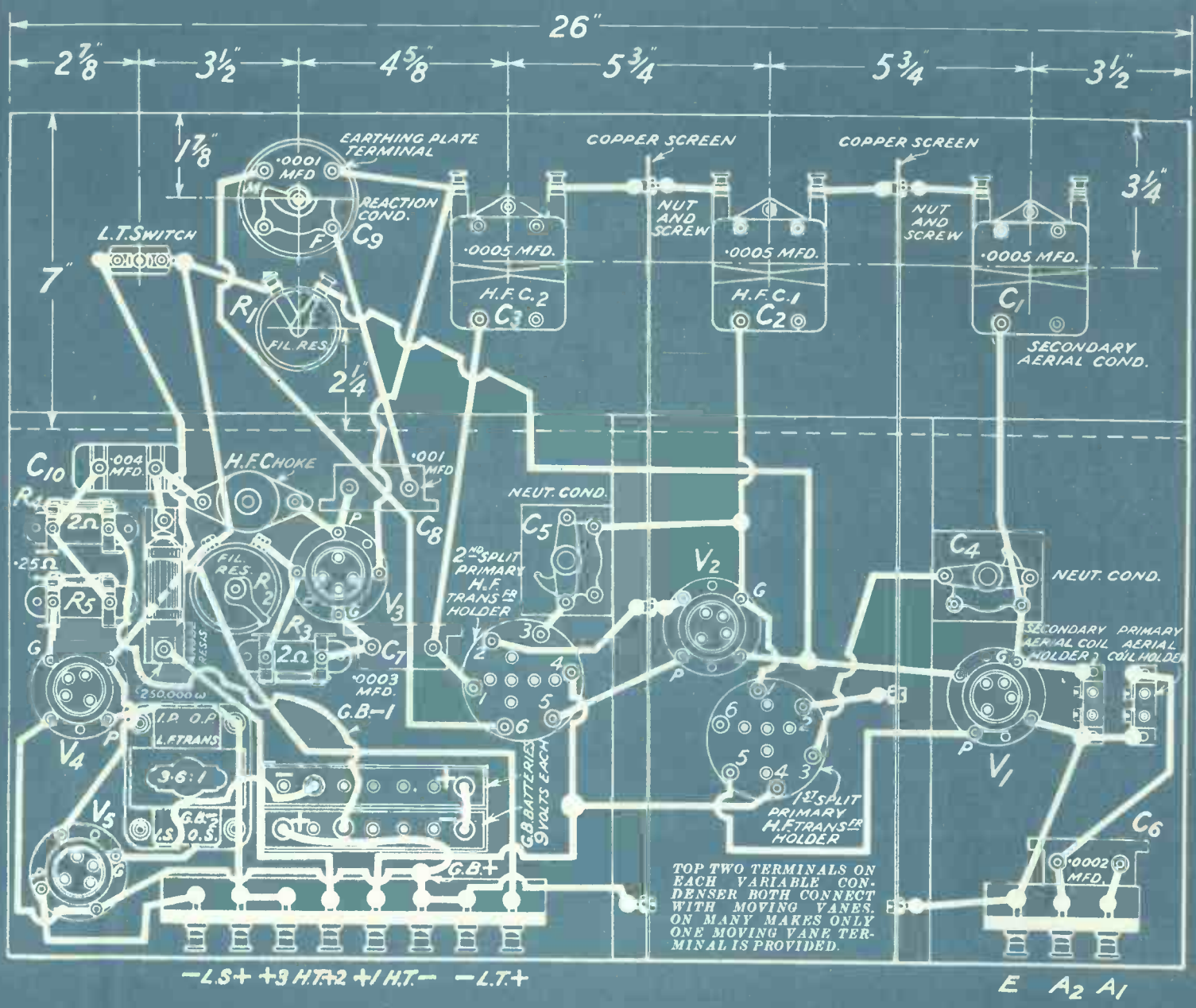
THE P.W. BLUE PRINT CIRCUIT No. 44

The "Economy Five"

COMPONENTS AND MATERIALS

1 Ebonite panel, 26 in. × 7 in.
1 Cabinet, 26 in. × 7 in. × 12 in. deep, complete with $\frac{3}{8}$-in. thick plywood baseboard.
2 Ebonite terminal strips, 1 $8\frac{1}{2}$ in. × $1\frac{1}{2}$ in. × $\frac{1}{4}$ in. thick, and 1 $3\frac{1}{2}$ in. × $1\frac{1}{2}$ in. × $\frac{1}{4}$ in. thick.
5 Sprung valve holders.
1 Baseboard-type filament resistance.
1 Panel mounting filament rheostat
3 ·0005 mfd. variable condensers, complete with vernier dials or slow-motion mechanism.
2 Neutralising condensers for baseboard mounting.
2 6-pin bases (unscreened type).
2 Single-coil holders, baseboard mounting.
1 L.F. transformer, fairly low ratio.
1 ·0001 mfd miniature type variable condenser.
1 L.T. on-off switch.
1 H.F. choke.
1 250,000-ohm anode resistance with holder.
3 Grid-leak holders.
2 2-meg. grid leaks.
1 ·25-meg. grid leak
1 ·0002 mfd. fixed condenser.
1 ·0003 mfd. fixed condenser.
1 ·001 mfd. fixed condenser.
1 ·004 mfd. fixed condenser.
2 Sheets of Copper 12 in. × 6 in., approx. $\frac{1}{32}$ in. thick.
2 Strips of wood, $\frac{3}{4}$ in. × $\frac{3}{8}$ in. × 12 in. long, for supporting screens.
1 Strip of wood, $\frac{3}{4}$ in. × $\frac{3}{8}$ in. × $8\frac{1}{2}$ in., for supporting terminal boards.
1 Strip of wood, $\frac{3}{4}$ in. × $\frac{3}{8}$ in. × $3\frac{1}{2}$ in., for supporting terminal boards. 11 Terminals.
4 H.F. type valves.
1 Power or super-power valve.
2 Split-primary H.F. transformers for B.B.C., and 2 for 5 X X, if desired.

Coils Nos. 25, 35, 50 and 60 (also 100, 200 for 5 X X).
H.T., L.T. and grid-bias batteries to suit valves.
Loud speaker.



WIRING DIAGRAM.

DRAWN BY	E.
CHECKED	BR
SERIAL Nº	44A

The "Economy Five." An inexpensive but sensitive and selective five-valve set (2 H F., Detector, 2 L.F.) for long-range loud-speaker work. H.F. stages are split-primary transformer-coupled and neutralised. L.F. stages are one resistance coupling, and one transformer.

R_1 is intended to serve as volume control on distant stations. On local dim a little on R_1, and reduce to desired volume by detuning on condensers. Neutralise by "reaction demands" method as given in "P.W." at intervals.

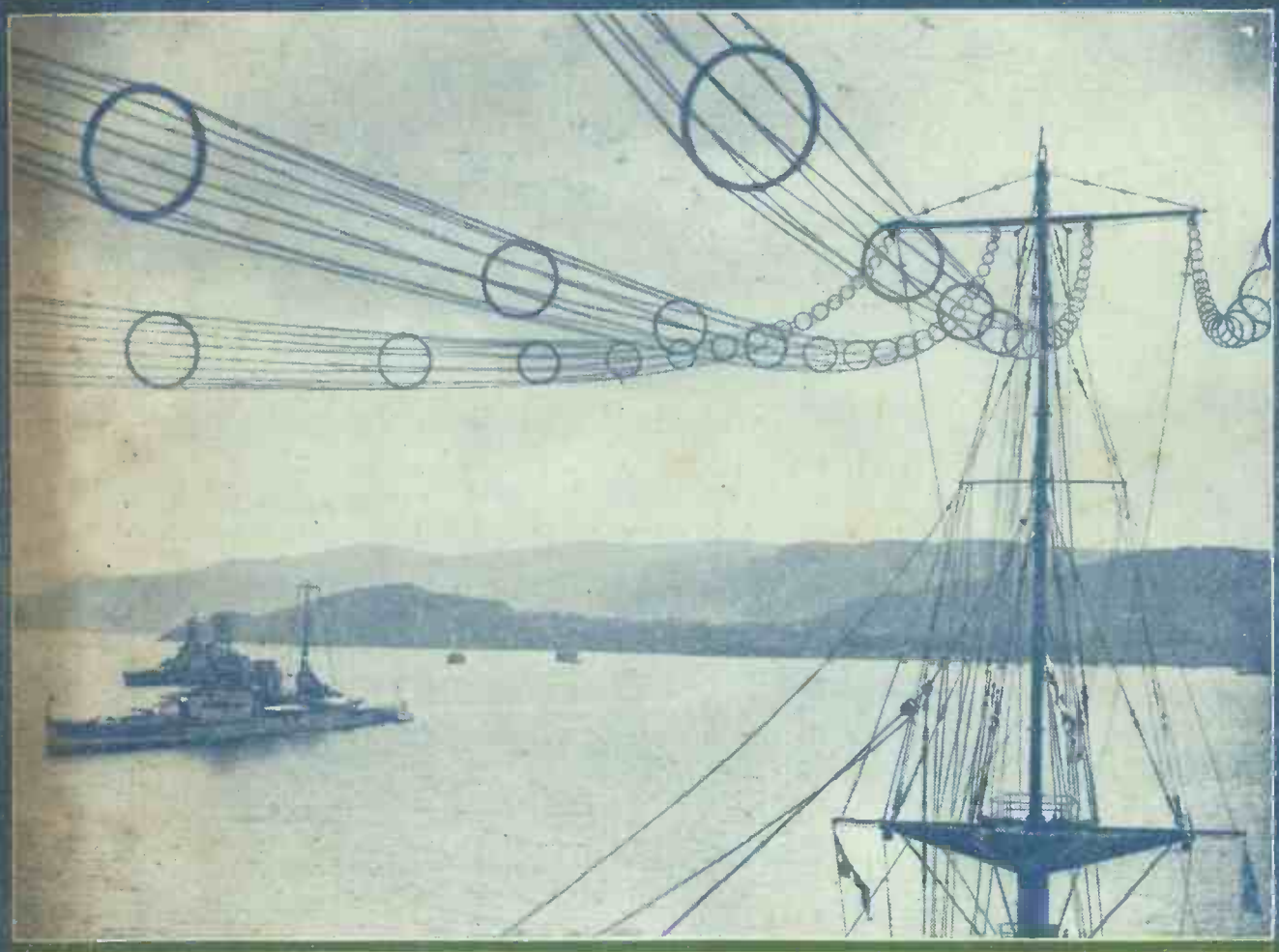
REGISTERED AT THE G.P.O. AS A NEWSPAPER.

FACTS ABOUT THE MULLARD "MASTER 3" (See Page 1183.)

Popular Wireless

Every Thursday PRICE 3d.

No. 297. Vol. XII. INCORPORATING "WIRELESS" February 11th, 1928.



Special Features In This Issue

Various Volume Controls. More About The "Q. & A." Three

THE "INEXPENSIVE" FOUR

The Construction of Short-Wave Coils. Producing for The B.B.C.

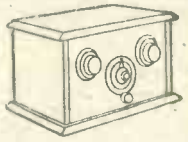
THE "ECONOMY" FIVE

An unusual view of a modern battleship is afforded by our cover photograph. This was taken from the gun-directing turret of H.M.S. "Renown" when she called at Vigo, Northern Spain, during the spring cruise of the Atlantic Fleet. The arrangement of the radio aerials can clearly be seen. The great battleships "Repulse" and "Hood" are also in this picture.

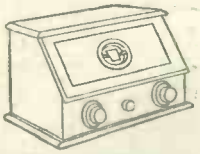
YOU GET MORE FROM MARCONIPHONE

GEO. MUNRO, Esq., COVENT GARDEN, writes:—*"It is the most perfect toned and the easiest controlled instrument I have come across and a great advance on anything so far."*

Marconiphone Model 82 (8-valve) Superheterodyne Receiver including frame aerial and Power Control. £53. (Royalty £5 : 5 : 0.) Gradual payments if desired.

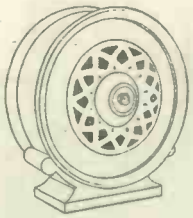


Marconiphone Model 22. The highest standard of performance for two-valve receivers. **£6 : 10 : 0** *(Royalty £1 : 5 : 0.)*

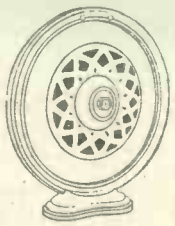


Marconiphone Model 32 (3-valve), a fine example of the sensitivity and power inherent in all Marconiphone receivers. **£12** *(Royalty £1 : 17 : 6.)*

Marconiphone Model 51 (5-valve) Receiver. Great range with purity of tone. **£24** *(Royalty £3 : 2 : 6.)*



Marconiphone Cabinet Cone Model 105, reproduces the entire musical scale to perfection. Sound emission from both sides. **105/-**



Marconiphone Cone Speaker Model 75, of acute sensitivity and artistic appearance. Adjustment controlled from the front. **75/-**

THE MAGIC TOUR

Travel "Via Marconiphone Wireless." In vivid fancy you are whirled to the far-away corners of Europe; in a single evening you enjoy the orchestras and artists of the principal Continental musical centres.

Marconiphone Super-Eight is operated by only one tuning control. Yet signals from thousands of miles away are picked up on the frame aerial—no outside aerial or earth is needed—and transformed into powerful tones of crystal-clear purity. Volume is modified, as desired, by a Power Control operated from your arm-chair.

Send for Publication No. 438, fully describing Model 82 and other Marconiphone Wireless Apparatus, mentioning "Popular Wireless."

THE MARCONIPHONE CO. LTD., 210-212, Tottenham Court Rd., W.1

Showrooms: Marconi House, Strand, W.C.2

EVERY DEALER OFFERS DEFERRED TERMS FOR MARCONIPHONE PRODUCTS COSTING £10 OR OVER.

The New Radio Simplicity

No Batteries No Accumulators

Your duty towards your neighbour!

ONE H.F. STAGE

There is a large Public who are content with reception from the local Station and Daventry, whose requirements can be met by the ordinary 3 Valve re-acted Detector Set of which there are so many varieties advertised with fanciful names. To get more than this inevitably means "oscillation" with consequent howling and annoyance to your neighbours.

The B.B.C. definitely state that one H.F. stage is essential at the following ranges, if loud speaker reproduction is to be anything but "indifferent":—

100-150 miles from Daventry.	5XX.	4 Valves.	1 H.F. stage.
50-100 „ „	5GB.	„	1 H.F. stage.
Over 15 „ „	Main Station	„	1 H.F. stage.

These figures obviously allow for that factor of safety which is so necessary if consistently pleasing reception is to be obtained under all conditions.

One neutrodyned stage of H.F. will give that additional sensitivity necessary for more distant reception, with radiation reduced to a minimum.

The Met-Vick 4 Valve A.N.P. Constructor's Set is the ideal solution. With the additional H.F. stage, there is no need to force the set. Using A.N.P. coils the set is stabilised, screening is unnecessary and high voltage factor Valves can be used. Additional selectivity is provided by a Tuned loose coupled aerial circuit, brought into action when required. Delightful to operate and cheap to build, the parts with two sets of coils costing only £9.

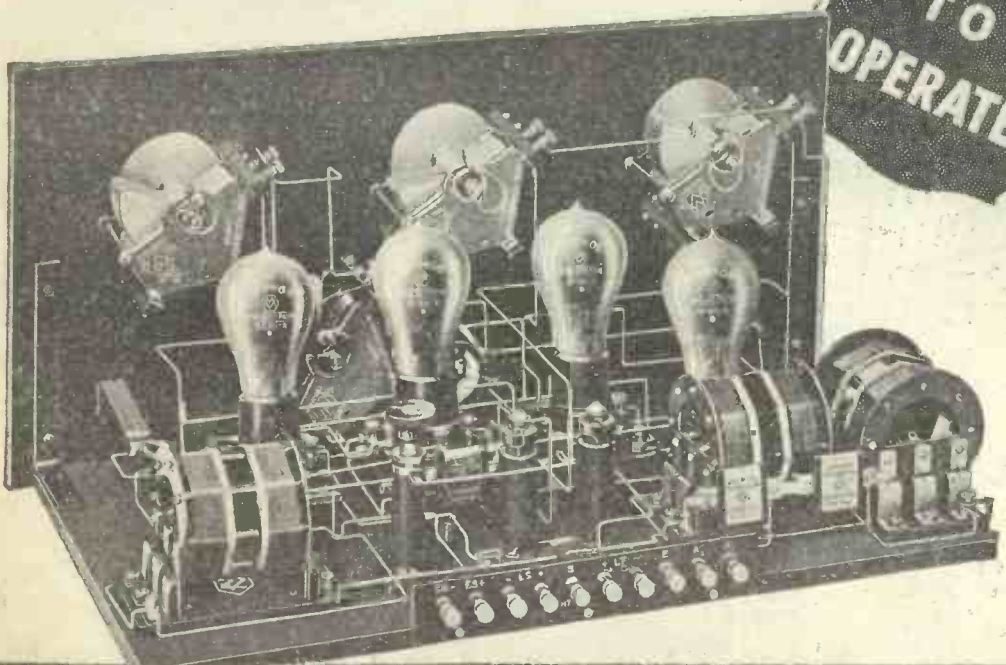
The Met-Vick A.N.P. 4 is pre-eminently the 4 Valve Set of the Day.

If unable to obtain instruction book from your dealer, write for Publication No. 7117/5 or 7117/4 (the A.C. Valve Model) free on request.

MET-VICK

CHEAP TO BUILD

EASY TO OPERATE



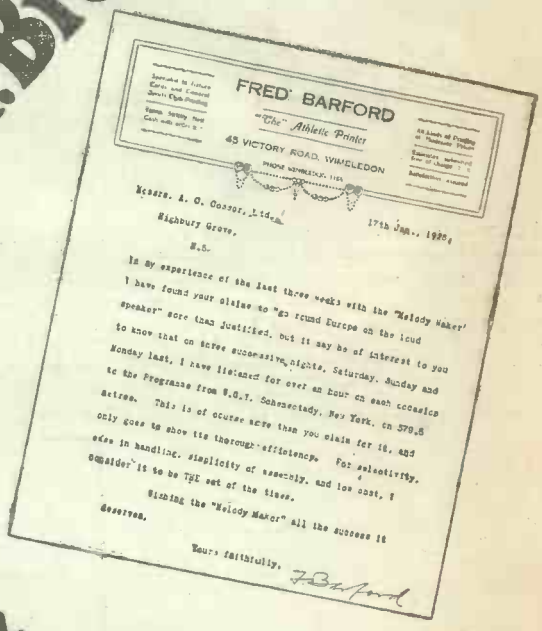
RP
104

METRO VICK SUPPLIES LTD. 155, CHARING CROSS RD. LONDON. W.C.2.

★ *P.S. See our exhibit-Block 25E, Building "C"-B.I. Fair, Birmingham.*

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

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



FRED BARFORD

"The" Athletic Printer

45 VICTORY ROAD, WIMBLEDON

Messrs. A. C. Cossor, Ltd., 17th Jan., 1928.

Highbury Grove,

N.5.

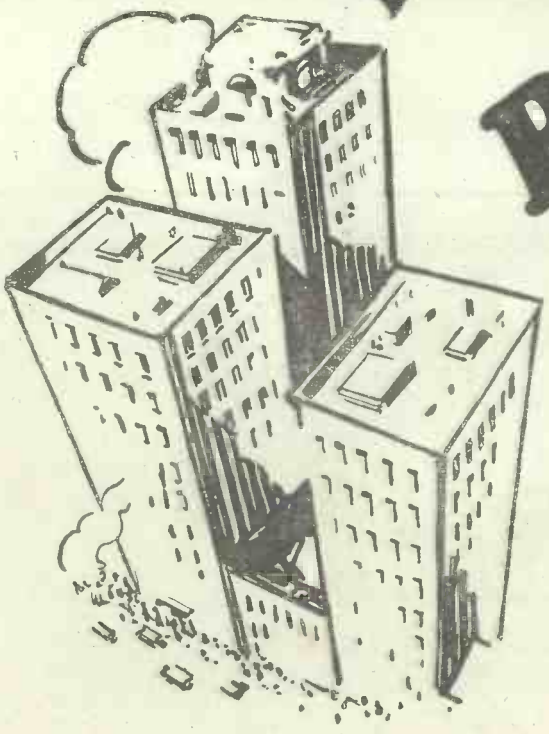
In my experience of the last three weeks with the "Melody Maker" I have found your claims to "go round Europe on the loud speaker" more than justified, but it may be of interest to you to know that on three successive nights, Saturday, Sunday and Monday last, I have listened for over an hour on each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

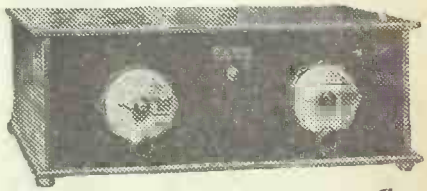
Wishing the "Melody Maker" all the success it deserves.

Yours faithfully,

F. Barford

But Mr. Barford gets it all the same





on his home-built Cossor Melody Maker

1714

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

Popular Wireless

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Sir OLIVER LODGE, F.R.S.
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RADIO NOTES AND NEWS.

"Watch" Your Set—The Horrors of Peace—How Licenses "Pan Out"—Fairy Tales—Down with the Law—P.W. Reader Honoured—How Not to Earth—"Sydney Two" & Lo-Cost."

Faraday Medal Award.

THE Council of the Institution of Electrical Engineers has made the seventh award of the Faraday Medal to Dr. J. A. Fleming, F.R.S., the inventor of the two-electrode valve which was the fore-runner of the modern valve. A well-earned honour! But Dr. Fleming's reputation is really based on a long life devoted usefully to electrical engineering and the training of electrical engineers.

"Watch" Your Set.

I READ that a French manufacturer is mounting watches on the panels of his sets. This strikes me as luxury run mad, but it occurs to me that a good many people might welcome, not a watch, but a neatly-painted watch-face showing the time at the chief capitals of the world corresponding to noon G.M.T.

The Brain Storm.

A WRITER in the Daily Press, dealing with the principles of the cone loud speaker, playfully conjures up the idea of turning the floor or a table into a loud speaker—i.e. "Music from a bedroom floor." It is a belated headline, because every day in thousands of homes there is music from the bathroom door.

Horrors of Peace.

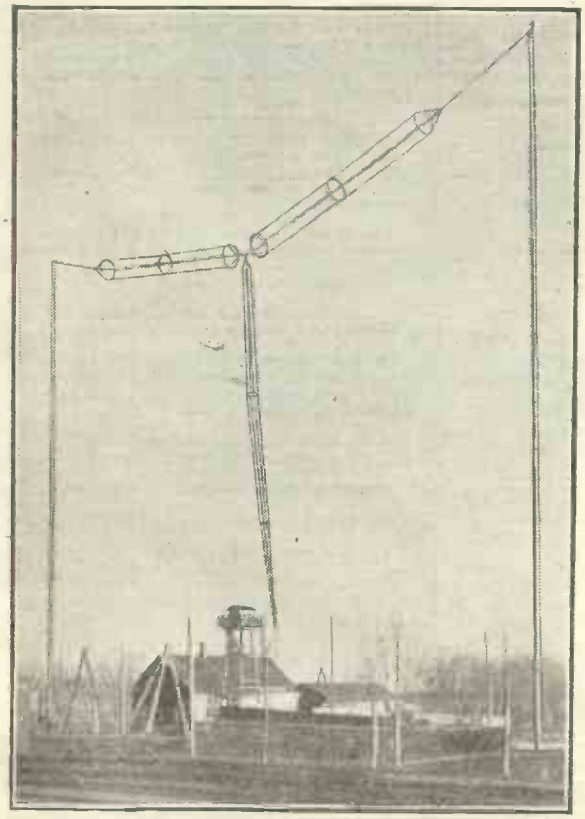
DO you know about the world's largest loud speaker? In America, *of* course, with the Bell Telephone Company as the culprit. The new device, it is estimated, can be heard by a million people within a radius of a mile. At a recent demonstration people standing on one side of the Hudson River spoke into a telephone and five seconds later their words came booming back from a laboratory a mile away on the opposite bank. The diaphragm of this voice-howitzer is little bigger than a watch and thinner than gold leaf.

How Licenses "Pan Out."

ACCORDING to the Royal Telegraph Department of Sweden the number of radio licences issued per 1000 head of population in various countries are as follow: Sweden 53·6; England, 53; Denmark, 44·8; Austria, 43; Germany, 28·1; Norway, 22·1; Switzerland, 15·9; Czecho-Slovakia, 15·2; Hungary 9; Finland, 8·8; and Belgium, 4·6.

Dangers of Bad Transmission.

IF good reception of Chamber Music and Talks drives men out to the Draughts Club or to Glee Concerts, what must bad transmission do? I have been reading the letter of a victim in the "Irish Independent," and this plainly shows that he has been embittered to the point of 100 per cent acidity by his inability to receive Dublin and Cork properly. He goes so far as to complain that if he and his family have to listen to London every night, "the little ones will soon become 'happy English children.'" A lucky fate, say I—and say no more.



The above photo shows the cage type aerial and the buildings housing the transmitter of the Kalundborg Broadcasting Station. The aerial is 45 yards long and has a height of 175 ft. The smaller masts are made of telegraph poles specially impregnated. Kalundborg generally acts as a relay for Copenhagen, and has a wave-length of 1,153 metres. Its power being 7 kw., it is heard in many distant countries, although not many reports concerning its reception in this country have been brought to our notice. Does it come in on your set?

Fairy Tales.

OVERHEARD in radio sales-room. Lady motorist: "And what is in this case?" Salesman: "Carborundum crystals, madam." L.M.: "Ah, for grinding in the valves, I suppose!" Next, please! "Romance of Radio. Wireless finds long-lost brother." A. (listening-in): "Heavens! that is my brother's voice. He has not seen me for forty-five years!" B. (romantic): "How charming! What a joyful reunion!" A.: "Not at all! He's blind!"

Down With the Law.

A GENTLEMAN rejoicing in the title and name of Controller-General McCarl has announced that it is illegal for the U.S.A. Treasury to use radio for advertising purposes without the due authority of Congress. That any kind of publicity by anybody in the U.S.A. is illegal will hardly be believed in Europe, but if the fable is founded on fact I can foresee Congress getting a smart wiggle on. That the Treasury of the Land of the Free should be stifled smacks of tyranny; where are Washington, Lafayette, Paul Revere, John Brown and Co.?

Transmitting Note.

MR. GERALD A. JEAPES, 2XV, of 117, Victoria Road, Cambridge, announces that from early in February

(*Continued on next page.*)

NOTES AND NEWS.

(*Continued from previous page.*)

till April he will be transmitting on 32 to 34 metres (Morse), input 60-100 watts. Times, Sats., Sundays, and Mons., 6.0 a.m. to 8.30 a.m. These transmissions will be particularly aimed at Australia, Tasmania and New Zealand, whose amateurs are hereby begged to report on his signals, to the address given above. My benison on ye all, poor down-trodden, British beset amateurs!

New Short-Wave Station.

OPENED at Porto Rico. W G T, 21·75 m. (20 kw.) and 62·25 m. (400 watts). Telegraphy only. I need scarcely point out that the ability to read Morse endows a short-wave enthusiast with much more fun and power of long-distance exploration. Quite simple to learn. Just *dah dee dah*, and so forth.

No More DX?

CAPT. ECKERSLEY, writing in a ladies' magazine, predicts that in the not far distant future the relay station will be able to re-radiate programmes from many distant stations, and that it will be the death of direct distant listening.

Maybe! But not for *pukka* radio people. We want to do the distance *ourselves*—and we don't care much what the language, or what the programme, so long as we identify the station. Our Eck is thinking only of the old folks, and forgets "P.W.'s" myriad readers, aged 13, *et seq.*

What? Never?

"WELL, hardly ever." It is reliably reported that Sir Thomas Beecham has broadcast a concert in America. Get the sackcloth and ashes ready. There's something in American air. Suppose every listener added a penny to his licence fee, would Sir Thomas revise his opinion of us?

Habbakkuk the Second.

I NEVER *could* spell that properly. It's as bad as catarrh. B. S. (Forest Gate), writing to a London "daily," prophesied that within the next twenty-five years it will be possible to dispense with aerials, accumulators, and batteries, and to buy a portable outfit for a guinea. A cautious prophet! We can now dispense with aerial, accumulators, and batteries—I suppose he means H.T.—but the guinea portable is not yet on the market, unless it be a crystal set. I have seen a portable crystal set for sixpence. I would, however, warm up much more to a prophet who confined himself to five years. This one adds: "Our weather will not improve." Elementary, my dear Habbakkuk!

Birmingham Special.

There was a young plumber of Aintree
Who tried every night to get Daventry,
He had small success,
But at Brum they had less,

.....

Fill in the missing line. No prizes, but the winner gets into print.

"P.W." Reader Honoured.

F. N. H. (Dursley) should ere this have received a most unusual distinction. It appears that some months ago he sent to Calvary Church, East Pittsburg, U.S.A., a report on one of its broadcasts. In return they promised to send him radio greetings during the church service on January 15th, via K D K A. Very nice of them, but fancy—it is fancy—a church service in England including greetings to a casual eavesdropper!

"Sydney" Two and "Lo-Cost."

FROM a batch of letters about these sets I select two typical examples. Of the "Sydney Two," C. M. (Shoreditch, E.C.) says: "For simplicity of control and wonderful results it cannot be beaten." On a 17-ft. high aerial he gets a number of American stations besides signals from places "all over Europe too numerous to mention." We just thought that is what would happen. C. A. (High Wycombe) made the "Lo-Cost" Crystal set. It gives him London (30 miles), 5 G B, and 5 X X (50 miles). He says, "It is a wonderful little set." Oh, quite! Have you tried for Sydney?

SHORT WAVES.

A wireless set and a gramophone are stated to be among the supplies which are now on the way to the lonely island of Tristan da Cunha. This eliminates Tristan da Cunha from our list of refuges.—"Punch."

* * *

Madge: Dolly is always changing her barber.

Marjorie: She says she can never get the right wave-length.

* * *

"The perfect set," declares an authority, "is one which operates without an aerial, without an earth and without much manipulation."

And without, we should say, a licence.

* * *

THE LAST WORD!

The B.B.C., it is announced, has arranged a new series of forty-six talks and lectures to be given between January and April. Now we realise why some husbands dislike wireless.—"News of the World."

* * *

Home set builder (to neighbour): See that receiver over there? I built every bit of that with my own hands, and I'm telling you a thousand wouldn't buy it.

Neighbour (possibly jealous): Well, I don't doubt your word at all. I'm one of the thousand.

* * *

B.B.C AND THE SALES.

Weather forecast: "A deep depression is now centred over the Better Half of the British Isles, and a heavy fall in Bank balances will occur in the near future . . ."—"Daily News."

* * *

The B.B.C. announce that it is trying to arrange a substitute for Mr. Guedalla.—"Westminster Gazette."

Very trying, we should think.

* * *

DEFINITION OF AN AERIAL.

A good clothes-line running to seed.

* * *

We congratulate Captain Reginald Berkeley on the fact that his play was not thought dull enough to form part of the B.B.C. programme.—"G. K.'s Weekly."

* * *

My radio gets most anything
From near and distant climes.
I only wish that everything
Would come at different times!

Watering the Taproot.

I HAVE received from India a prospectus of a book by Mr. Habibur Rahman Khan, which deals with his discovery of a new theory of radio transmission. He says that the "taproot" of wireless phenomena is a "magneto-electric molecule," and goes on to divulge that he has invented an entirely new system of wireless transmission and reception; no masts and overhead aerials but plenty of water. Well, we shall have to invent a portable lake. Meantime, we shall short-circuit the book unless the inventor will say with what stations he communicates by means of the taproot.

How Not to "Earth."

HERE'S a very "matey" letter from T. C. (Carlisle) full of wireless lore and scandal. T'other day he found a set "earthed" to a shrub tub; and the irony of it all was that the lead passed to the tub along a main water-pipe! T. C. suggests that poor results are frequently due to similar bits of bad installation and far less to faulty gear. Agreed! He tells me that 5 G B is useless to him, owing to fading, and that Dublin, Belfast and Newcastle compete for the honour of operating his loud speaker. Better move South old thing, and follow the clan. Mani tks for ur ltr.

Television.

SAVE for a small amount of hasty publicity connected with transatlantic trials, Mr. Baird maintains silence on the subject connected with his name. What on earth some people have formed a television society for—when there isn't any—beats me. I begin to fear that an insuperable snag has been encountered, and that the transatlantic adventure is a red herring.

Controversy.

THE B.B.C. announces that the ban on political, religious and industrial controversy causes them vexation They ought rather to be glad. Free speech is all right up to a point, but those three kinds of subject are about the most dangerous and unprofitable for discussion it were possible to find, especially the second one. My reason for opposing the broadcast of religious and political debates is that I consider they would bring dissension into many family circles. There are plenty of subjects for debate apart from religion and politics, thank goodness.

That's the Stuff.

THE town of Fairfield, Iowa, U.S.A., has apparently been studying the persuasive methods of Signor Mussolini and General Primo de Rivera. Realising that listening to radio is a serious business, the local council have prohibited the use between noon and midnight of any machine which shall cause electrical interference with radio reception, the exception being X-ray apparatus used "in emergency cases of physical injury." The penalty for breaking this law is £20 or 30 days. A bit of a snorter, eh? Why do our American cousins plunge to such extreme depths in search of Liberty? I thought the famous Declaration gave them all they desired.

Mr. Marcuse Speaks.

IN the report of an interview with Mr. Marcuse (2 N M and first Imperial broadcaster), the "British Australian and New Zealander" makes him say that Australians are the keenest radio fans, mainly, I gather, because they get up at 2 a.m. to listen to his broadcasts. Personally, I believe heaps of fans at home rob themselves of sleep in order to try for Australia. Mr. Marcuse complains that the Post Office is killing private wireless enterprise. It is a speciality of the Post Office, and the country is the loser. Interesting facts divulged by 2 N M are that his broadcasting station cost him about £1,000, and that its running expenses are six shillings per hour.

ARIEL.

PRODUCING FOR THE B.B.C

The author writes with authority, as he has produced several radio shows which were very well received by both critics and the public.
By OSCAR M. SHERIDAN.

PRODUCING revues and musical shows for the British Broadcasting Corporation is not without its thrills. There are things that happen in the studio on the first night of a revue which, owing to the fact that they do not gain newspaper publicity, remain unknown to wireless audiences.

It is not the easy thing one imagines to produce a revue that should entertain a million licence-holders. There is no item of average popularity in the wireless programme of to-day. It nearly always depends on its methods of presentation.

The wireless producer is ever on the look-out for vehicles of originality, and these are hard to find. The producer who presents a show written by somebody else is a lucky man. There is always some kind person who says: "He is brilliant, but what could you expect with such poor material!"

Many Appreciations.

I am not so fortunate. In collaboration with Hubert W. David, I write all my shows myself, book, lyrics, music and sketches. Then, if the show is bad there is no one to blame but the producer, which is myself. "Cabaret Calling," "The Show's the Thing," "Crackers," and "Paris Calling," however, were all very popular shows.

It is no easy matter to get a wireless show "over." My experience has always been with shows where, if the material was unworthy, I could rely on the production. While production exists in a very important form at the B.B.C., it is absent when one wishes to resort to such things as "looks, legs and lighting."

By careful production, however, one can put over atmosphere in such a way that its result is most effective. For instance, in my production of "Paris Calling," which Alice Delysia presented, I received a delightful letter, from, I expect, a charming old lady. She wrote: "Dear Mr. Sheridan, I must write and tell you how much I enjoyed your wireless revue on Saturday night. I understand French, of course, and your mixture of the French and English items I found perfectly delightful. I do wish, however, the engineers hadn't cut it off to relay that boxing match. I hate cruelty, and so am no lover of boxing, but——" and so on.

Realistic "Effects."

The boxing match in question was a sketch entitled "The Knock-Out," and was the reproduction of a French boxing match taking place between Georges Carpentier and Bill Smith! Thanks to the effects department, I had all the sounds and atmosphere of a real boxing match, and the result was that this was a very popular item indeed, at least so I imagine, according to the large number of letters I received, the majority of which made a point of that particular item.

My experience in producing shows on the continent has convinced me that it is

M. Andre Charlot, who also has produced several successful revues for the B.B.C.

a good idea to take your wireless audience out of London. Via the B.B.C., I have already travelled as far as New York, France, Russia, and one or two other places, one show being entirely devoted to France and another one entirely to America.

The next show I am doing will take my audience and myself to Spain, among the orange groves of Seville and the bull-fights of Madrid. Again my collaborator in this show will be Hubert David; and Raquel Meller, the famous Spanish singer, is presenting the revue.

I have often been asked whether there are mishaps on the first nights of a revue at the B.B.C., just as there are at theatre premières. Alas, they are all too frequent, the only difference being that they are never serious and are always righted in the end. While they last, however, they are nerve-racking, for a B.B.C. show must have no postponement, and from beginning to end it is a fight for time.

Awkward Moments.

I remember one night a clock in the Strand informing me that it was a quarter past nine, so I continued my quiet walk to the B.B.C. realising that I had plenty of time. I arrived for "The Show's the Thing" just one minute before it was due to start. The clock was slow, and as I had half a dozen of the scripts in my possession the result might have been very serious for one or two of the artistes who had not memorised the lines of the "book."

In "Paris Calling" Henri Leoni was missing one minute before his next song. Out of the studio I ran, up and down stairs, into the street, but no sign of my friend. Out of breath and armed with the decision to change the next number, possibly spoiling the whole show, I found him calmly sitting behind the piano.

Sometimes there are effects which fail one at the right moment, although they are very rare occurrences; the B.B.C. organisation is so good that it is rare that a show can go wrong. Every assistance is given to the outside producer, and if ever one is let down in a revue it is generally the fault of the artiste.

New Shows Always Required.

On the whole, I have thoroughly enjoyed my experiences with the B.B.C. I must say that I have had every co-operation and encouragement at Savoy Hill. They have been most helpful. I wish that the professional managers and artistes alike would work more closely with the British Broadcasting Corporation.

Everything said and done, the B.B.C. is a theatre, as a matter of fact the biggest and most powerful theatre in this country.

As such, of course, it has not the advantages of the ordinary theatre, for the audience is so large that a "show" can be run for one or two nights only before it has to come off and be replaced—no easy matter.

THOSE ABANDONED DEBATES.

International Tests by Amateur Transmitters—Some Interesting Statistics.

By THE EDITOR.

WELL, the result of the deliberations of the Governors of the British Broadcasting Corporation has been announced—to the effect that radio debates have been abandoned!

Our readers will remember that when attention was drawn to the restriction on broadcast controversy, the Governors of the B.B.C. issued a statement to the effect that "the whole question of broadcasting controversial matter has had for some time past, and is still having, their careful consideration."

Then followed another debacle, when Mr. Philip Guedalla withdrew from a debate because of the limitations imposed by the B.B.C.

It is regrettable that the B.B.C have taken the weakest line of action. The question of the restriction on controversy has, as a result, not been thrashed out in full. In fact, the B.B.C.'s attitude in cancelling radio debates might be termed precipitate.

"Existing Restrictions."

The co-called restriction on broadcast controversy is not a definite imposition and, as is well known, the Postmaster-General more or less leaves the B.B.C. Governors to exercise their own discretion in the matter of controversy. But this discretion, it appears, in practice, only extends to a very limited degree—and at the first sign of hostility, agitation and argument about broadcasting controversy, the B.B.C. Governors throw overboard what could be one of their most attractive programme features and allow censorship to win the day.

Reasonable freedom of speech for broadcasting is essential: and Mr. Guedalla, when he found that he could not allow his talk to be broadcast unless he was given that necessary freedom, very rightly decided to withdraw from the debates arranged for January 6th and 30th.

As a result of this the Talks Director, on behalf of the B.B.C., wrote: "We had hoped that it might have been possible to resume the series even in the face of existing restrictions. It will be recalled that leaders of thought of widely differing shades of opinion have found it possible to participate in debates related to current controversy. No one is more keenly aware than we are of the desirability of an early removal of existing restrictions."

We should like the B.B.C. to state definitely exactly what restrictions have been imposed upon them, and if these restrictions have been given them publicly or whether the restrictions have been given to the Governors of the B.B.C. by the Postmaster-General in the form of private instructions.

When Mr. Guedalla asked for complete freedom of speech the B.B.C. had to refuse according, they said, with the terms of their licence. The Talks Director, Miss Matheson, wrote saying:

"It is common knowledge that periodically in the past four or five years the B.B.C. has made urgent representations that the frontiers of broadcasting should logically and in the general interest be extended to include controversial matter, treated with adequate safeguards for impartiality. A case in point was the representation to the Crawfurd Committee in 1925. So far, however, the Corporation operates under the same instruction as the Company (the old B.B.C.), viz. that it must refrain from the inclusion of industrial, political or religious controversy in matter broadcast."

"I understand you" (continues Miss Matheson in her letter to Mr. Guedalla) "to suggest that you might accept the restrictions but, in the course of your remarks, would comment adversely on the maintenance of these restrictions. I am sure, however, you will realise that the B.B.C. could scarcely be party to an arrangement of this nature."

Well, unless the B.B.C. take the initiative it is hard to imagine how, until the present Government goes out of power, we are going to get complete freedom for broadcasting. It is scandalous and disgraceful that such restrictions should be imposed upon a public service like broadcasting, which exists purely for the benefit of the public. The present Government seem to think that they can impose restrictions which the traditions of this country have always resented, none more than that which takes away the right of free speech.

This is not the place to enter into political arguments nor to express any political view, but it would seem to the impartial observer that a Government which interferes with a public right, such as is the right of free speech, is not likely to inspire the confidence of the electorate at the next General Election, nor are the present Governors of the B.B.C. likely to inspire confidence or respect when, without any campaign worth calling a campaign, or without any real and strenuous effort to combat an unjustified restriction, they meekly and mildly submit to a vague political fiat which even the Postmaster-General has never yet publicly worded as a definite order to the B.B.C.

One can only quote Mr. Shaw again by saying: "The whole thing is perfectly silly."

International Tests.

We understand that radio amateur transmitters will be holding a series of international tests dating from February 5th to February 18th, both days inclusive. These annual tests are much looked forward to among the transmitting amateurs in this country, and especially among the members of the American Radio Relay League. Although it is extremely difficult to obtain a transmitting licence these days—for the Post Office seem to delight in placing every obstacle in the way of the amateur who wishes to take out a transmitting licence—there are, nevertheless, a few thousand keen transmitting amateurs in this country, and this annual international test is, in more than one sense, their great field day.

These tests will be carried out in conjunction with the American Radio Relay League, which was established in order that long distance messages could be interchanged and relayed among amateurs.

It is understood that in this year's international tests an attempt will be made to relay messages round the world. The 25-metre wave has already proved the best for day-time working, and the waves from 35 to 95 metres for working when both transmitter and receiver are situated in the dark zone—that is to say when it is dark at both transmitting and receiving end.

Breakdown Figures.

Some interesting statistics have been released by the B.B.C. regarding the working of the stations during 1927. Altogether the B.B.C. stations during 1927 had 65,299 hours of programme time, and the time lost through breakdowns was only ·03 per cent—an infinitesimal amount. This works out that a total loss of time incurred by twenty stations—disregarding 5 G B—was roughly nineteen hours throughout the whole of 1927.

In 1925 the breakdown percentage was ·09, and in 1926 it was ·07, so it will be seen that the record of technical efficiency improves as the years go by.

Daventry, 5 X X, seems to have been the hardest worked station, for it broadcast 4,972 hours during 1927, and was only out of action for ·07 per cent of the time, or approximately three and a half hours.

The next station as regards hard work was 2 L O, which broadcast for 3,562 hours, roughly a weekly average of sixty-eight hours. The breakdown factor was ·02 per cent of the time, or roughly forty-two minutes. In 1926 2 L O's breakdown percentage was nearly ten times as much, i.e. ·22 per cent.

The "ECONOMY" FIVE

A magnificent long-range loud-speaker receiver of modern design, that, as its name suggests, is cheap and simple to assemble and easy to operate. A 6d. Blue Print of this set was one of four presented free to readers last week.

Designed, Built, and Described by the "P.W." Research and Construction Department.

A REAL "distance-getter" in the shape of an up-to-date H.F. receiver is a very attractive proposition. This is more especially so when it is remembered that such a set, backed up by a couple of well-designed L.F. stages, will receive practically everything "on the air" worth listening to, at full loud-speaker strength.

There is a fascination about such a receiver that no other class of set seems to possess. Possibly the knowledge that on an occasion a turn of the dials may bring in the voice of an announcer speaking six or seven thousand miles distant has some bearing on this effect

In any case, it is an undisputed fact that the ideal receiver for the long-distance enthusiast is a "Straight Five" incorporating two "live" H.F stages. The "Economy" Five is a set fulfilling these requirements In addition, it has a further very important feature; it is cheap to build. Most five-valvers designed for long-distance work require elaborate screening, or other precautions, in order to obtain maximum liveliness combined with stability.

The "Economy" Five, however, has been very carefully laid out with a view to obtaining these vital characteristics with the minimum of shielding. This, together with the fact that the design has been worked out to employ the smallest possible number of components, brings the receiver within the reach of those whose pockets are not large enough for them to contemplate the construction of the more elaborate and costly designs.

A Well-Tried Circuit.

The circuit employed is a well-tried arrangement consisting of two split-primary, neutralised H.F. stages, followed by a grid-leak detector, a resistance-coupled valve, and lastly a transformer stage.

This is a circuit which experience has shown gives the best all-round results from the point of view of sensitiveness, selectivity, and purity. The H.F transformers and leads have been spaced out so that, with the aid of two simple metal static screens, a perfectly stable receiver results.

Before commencing with the constructional details, it may be as well to say a few words about one or two of the special features in the set. There is, for instance, a variable resistance marked R_1 in the diagram, and mounted on the panel just beneath the reaction condenser. This is for the purpose of controlling the volume. The resistance may have a value of 15–30 ohms, and should be capable of carrying the current for the two H.F. valves. By dimming the filaments a cheap and effective control of strength is obtained. The use of a control of this type on the H.F. side is a good scheme, because one is able to prevent overloading of the detector valve on very loud signals, an important point when receiving the local station

Maximum Selectivity.

The aerial circuit employs two ordinary plug-in coils, hence various degrees of selectivity can be obtained by changing the size of the primary coil. Maximum selectivity is possible if the aerial lead is connected direct to terminal A_1, thus bringing a ·0002 mfd. fixed condenser in series between the aerial and the primary coil.

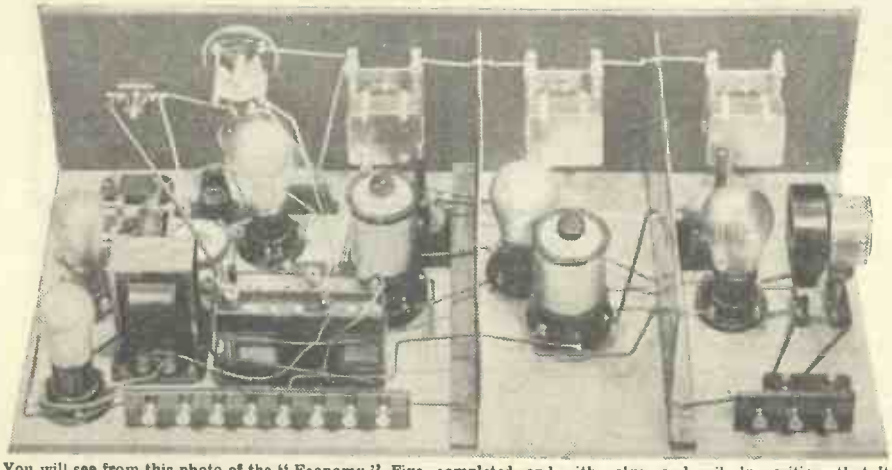
Great care has also been taken to keep H.F. currents out of the L.F. stages by the insertion of a ·25-meg. grid leak between the grid condenser C_{10} and the grid of the fourth valve.

Constructional Details.

Let us now turn to the actual constructional details. In making a set of this type it is necessary to take considerable care in laying out the various components on the H.F. side, and this applies as well to the spacing of the leads. It would be fatal to attempt to construct a receiver such as the "Economy" Five in a smaller space than that chosen, viz., 26 in. by 12 in. If the parts were placed any closer together the result would almost certainly be hopeless instability.

To start with, you will require the 26 in. by 7 in. panel and 26 in. by 12 in. baseboard. Commence operations by marking out the panel ready for drilling. You will need a steel rule and a scriber, or any piece of steel with a sharp point. Mark out the positions for the three variable condensers, the reaction control, filament

(*Continued on next page.*)



You will see from this photo of the "Economy" Five, completed and with valves and coils in position, that it has been designed so that the lay-out is simple and the assembly within the scope of anyone who can handle a few most ordinary tools, such as a screwdriver, pliers, and so on.

THE "ECONOMY" FIVE.

(Continued from previous page.)

rheostat, and L.T. switch. The latter is placed just above the centre line of the panel, but this is not particularly important. It is merely a question of appearance.

The three tuning condensers, you will note, are placed just above the centre line, and the holes for the spindles are 3¼ in. from the top edge of the panel. Don't forget to do your marking out on the back and not the front of the panel.

When you have located the drilling centres, mark them by giving a small centre-punch a sharp tap with a hammer or mallet.

Mounting the Screens.

If you consider it desirable to use two angle-brackets to take the weight of the baseboard, you can drill the holes for these after you have placed the panel in position against the baseboard.

You will, of course, need four or five holes along the bottom of the panel, and about $\frac{3}{16}$ in. from the lower edge, in order to secure it to the baseboard.

Having drilled the panel and screwed it to the baseboard, you can now mount the condensers, switch and filament rheostat in position.

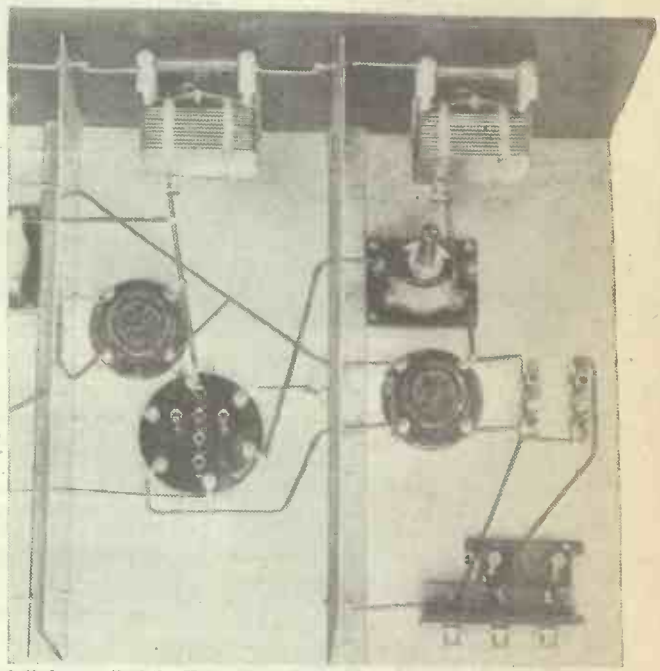
The next procedure is to screw the two copper screens to the baseboard. These are simply two pieces of thin sheet copper, size 12 in. by 6 in. They are fixed in position with the aid of two wooden strips. Each batten is fastened to its screen with four wood screws, and screws are also passed through the strip to the baseboard. Another scheme would be to bend the lower edge of each screen at right angles, and then to screw each shield direct to the baseboard.

The first screen is placed 6½ in. from the right-hand edge of the baseboard (looking at the back of panel), and the second screen is approximately 5½ in. from the first. Fasten the screens down, and then start laying out the components. Try to keep them in the positions shown in the diagram and photographs.

On the L.F. side be sure to leave sufficient space for the 9-volt grid-bias batteries. Screw down the components, and mount the two terminal strips, and the set is ready for wiring. You will see that certain leads have to pass through the holes in the copper partitions. Well, then, mark off the positions for these holes with a pencil, remove the screens and drill them, making your holes sufficiently large to prevent the sharp edges from injuring the insulation covering on the leads which have to pass through these holes.

The easiest method of ensuring adequate insulation is, probably, to use 16- or 18-gauge tinned copper wire and to place over each short length, where it passes

(Continued on page 1211.)



A "close-up" of the H.F. end of the receiver, showing the simple screening. Note the ample space allowed for these H.F. components and wiring. You should adhere very closely to specification at this end of the set.

POINT-TO-POINT CONNECTIONS.

One filament socket of V_1 to one filament socket of V_2, and to one side of the rheostat on panel.

Other side of rheostat to one tag on the L.T. on-off switch, to one side of the baseboard rheostat R_2, and to one filament socket of each of the valve holders V_4 and V_5.

Remaining side of R_2 to nearest filament socket of V_3 and to one tag of the detector valve 2-meg. grid-leak holder.

Remaining side of the L.T. on-off switch to the L.T. + terminal.

Earth terminal to a screw through the first copper screen, to the plugs on both the primary and secondary aerial coil holders and to the remaining filament socket of V_1.

Remaining filament socket of V_2 to a screw through the second copper screen. Opposite side of screw on the other side of copper screen to the No. 2 terminal on the 2nd H.F. transformer holder.

H.T. — to L.T. — terminal, to a screw through the second copper screen, to the remaining filament sockets of the valve holders V_4 and V_5, and G.B. +.

Right hand "frame" terminal on the variable condenser C_3 (·0005 mfd.) to a screw through the second copper screen facing the terminal.

Left hand "frame" terminal (these terminals are common to the moving vanes of the condenser) to the earthing plate terminal on the ·0001 midget condenser C_9 and to the remaining filament socket of V_3.

Left and right hand "frame" terminals on the variable condenser C_2 (·0005 mfd.) and left hand of C_1 to screws through the nearest copper screens.

No. 2 terminal on the 1st H.F. transformer holder to a screw through the first copper screen.

A_1 aerial terminal to one side of the ·0002 fixed condenser C_6.

Other side of C_6 to the A_2 aerial terminal and to the socket of the primary aerial coil holder.

Socket of secondary aerial coil holder to the grid of V_1, to the fixed vanes of the neutralising condenser C_1 and to the fixed vanes terminal on the variable condenser C_1 (·0005).

Moving vanes of the neutralising condenser C_1 to the No. 3 terminal on the 1st H.F. transformer holder.

No. 5 terminal on same holder to the plate of V_1.

No. 1 terminal on the 1st H.F. transformer holder to the grid of V_2, to the fixed vanes terminal on the variable condenser C_2 (·0005), and to the fixed vanes of the neutralising condenser C_5.

Moving vanes of the neutralising condenser C_5 to the No. 3 terminal on the 2nd H.F. transformer.

No. 5 terminal on same holder to the plate of V_2.

No. 4 terminals on both the 1st and 2nd H.F. transformer holders joined together and to the H.T. + 1 terminal.

Grid of V_3 to one side of the ·0003-mfd. grid condenser C_7 and to the remaining side of the detector valve 2-meg. grid-leak holder.

Other side of the ·0003 fixed condenser C_7 to the No. 1 terminal on the 2nd H.F. transformer holder, and to the fixed vanes terminal on the variable condenser C_3 (·0005).

Moving vanes of the ·0001-mfd. variable condenser C_9 to the No. 6 terminal on the 2nd H.F. transformer holder.

Fixed vanes of the same condenser to one side of the ·001 fixed condenser C_8.

Other side of C_8 to the plate of V_3 and to one side of the H.F. choke.

Other side of H.F. choke to one side of the ·004 mfd. fixed condenser C_{10}, and to one side of the 250,000-ohm anode resistance.

Remaining side of anode resistance to the H.T. + 2 terminal.

Other side of the ·004 mfd. fixed condenser C_{10} to one side of the 2-meg. grid-leak holder R_4, and to one side of the ·25-meg. grid-leak holder R_3.

Other side of R_3 to the grid of V_4. Remaining side of R_4 to the G.B. — 1 plug via a flexible lead.

Plate of V_4 to the IP of the L.F. transformer.

OP to the H.T. + 3 terminal and to the L.S. + terminal.

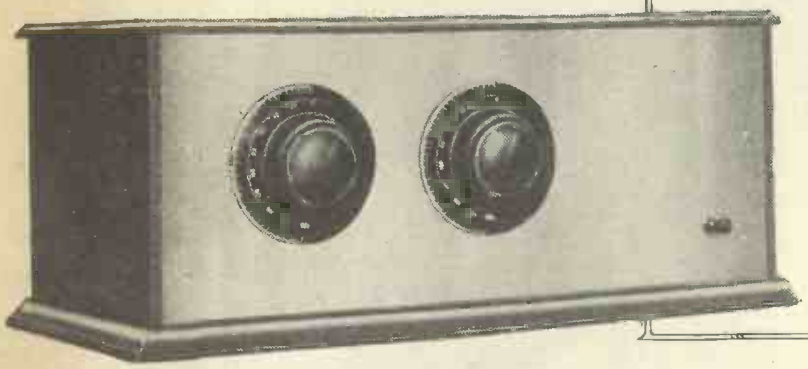
OS of the L.F. transformer to the grid of V_5.

IS to the G.B. — 2 plug, via a flexible lead.

Plate of V_5 to the L.S. — terminal.

IMPORTANT NOTE.

The L.T. — connection to the H.F. and detector valves is made via the metal frames of the ·0005 variable condensers. If condensers other than those specified are used, the "frame" terminals mentioned in the list of point-to-point connections should be taken to mean "moving vanes," and in the case of left and right hand "frame" terminals connecting to the nearest copper screens, a lead should be taken from one screen to the other and then to the moving vanes of the variable condenser.



MAKING THE MULLARD "MASTER THREE"

The Mullard "Master Three"—the Cossor "Melody Maker," and the Ediswan R.C. Threesome, are sets which everybody has heard about, and in the following article Mr. Dowding describes his actual adventures with the "Master Three." In future articles he will deal with the others, and constructors of these popular sets will pick up many "tips," and learn facts which they will find useful.—

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

HAVING built that popular receiver the Mullard "Master Three," I am going to chronicle my experiences more or less in detail, in the hope that the thousands of amateurs who already have constructed, or are contemplating the construction of this set, will find them of interest.

The popularity of the "Master Three" was assured before the Mullard people booked a single advertisement concerning it, for the simple reason that it is that type of set (as "P.W." has often demonstrated) which answers the requirements of the majority of listeners. It will give reasonably powerful and pure loud-speaker reception under average conditions from, at the very least, six broadcasting stations; it is easy to build and to operate, and, finally, its initial cost and cost of upkeep have been reduced to the barest minimums compatible with a high order of general efficiency.

An Excellent Circuit.

The circuit is an excellent arrangement of three valves. Critically examining the theoretical diagram shown in the December, 1927, issue of "Radio for the Million," I think I can say with all honesty that there is not a single alteration I would wish to make.

The gifts of a copy of the above useful book, a full-sized blue print, *and* a packet of connecting leads are splendid, and place the constructor well and truly on the road to a loudly operating loud speaker. Now I am going to take it for granted that you have these before you, and if I cannot tell you anything else, I can at least explain that the job of construction is just as easy as the makers claim. That it is not one of our own designs does not worry me at all. The more sets, whatever their origins, that are built, the more popular radio home construction is going to be, providing they are all good sets—and the "Master Three" well deserves to come within this category. And, anyway, every budding enthusiast who has built at home with his own hands at least one good set is half-way towards qualifying as a "P.W." Valve Baronet (watch "Ariel's" "Notes and News" for the latest "Radio Honours Lists"!).

An Important Point.

Now, obviously the first thing one has to do is to collect together all the necessary components. To be fair to the designers, and to ensure success, *you must adhere to the list of specified components.* Variations from this may be fatal. A metal panel, for instance, is not specified because the designers think a metal panel looks pretty. It certainly has a comely appearance, but it also performs definite electrical tasks in the "Master Three." Not only does it act as a shield to the variable condensers, but it also enables the total number of connecting leads required very considerably to be reduced, by acting itself as one large lead common to a number of connections.

The Colvern metal panel must be handled fairly carefully, otherwise its black surface is liable to get scratched. Most of the time during the preliminary operations I kept it face downwards on a sheet of newspaper.

A Slight Hitch!

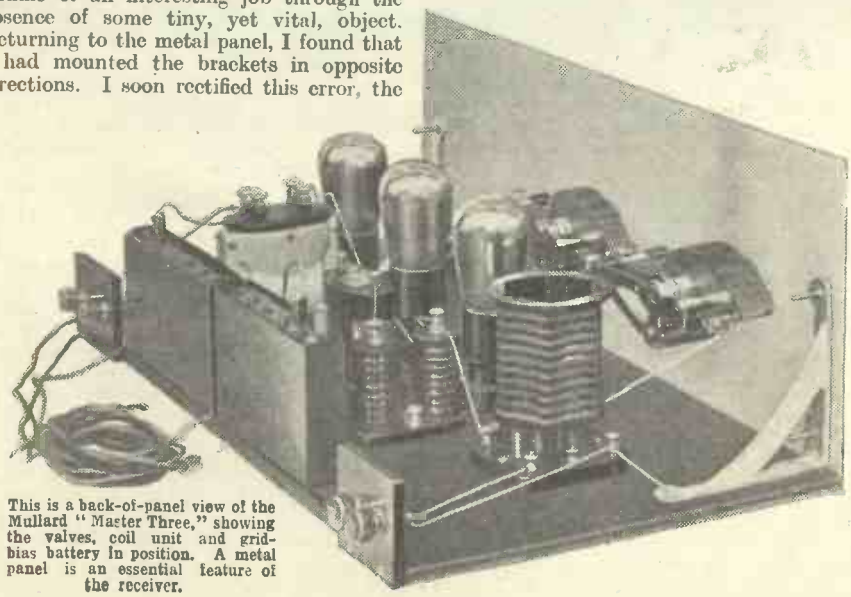
At this juncture I carefully checked my pile of components and materials, including such items as screws, for nothing annoys me more than to be held up right in the middle of an interesting job through the absence of some tiny, yet vital, object. Returning to the metal panel, I found that I had mounted the brackets in opposite directions. I soon rectified this error, the cause of which was a wandering of thoughts on the subject of "Simple mistakes I have made," and fixed the panel securely to the baseboard.

Securing the variable condensers to the panel occupied a matter of seconds, but I screwed up the centre fixing nuts as hard as I could, making them bite right into the aluminium. The "on-off" switch received similar attention. By the way, it is important to note that the metal part of this device must make good contact with the metal panel. A vital connection between the L.T. battery and "earth" is made from this switch through the metal panel. If I had used a switch which had a nice little ebonite bush, or was so designed that neither of its two terminals was connected to the metal panel, I wouldn't have expected the set to work.

Mounting the Components.

I was agreeably surprised by the ample room allowed on the baseboard for the components. Getting them in the positions illustrated by the full-size blue print was the work of seconds. Although I did not take the trouble to place them exactly as shown to the fraction of an inch, I made certain that I had extremely close approximations. Moreover, I saw that the valve holders, transformer, coil base, and so forth were *the right way round.* "1," "6," and "5" of the coil base are shown as being to the left (looking at the back of the panel), and I ascertained that it was so with my coil

(Continued on next page.)



This is a back-of-panel view of the Mullard "Master Three," showing the valves, coil unit and grid-bias battery in position. A metal panel is an essential feature of the receiver.

MAKING THE MULLARD "MASTER THREE."

(Continued from previous page.)

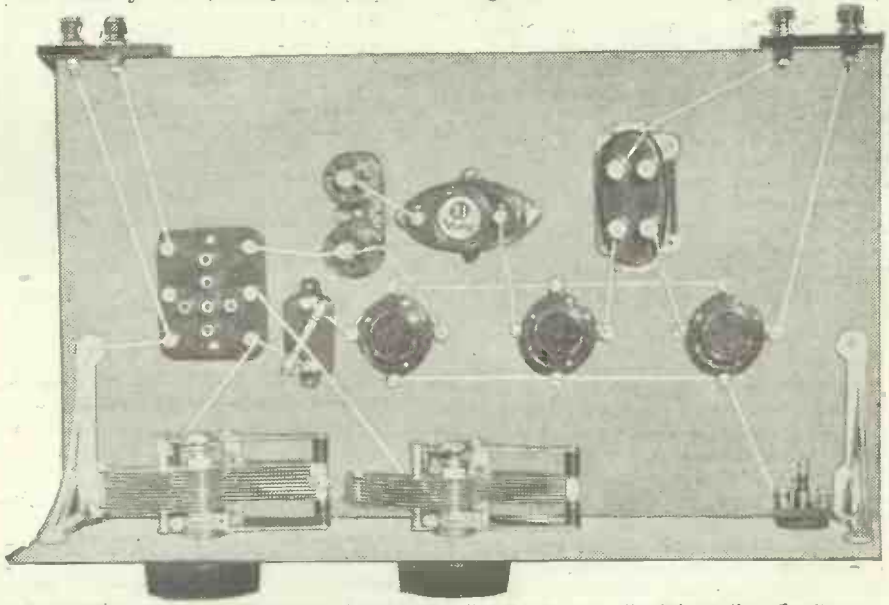
base. And so with all the other things, I checked their positions before screwing them down with ⅜ in. brass screws.

After screwing on the two terminal strips which I obtained complete with terminals, I commenced using the "backsheesh" bunch of leads. I carefully followed the "Key to Wires" list (how could anybody go wrong with such clear directions?), ticking off with a pencil each lead number as the appropriate lead was securely anchored. I tightened the various terminals with moderate force, not forgetting that too much power on such a task might mean the stripping of threads.

Point to Watch.

I made certain that each of the single leads to the variable condensers went to its right terminal. There is a tiny snag here of which constructors must beware. The leads "6" and "10" must go to those terminals on the variable condenser *not in direct metallic contact with the metal panel.* They must connect up with the fixed vanes of the variable condensers.

Subsequently to cutting and fixing the seven battery leads, I screwed on the two condenser dials. I arranged these so that when the vanes of each were fully meshed the 180 on each dial was nearest to the top of the panel. With a sharp-pointed bradawl I scratched two tiny lines on the black panel surface close to these 180's so that I could take dial readings.



A "bird's-eye" view of the Mullard "Master Three." Note the connection between the coil unit base and the bracket supporting the metal panel. This latter acts as a common connection to terminals of the variable condensers and "on-off" switch.

The Set Completed.

Then—but at that moment I realised, with quite a start, that there was nothing more to do. The set was complete and all ready to tap the vibrating ether. For one of the few times in my life I had placed myself absolutely in the position of a home constructor. I had built a radio set, implicitly following somebody else's instructions. And I had enjoyed it! I was not to revel in the thrill of a first exploration with fumbling fingers into the black night filled with music, but I could claim for that occasion a very goodly share of that thrill of achievement only to be experienced by the radio-set builder.

What was my first set? Thinking hard, I seem to remember a crude contraption of mainly wood and wire. 1911, I think it was. First ether noises heard? Morse time signals from Eiffel Tower, Paris! Wonderful enough, too, and it was a trembling hand that adjusted the clumsy silicon and steel detector. But dance music, brass bands, voices! These are the ether marvels for the new constructor of 1928. I must plead guilty to a great big slice of envy!

I needn't say much about connecting up the "Master Three" to the various batteries; there are very full instructions given on the blue print construction chart. I decided to use a 2-volt accumulator, as 2-volt valves are more popular than 6-volters owing to their L.T. economy. But I do like a super-power in the last stage of a three-valver, so I inserted a P.M. 252 in the V3 position and applied 120 volts H.T. A minimum voltage for this valve, by the way. The P.M. 252 needed 15 volts grid bias.

The Aerial Used.

The aerial available is what is described as "an average type." It is about 75 ft. long, runs from a 25-ft. pole to a well-insulated lead-in at one of the upper windows of the house. The lead-in is kept well away from the wall. The "earth" is the main water-pipe in the bathroom, and to this a 10-ft. copper wire of stout dimensions travels.

The moment I switched on—nothing happened. The "Master Three" has, as I have already indicated, quite a useful degree of selectivity, and it so happened that its tuning did not coincide with any particular station at that moment. But it did not take long to find 2 L O. This lusty "local" came in with a splendid roar. On a P.M. speaker the volume was adequate for the rather large room, the quality of reproduction being all that a listener could desire. 5 G B was equally well in evidence, while Langenberg was sufficiently robust to provide an alternative programme of pleasing orchestral items. Slightly lower down on the dial I found Frankfurt, who came along in a remarkably lively fashion. Three or four other Germans could be clearly heard on the speaker, as also could Toulouse. This was all with only the gentlest use of reaction.

General Hints.

I was not surprised by the ready manner in which the set demonstrated its ability to produce good music, for, as I have said, it is a straightforward and efficient design. A "howling instability" would have been due to a failure in that part of the circuit formed by the metal panel. Providing lead number "9" is well and truly connected, and that the variable condenser and the "on-off" switch make their contacts with the metal panel there is very little else that could go wrong.

One must make sure that the coil unit is firmly in position, and that its pins are all making contact with the sockets in the base and that each valve is doing likewise. There is, of course, always the possibility that one may strike a faulty component, but this is, nowadays, not a frequent occurrence. Should the moving vanes of the J.B. variables, which are being supplied with kits of parts for the "Master Three," tend to fall owing to looseness, they can be tightened by means of the ingenious friction devices incorporated in their movements. There is a small round-headed screw on each which takes up the pressure applied to the spindle by a small collar.

In conclusion, I cannot say more than that I consider the "Master Three" an excellent receiver and one that should give the constructor every satisfaction. It is very easy to assemble from the clear instructions provided, and it is very easy to operate. If it should not prove sufficiently selective to cut the local station out within the shadow of this worthy's aerial, that simple and very inexpensive "P.W." Standard Wave Trap will solve the problem (see the "Radiotorial" columns).

DO YOU KNOW THAT....

The length of wire used in a low-frequency transformer is sometimes as much as two miles?

* * *

Radio high-frequency currents flow only on the outside surface of a conductor and not at all in the interior?

* * *

It is estimated that the conductive skin which is active in high-frequency wiring is never more than one two-thousand-five-hundredth of an inch in thickness?

* * *

The great maritime nations of the world maintain a squadron of ships patrolling the Atlantic on the watch for icebergs, and twice a day these ships broadcast the position of all the icebergs they have observed.

* * *

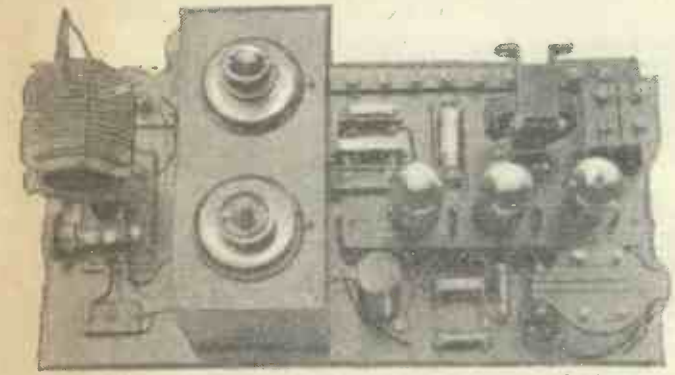
When drilling through thin metal, such as a condenser vane, the seizing of the drill which often occurs when it emerges may easily be prevented by backing the metal against a piece of very hard wood.

The Construction of Short-Wave Coils

A few useful hints with practical illustrations.

By G. H. LEVERSEDGE.

MORE and more victims are being claimed every week by the short-wave "disease." When one sees a wireless enthusiast struggling with that diabolical material, No. 16 hard-drawn copper wire, one knows that the epidemic has claimed another victim. Perhaps the following hints will be of use to those who are passing through this stage. It is not intended to give particulars of the number of turns required (these vary widely in different circumstances and details have already appeared in this journal), but to suggest one or two ways in which the work of making a short-wave tuning coil can be simplified.



Here is a complete short-wave outfit made up by the author, and using one of the coils he describes in the accompanying article.

A very effective tuning coil for use for the higher frequencies can be constructed by winding the requisite number of turns of the above-mentioned No. 16 hard-drawn copper wire on a "Becol" or similar pattern ebonite former, of about 3-in. diameter. The wire, which should be free from sharp bends or kinks, should be wound on a mandrel about 2¼ in. diameter.

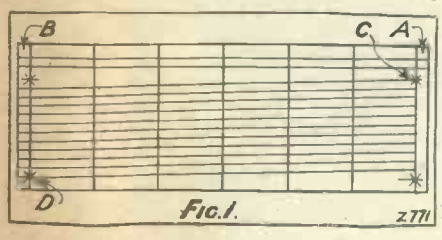


FIG. 1.

The winding should be in an *anti-clockwise* direction for reasons to be stated later, and as it is difficult to do the winding evenly unless a lathe is available, it will be well to make friends with some motor repairer or other possessor of one of these useful tools if you can. The wire will, of course, spring out to a larger diameter when released, but it should not be larger than 2¾ in., and may with advantage be a little less, say 2½ in.

Having obtained the coil with a few more turns than will actually be required, the next thing is to mark on the edges of the projecting "fins" on the ebonite former where slots are to be cut to hold the wire in position. For this purpose a paper template, as shown in Figs. 1 and 2, will be found very useful unless a screw-cutting lathe is available. Otherwise it will be found almost impossible to measure the positions of the slots, and if a mistake is made a "drunken"-looking helix will be produced when the wire is put in position.

Figs. 1 and 2 are almost self-explanatory. A paper strip is wrapped tightly round the former and cut off square at each end leaving a narrow strip for gumming. The crease where the paper passes over the edge of each fin should be marked, particularly that fin where the paper overlaps, giving, of course, a crease at both ends of the strip.

Marking the Former.

This particular fin should also be given a distinguishing mark, as the coil will start and finish here. Now, take the paper template off, flatten out, and mark out as in Fig. 1. The two parallel lines at the top are for the reaction slot, and the sloping lines produce a helical line round the former when the paper is gummed in position as shown in Fig. 2.

A small notch can be made with a fine triangular file, cutting through the paper and marking the ebonite at each place where the line passes over the edge of a fin. The paper being removed, the slots can be cut to the required depth.

Having got the slots cut the next thing is to get the wire in position. The reader may have noticed, when the paper template was in position on the former, that, although an *anti-clockwise* direction of winding was specified for the bare wire coil, the line on the former is in a *clockwise* direction. This is an intentional "mistake"! And is arranged to simplify the job of getting the wire into position on the former without getting it kinked.

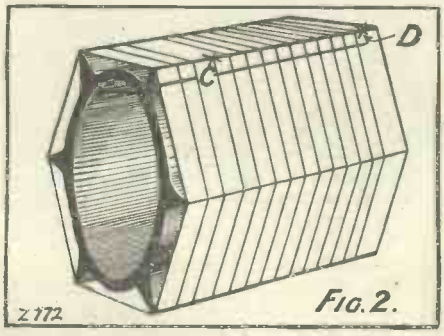


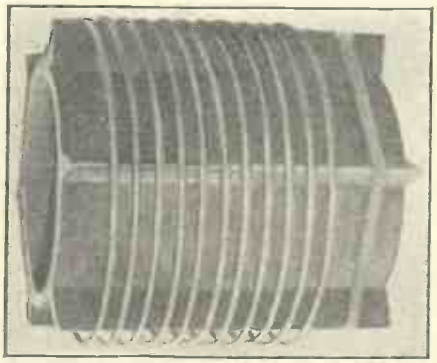
FIG. 2.

Bend a short piece at the end of the coil inwards towards the centre, and place the wire in the first slot "C," Fig. 2. Now gently spring the wire into each successive slot in a clockwise direction, taking care not to put any permanent sets in the wire.

Perfect Shape Assured.

The second turn must be passed over the top of the first, and subsequent turns passed over the preceding ones until all the slots are full. The spare wire can then be cut off, and a short piece bent down as at the commencement. The reader will now see that the anti-clockwise coil has been reversed.

This method of construction obviates the necessity of passing the wire over empty slots, and the danger of pulling the coil out of shape.



A short-wave coil constructed on the lines of those described in this article.

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

TRIMMING RADIO PANELS

CUTTING TUBES—A CONVENIENT HOLDER—THE HOME-MADE CONE.

Trimming Radio Panels.

I GAVE in these "Notes" a week or two back some hints with regard to the trimming of ebonite panels. Several readers have sent me suggestions for further hints in this connection, and in many cases have described their now special methods or workshop "dodges." I forgot to say that since an ebonite panel is usually rather large for holding in a metal-working vice, a carpenter's wood vice is more convenient.

Although the wood of the vice is softer than the ebonite, it is still desirable to cover the jaws of the vice with felt or thick wads of paper, because there may be particles of grit or other hard materials embedded in the wood from previous use, and these may damage or destroy the polished surface of a panel. Care should also be taken with the jaws of the vice to see that they are more or less accurately opposite to one another and that, when the vice is tightened up, the lower part of the panel is not driven hard against some other part of the vice or against the bench, as if so it is very easy to fracture the panel completely. Carpenters' vices are, as a rule, apt to be rather clumsy affairs as compared with metal-working vices, and therefore you should examine carefully the working of the wood vice, and the manner in which the panel is held, before pulling up tightly.

Cutting Tubes.

In this connection, it is often necessary for constructors to cut or file metal or ebonite tube. It is not easy to hold tube in an ordinary vice, unless special jaws are provided, but the difficulty can be got over by making a pair of wood jaws to suit different diameters of tube. All you need do is to take two small wood blocks, which may be, say, 2 in. × 3 in. × 1 in., and screw them together with the 2 in. × 3 in. faces in contact, making a block 2 in. × 2 in. × 3 in.

Placing the combined block in such a position that the interface (that is, the two faces which are in contact) is vertical, a number of holes should then be drilled at right angles to the top face, these holes being carried right through the combined block. The diameters of the different holes may very roughly correspond to the diameters of tubes which you commonly use.

Convenient diameters, for instance, would be ¼ in., ½ in. and 1 in. Of course, the diameters do not need to be the same as the diameters of the tubes which are to be gripped, and a hole of a given diameter will serve for gripping tubes varying quite considerably from that diameter.

A Convenient Holder.

After the holes have been drilled the two parts of the block are unscrewed and taken apart. There will then be a series of semi-cylindrical grooves in each of the two blocks, so that when the two blocks are placed together the grooves register with one another. The two blocks need not be attached together, but it is convenient to hinge them so that they resemble the jaws of a pair of gas-pliers.

Very little further explanation is needed. You will see that when you wish to grip any piece or rod in the vice, you simply clip on these wood jaws to the tube or rod, selecting the pair of grooves which most nearly fit the work, and then place the whole in the vice. It is better to select grooves of *larger* diameter than the work as, if you insert the work into grooves of rather *smaller* diameter, you may find that either the work is damaged when you pull up the vice or the wood jaws are split.

It is not only the voltage of a battery that falls from a maximum to a minimum as the cell becomes discharged. The "weight," or specific gravity, of the liquid also falls, in exact accordance with the state of the battery. It can be measured by a hydrometer, as shown above, the liquid being drawn up into a glass tube in which "floats" are placed. By noting which of these sink and which swim in the liquid, an exact indication of the battery's condition is obtainable.

The Home-Made Cone.

Before the advent of the cone loud speaker, when the trumpet or horn-type practically held the field, there was not much encouragement for the experimenter or constructor to make his own loud speaker. In fact, the loud speaker was regarded as one of the few parts of the wireless outfit which did not come within the purview of the constructor's art.

It is true that more recently the parts for making up horn-type loud speakers have been put on the market, but the home-made horn speaker is never quite the same thing as the commercial article.

With the cone loud speaker, however, the position is entirely different, and this very useful and efficient reproducer is peculiarly adapted for home construction. In fact, the readiness with which efficient and attractive loud speakers may be made by the experimenter has been a source of no little anxiety to the manufacturers. They have, however, wisely met the situation by providing the parts for the home construction of cone loud speakers, and have thereby no doubt turned the position to good business account.

Easily Assembled.

One of the latest loud speakers to be supplied in parts for assembly is the

(*Continued on page* 1216.)

NEWS FROM SAVOY HILL. FROM OUR OWN CORRESPONDENTS.

NEW BROADCAST OPERA

MR. LLOYD GEORGE—THE LEICESTER BAND FESTIVAL—PRAISE FOR CARDIFF—5 G B AND THE CHILDREN.

New Broadcast Opera.

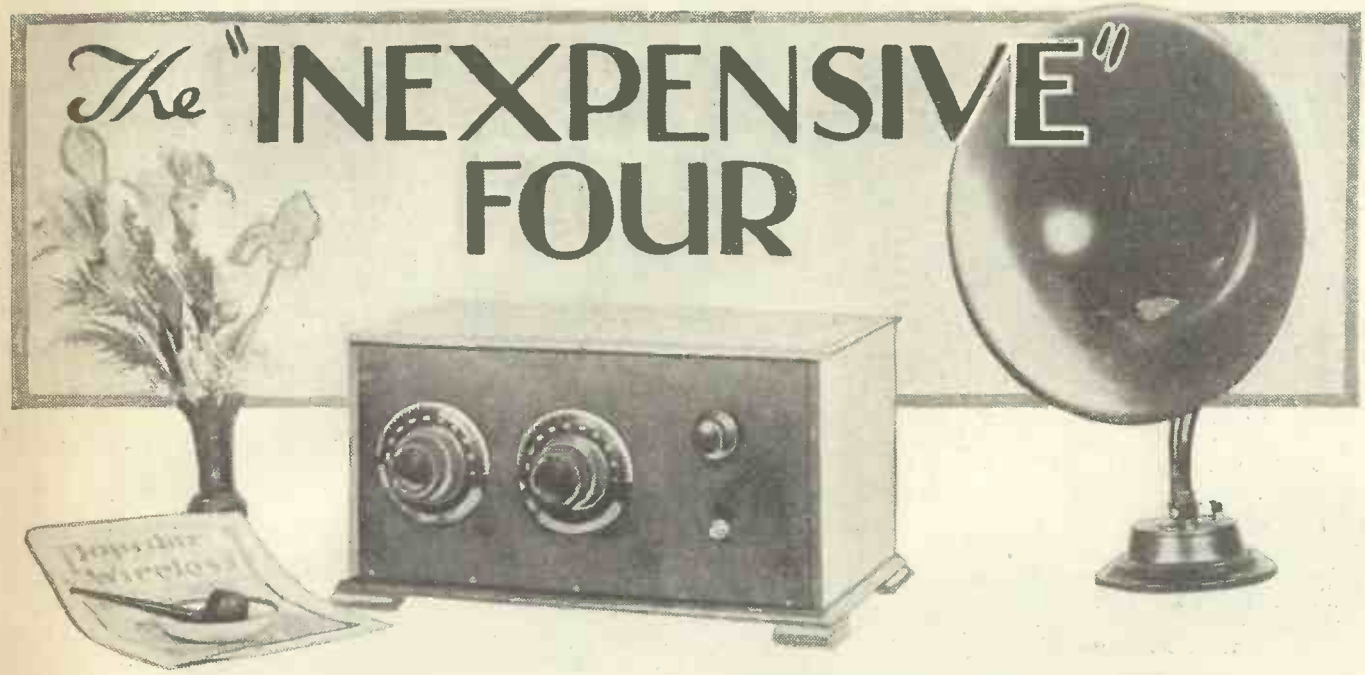
THE first broadcast performance of Berlioz' only oratorio, "The Childhood of Christ," will be given by the Birmingham Studio Orchestra and Chorus and radiated from 5 G B on Sunday evening, February 12th. The work, which is based on legends akin to our own folklore, was regarded with special affection by its author, who wrote both the words and music. Its chief characteristics are a devotional intensity, freedom from complexity and an exquisite simplicity, which is not altogether typical of the composer's other works. It was introduced to this country by the late Sir Charles Hallé in Manchester in 1880, twenty-six years after it had received its first performance in Paris. The afternoon concert on the same day will also be given from the Birmingham Studio, the soloists being Wynne Ajello (soprano), Gladys Palmer (contralto), Margaret M. Kennedy (recitals), Appleton Moore (baritone), and Harold Mills (the musical director of the Birmingham Repertory Theatre) in violin solos.

Sir Henry Wood in Belfast.

Sir Henry J. Wood is visiting Belfast on Tuesday, February 14th, to conduct a Symphony Concert in the Ulster Hall, when the Station Symphony Orchestra will be augmented to 80 performers. The programme includes Liszt's "Les Preludes" and Beethoven's "Eroica Symphony."

(*Continued on page* 1212.)

The "INEXPENSIVE" FOUR



HAVE you ever wanted a four-valve set which, although it would only cost you a few pounds to construct, would enable you to bring in a dozen or more stations on the loud speaker and many more on telephones?

I have a feeling that some of my readers will say, "Yes, but a three-valver will do all this. Why use four valves?"

The reply is that with the larger receiver you will get your dozen or more stations at greater strength and more consistently than you would with the smaller set. The four-valver will give full-room strength on stations that with three valves would only be comfortably audible on the speaker.

This is a description of one of the efficient, cheap-to-build, and easy-to-make long-range loud-speaker receivers, of which a 6d. Blue Print was presented to readers last week. By the "P.W." Research and Construction Department.

You Don't Want Distortion.

In addition, suppose you are 25 miles or more from one of the B.B.C. main stations, or 150 miles from Daventry (5 X X).

You will not like it if you have to "boost" up your signals with reaction, to the detriment of purity. Your nearest B.B.C. station is the one you will wish to listen to the greater part of the time, and, while a little distortion is probably inseparable from the more distant transmissions, it is intolerable on the local.

The circuit of the "Inexpensive" Four-Valver is what is sometimes called a "straight" circuit. It is a conventional and well-tried arrangement. It is one of those circuits which cannot help giving good results provided it is hooked up correctly.

Pure and Powerful.

The first valve is a high-frequency amplifier and gives you range. It is neutralised, and so the receiver will not interfere with neighbouring sets when too much reaction is used. Then comes the detector, and lastly a couple of L.F. valves for magnifying the detected signals. These last two stages are arranged so as to give high-quality reproduction with maximum amplification.

I will now describe the construction of the receiver. The panel dimensions are given on the blue print.

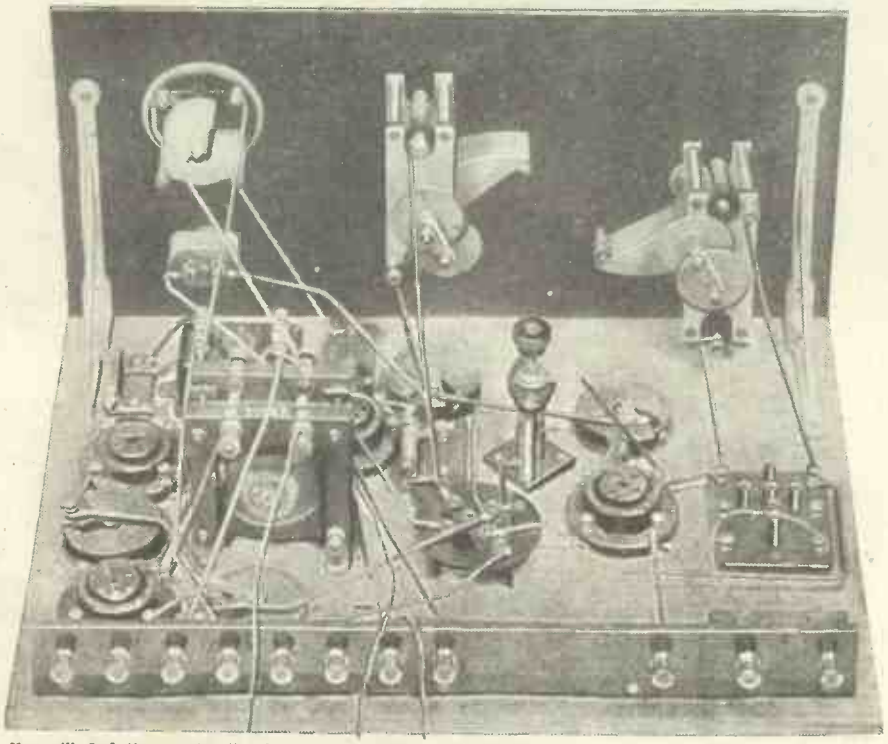
You will see that there are four main holes. On the left front of the panel are two variable condensers.

That on the extreme left is for tuning the aerial circuit, and the other tunes the detector-grid circuit. To the right of this is the reaction condenser, which is really a strength control, since by increasing its value louder signals can be obtained. Below this knob is the "on-off" switch to enable the set to be switched off when it is desired.

Drilling the Panel.

It is usual to drill the panel first. Do your marking out on the back, remembering that the positions of the holes when working on the back of the panel will be reversed. That is to say, the reaction condenser and filament "on-off" switch will be on your left. You can use one drill for all four main holes provided you chose single-hole fixing condensers.

(Continued on next page).



You will find the constructional work even more easy if you have this photograph before you while you are building the set.

THE "INEXPENSIVE." FOUR

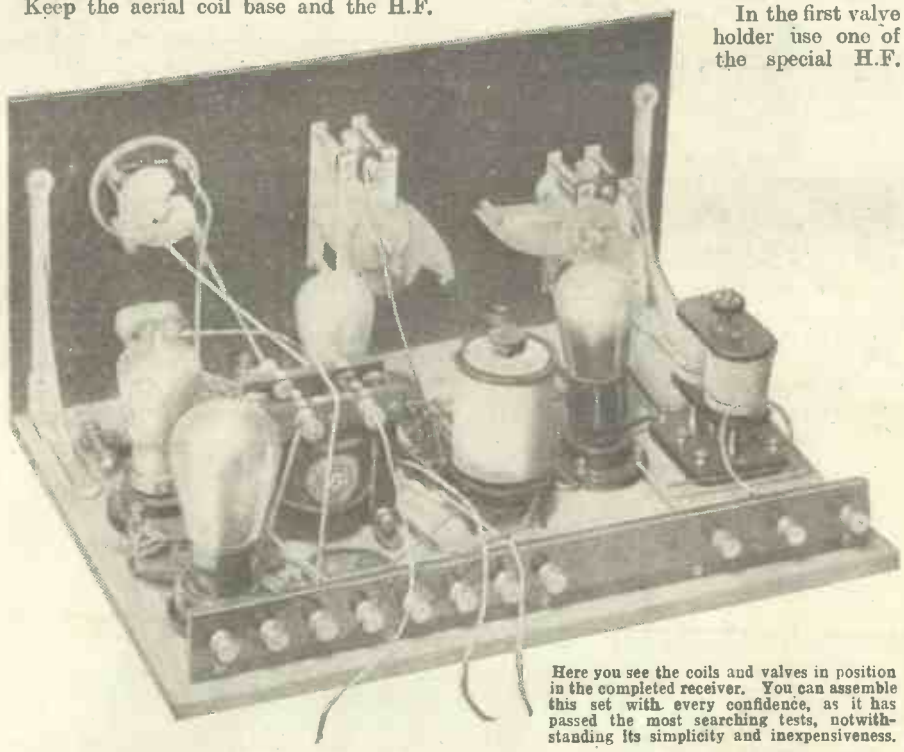
(Continued from previous page.)

A ⅜-in. twist drill is the correct size. Along the bottom edge of the panel, about ⅝ in. up, you will need five small holes, preferably countersunk, to secure the panel to the baseboard.

Then there are two holes for the angle brackets to support the baseboard. Incidentally you can purchase a countersink in any tool shop for about ninepence. Now screw the panel to the baseboard and start placing the components in position on the board. Follow as accurately as possible the lay-out shown on the blue print and in the photographs.

This is rather important, because the positions for the various components have been very carefully worked out, and although a slight deviation will not much matter, it is best to adhere to the general scheme as shown.

Keep the aerial coil base and the H.F. transformer base well separated, placing the neutralising condenser near the latter and the H.F. valve holder between the two bases.



Here you see the coils and valves in position in the completed receiver. You can assemble this set with every confidence, as it has passed the most searching tests, notwithstanding its simplicity and inexpensiveness.

A Useful Hint.

When you place the valve holders in position, make sure that there will be adequate clearance for the valve itself. Don't arrange the components in such a way that the valve, when inserted, fouls one of the variable condensers or the L.F. transformer. This hint may seem to be unnecessary, but I have made this mistake in the past when laying out a set, and it is very annoying to find that after you have completed the wiring it is necessary to rearrange things because one of the valves cannot be inserted properly.

The terminal strip along the back of the baseboard has its battery terminals spaced about an inch apart, and the aerial and earth terminals one inch and a half.

When Care Is Needed.

You will see from the photographs that each wire has been taken to its respective tag or terminal by the shortest route. The wiring diagram will not show this so well, because the draughtsman has had to alter the spacing a little for clearness, and in addition some of the wires in the drawing look longer than they actually are. If you haven't had a great deal of experience at wiring up sets your safest plan will be to buy some 18-gauge tinned copper wire (a ¼-lb. reel) and a number of lengths of Systoflex covering. After pulling the wire straight, measure out the various lengths required, and then slide the Systoflex covering on. Leave a short length of wire projecting at each end for soldering purposes.

Testing The Receiver.

Place a binocular type aerial coil in the aerial socket and one of the standard split-primary H.F. transformers in the second coil base.

In the first valve holder use one of the special H.F. type valves and in the detector socket a similar valve or one of the special R.C. type.

The first L.F. valve may be of the general purpose or H.F. type if you require maximum signal strength. In the last socket a small power valve should be used.

Using a 120-volt H.T. battery, apply these voltages in the preliminary tests. H.T. + 3, 120 volts, and grid bias according to makers' instructions. H.T. + 2, about 80 volts, and H.T. + 1 from 80 to 100 volts. You can vary these values afterwards until you obtain the best results.

Now switch on the set, and with the reaction condenser all out rotate the two tuning controls until you hear the local station.

If you are within 15 or 20 miles of the local broadcasting transmitter switch out the H.F. valve by cutting out the baseboard resistor. Now try to tune in the broadcasting station (with the H.F. valve in its socket but turned off). You will probably hear faint signals. If so, rotate the neutralising condenser knob very slowly until signals fade away. If you go too far they will return again. There is one point, called the "silent point," and with this setting signals will be at their minimum. This is the neutralising point, and when you have found it you can switch on the H.F. valve and the set is ready for use.

On first test the receiver brought in ten stations on the 250-550 metre wave-band at full loud-speaker strength.

On the longer waves, 5 X X, Radio-Paris, Hilversum, and one or two other stations, can be received on the loud speaker.

POINT-TO-POINT CONNECTIONS.

Join L.T. — to one side of H.T. fuse to terminal E, terminal 2 on aerial coil holder, moving vanes of aerial tuning condenser, negative filament socket of V_1, V_2, V_3, V_4, earthing plate of reaction condenser and to flexible lead for G.B. +.

Join other side of H.T. fuse to H.T. —.

Join L.T. + terminal to one side of L.T. switch.

Other side of L.T. switch to moving vanes of H.F. condenser, to slider of baseboard resistors R_2, R_1, to socket 2 of split-primary H.F. transformer holder, thence to moving arms of R_4 and R_3.

Other side of R_2 to + filament socket of V_2. Other side of R_1 to + filament socket of V_1, other side of R_4 to + filament socket of V_4, other side of R_3 to + filament socket of V_3.

Terminal A_1 to one side of ·0002 fixed condenser.

Other side of ·0002 fixed condenser to A_2, and to a flexible lead for terminals 4 or 3 on aerial coil holder.

Terminal 1 on aerial coil holder to fixed vanes of aerial tuning condenser, to grid of V_1, to top of neutralising condenser.

Bottom of neutralising condenser to terminal 3 on split-primary transformer holder.

Terminal 5 to plate of V_1. Terminal 4 to H.T. + 1.

Terminal 1 to one side of grid condenser and leak, and to fixed vanes of H.F.C.

Other side of grid condenser and leak to grid of V_2.

Terminal 6 to moving vanes of reaction condenser.

Plate of V_2 to one side of ·001 fixed condenser and to one side of H.F. choke.

Other side of ·001 fixed condenser to fixed vanes of reaction condenser.

Other side of H.F. choke to P on R.C.C. unit.

H.T. + on R.C.C. unit to H.T. + 2 terminal.

G.B. — on R.C.C. unit to flexible lead for G.B. — 1.

G on R.C.C. unit to one side of ·25-meg. grid leak.

Other side of grid leak to G on V_3.

P on V_3 to OP on L.F. transformer.

IP to H.T. + 3 terminal and to L.S. + terminal.

OS to G of V_4.

IS to flexible lead for G.B. — 2.

L.S. — terminal to P of V_4.

VARIOUS VOLUME CONTROLS.

By CHARLES GOLENPAUL
(Of the American Mechanical Laboratories).

TIMES change. Several years ago the main thing was how to obtain volume, irrespective of tone quality. To-day, most sets are capable of producing more than ample volume, so that the main aim is to cut down the volume when desired, without sacrificing tone quality.

Let us bear in mind at the very start that the radio receiver is a collection of delicately-balanced circuits—or at least it should be so, if the best results are to be obtained. The values of inductances, etc, are usually quite critical, so that any change in the inductance of one circuit may unbalance the receiver and result in distortion. For this reason, therefore, a volume control should be of the non-inductive type, so that there will be no change in inductance value as the result of a variation of the control.

Begin "Early."

The cardinal principle in controlling loud-speaker volume, apart from the use of a non-inductive resistance, is to begin as soon as possible in the receiving process. In other words, the nearer the antenna end that the control is put into effect, the better the results and the simpler the control; and vice-versa, the nearer the loud speaker end, the more energy must be handled by the variable resistance and the more likelihood of distortion.

The simplest volume control is a variable high resistance in the aerial lead, which serves to cut down the signal energy, and is of real value especially when intercepting powerful local stations. Sometimes the variable high resistance may be shunted across the antenna and earth terminals of the set. At any rate, with a suitable non-inductive variable resistor, a simple and undistorted volume control is obtained for any receiver. The resistance range must be from practically zero to several million ohms in the case of the resistor placed in the aerial lead, which appears to be the better of the two arrangements.

H.F. Volume Control.

Now if we do not control the energy at the very entrance to the radio set, the next best thing is to control it as soon as possible in the radio-frequency or high-frequency stages. Here the best practice is to place the variable resistor in the plus H.T 90-volt lead, so as to control the plate current of the radio-frequency tubes, and therefore the energy passed on to the detector valve.

It is also possible to control oscillation by means of a variable high resistance, but in this case a fine adjustment variable resistor—one that has an absolutely gradual adjustment of resistance—is essential. Even the finest wire resistor will not function properly in this case, since there may be too much difference in resistance from one turn to the next, thus preventing the precise adjustment of the high-frequency stages for the critical non-oscillating point. The resistance must be of the order of practically zero to some 500,000 ohms, in providing the necessary wide adjustment.

With a volume control in the plate circuit of high-frequency valves, it becomes possible to employ coils which will normally oscillate at 90 volts on the valves, with whatever stabilising method may be used. Then, with variable plate voltage, the receiver can be worked at top efficiency, right on the very verge of oscillating, as well as brought down to a very low efficiency in reducing loud-speaker volume without distortion. We have, therefore, a sensitivity control as well as a volume control.

At the L.F. End.

In going into the audio-frequency field of reception, we begin to encounter real power. Still, the volume can be controlled at the secondary of the first transformer, by means of a volume control shunted across it. In the case of resistance coupling and choke coupling, a potentiometer arrangement is more desirable, as a rule, but it is good practice to shunt the variable resistor across the input to such an amplifier, by passing more or less of the energy delivered by the detector.

The next and last place for controlling the volume of the receiver is to shunt a substantial variable resistor across the loud-speaker terminals. Here again a non-inductive variable resistor must be employed, and since there is often considerable energy to handle, a substantial device must be used.

Schoolboys deeply interested in a young constructor demonstrating the assembly of a three-valve set at a recent London exhibition.

MORE ABOUT THE "Q. & A." THREE.

RESULTS OF TEST—BATTERY AND VALVE DETAILS.

Further notes on the three-valve set described last week.

Q. "Good evening! I've come round to discuss those batteries and things, as I suggested. I've bought a loud-speaker like yours. By the way, I've brought the set round for you to look at. What do you think of it?"

A. It looks topping. You've made a neat job of it. We'll stick it on and test it if you like, after we've chatted over those other points. What do you want to know about the accessories?

Q. "First, I will get you to tell me what kind of batteries and valves, and so on, I shall have to use. Valves, for instance, I suppose they are important, are they not?"

A. They are the most important things in the set.

Q. "Let's take the valves one at a time. The first one, you say, is a detector? What sort of valve shall I want for that?"

A. The first valve should be of the H.F. type, you know, somewhere about 20,000 ohms impedance, or something like that.

Q. "Will any 'detector' valve do?"

A. Yes, any detector valve. Those advertised as H.F. or detector are most suitable. Or if you want to be quite sure, the technical description of the valve you want is one with a magnification factor of 20 and an impedance of 20,000, or round about those figures. Something like the P.M.1 H.F., or the Cossor H.F., B22, or the Marconi or Osram H.F. valve will be quite all right.

Q. "Apart from the filament voltage (I shall get 2-volters) what else do I have to watch out for? I believe they call it valve curves or characteristics or something, don't they?

A. Yes. But you need not worry about those,

STATIONS HEARD ON THE LOUD SPEAKER	
BRUSSELS	Fair.
5 G B	Very Good.
LANGENBERG	Good.
FRANKFURT	Good.
LONDON	Very Good.
DORTMUND	Fair.
BOURNEMOUTH	Faint, but readable.
HILVERSUM	Good.
MOTALA	Fair.
5 X X	Very Good.
RADIOLA	Fair.

just get valves of the types I mention and you will be quite O.K.

Q. "Now what about this middle valve? I think you called it the first L.F. What sort of valve shall I want there?"

A. An ordinary first-stage L.F. valve with an impedance of about 8,000 ohms. The P.M.1 L.F., Cossor, Ediswan, Marconi, Osram, B.T.H., or Cosmos L.F. valves are O.K.

Q. "Now, the last valve. I suppose that is very important to get a good one, because I understand that that is the one that the actual loud speaker is run from?"

A. Yes, that is important. For instance, if you want to use three or four loud speakers going at full strength you will want a super-power valve. Just for an ordinary loud-speaker like the one I have here an ordinary power valve will be quite sufficient.

The Question of Cost.

Q. "Are they very expensive—those super-power valves?"

A. Yes, they are a little bit more expensive than the others—they cost about 20s. By the way, you will want a big H.T. battery if you use one of those.

Q. "Do you mean more voltage—a higher voltage on the H.T. battery?"

A. No, not necessarily a higher voltage, but what we call a super H.T. battery. One with a large capacity, because the super-power valve takes more current out of it than the ordinary type, and a small H.T. battery would not stand up to it for long.

Q. "Could I use dry cells for the H.T. for ordinary valves in this set?"

A. Oh yes, dry cells are quite sufficient. As long as you get a battery of good make, that is all you want to worry about here. For the super-power valve you can get a dry battery of big capacity, costing about 45s., I believe, but you will find it will last a long time and is really well worth the extra money.

Q. "Talking about batteries, how much shall I have to pay for the accumulator? Can I get a small one?"

A. I shouldn't get it too small, or else you will always be running to the charging station. One with an actual capacity of, say, 20 or 30 ampere hours will be about the size you want. This should not cost more than 12 or 15 shillings. The whole outfit, you know, should not cost you more than about five pounds or so, without batteries or loud speaker. Not a very great sum when you consider what you will get out of it.

Buying the Batteries.

Q. "What do you estimate the cost will be for upkeep in the way of batteries? How often shall I have to get the L.T. charged, for instance?"

A. That will depend on how often you use the set and for how long. I should say you will get somewhere about fifty hours.

Q. "I expect we shall be using it from about seven till half-past ten or so, every night, so that you could reckon about four hours a day at the outside, I should think. How long will it be before I need to re-charge the accumulator if I do that?"

A. Oh, about a fortnight.

Q. "Did you say a thirty actual capacity accumulator?"

A. Yes, a thirty will last longer than a twenty. As a matter of fact, I think I said a twenty or a thirty. Thirty is certainly a bit better.

Q. "One thing I should like to know: When I change over from the short waves to the high waves, if I should do so, is there any danger of shorting or spoiling the set in any way when I change over the coils?"

A. Oh no. That is simply a matter of pulling out the coils and then pushing in the new ones. By the way, I had better tell you something about those coils, hadn't I?

Q. "Yes. What sizes shall I want?"

A. Well, for the short waves I think a 20 or 25 aerial coil with a 60 in the second socket (that's the middle one) and about a 40 in the third will do.

Q. "How about the high wave-lengths? What shall I need there?"

A. About 100 in the aerial, a 200 in the middle one, and a 100 or 150 in the further one will give you about the results.

Q. "But, speaking frankly, would you recommend me to get the high ones, or do you think I shall get plenty of fun if I only use the low ones?"

A. You will get plenty of fun on the lower range. There are, however, one or two stations really worth listening to on the higher range, you know. There's Daventry, and Motala, that place in Sweden, and Hilversum is nearly always on the air with a good programme. This especially is a good one on a Sunday. Let's hook the set up and see how it goes. (See list of Stations heard.)

Q. "It certainly is very fascinating, and it goes very well, I think. How many stations was it we heard—eleven on the loud speaker? There's one thing I should like to ask you: Is this a set that is likely to go out of date quickly, or is it one that is likely to give good results for several years?"

A. Yes, eleven stations. Here's the list so that you can see if you can beat it. (See list on this page.) The last four are long-wave ones. I think you will find this is a well tried circuit. It's not a new one, you know, and I do not think it will go out of date for very many years. It will last you as long as you like, I should say.

For Foreign Stations.

Q. "Another point interests me very much, which you might be able to tell me—and that is, do you think I shall have much difficulty in picking up the foreign stations? I should very much like to do this, if it's not going to be too troublesome, and I wouldn't mind putting up a new aerial if that would improve matters. What range of wave-lengths do you consider those coils you told me of will cover?"

A. You've spoken to me about your aerial before. It seems quite a good one—quite an average sort of thing. If you find your local station is bothering you at all, try using a smaller aerial coil, say about ten turns, or something like that. You will lose a little in signal strength, but you will get it in selectivity. The smaller coils will cover stations with wavelengths from about 200 or 230 to about 500 or so.

Q. "One friend of mine, whom I think will be very interested in this set, has an indoor aerial. Could I use this set on that sort, if I take it round to his place sometimes?"

A. Well, an indoor aerial will give quite good results, providing you are not too far from the station, but an outdoor aerial is miles better, you know. The set is not designed for an indoor aerial, but providing you are not after too many distant stations you can use one quite well.

When in Doubt.

Q. "Well, thanks ever so much for all you have told me about it; I feel quite anxious to begin listening on the set. I don't want to sound like Mr. Everyman, but I must thank you, and I cannot help feeling I am on a real good thing here.

A. Oh yes, let me know how you get on. I shall be awfully interested. I do not think you will get any trouble, but if you do hit a snag—well, drop me a line or write to the Queries Department. They will soon put you right.

"Cheerio, Old Bean!"

Cheerio, and all the best!

THE COMPLETED SET.

Easy to build and easy to handle, the "Q. and A." Three has only two operating controls—the tuning condenser and reaction adjustment.

The G.O.M. of RADIO

The whole world knows that Sir Oliver Lodge, "P.W.'s" Scientific Adviser, invented "tuning," without which the broadcasting of to-day would be impossible. But in acknowledging this great achievement many overlook the eminent scientist's other valuable contributions to the science of wireless.

By J. C. JEVONS.

IN these days of conflicting claims to master patents and priority rights in connection with discoveries in radio science, it is interesting to recall the pioneer work of the veteran scientist who has for so many years honoured POPULAR WIRELESS by occupying the position of Technical Adviser-in-Chief.

So long ago as 1898 Sir Oliver—then Professor Lodge, F.R.S., of the Liverpool University—invented a moving-coil sound-reproducer which is the prototype of the modern electrodynamic loud speaker, typified in one form by the Magnavox, and in a later and improved form by the well-known Rice-Kellogg instrument.

Early Moving Coil-Loud Speaker.

The original Lodge moving-coil apparatus has been placed in the National Science Museum, and may be seen there at any time by those interested.

The details of the construction are illustrated in Fig. 1. The moving coil A, to which the currents to be amplified are fed, is mounted in a narrow gap between a central polepiece N, and an annular polepiece or keeper S. The sides of the coil are connected by a rigid tripod T, as shown, to a large disc or diaphragm D. The vibratory movements of the latter are then communicated directly to the surrounding air.

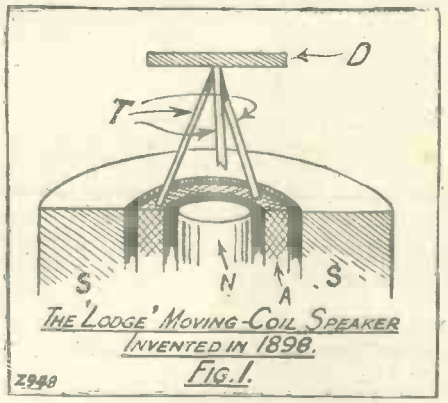
Sir Oliver proposed to use a cascade arrangement of such moving-coil relays in order to amplify the received signals into sounds of large magnitude. It must be remembered that this work was being carried out nearly ten years before the invention of the Fleming valve, so that thermionic amplification was not available.

The relay arrangement is shown in Fig. 2. Telegraphic or telephonic signals, transmitted by induction from a distant closed circuit, were picked up by the vertical winding A, and fed to the moving coil of the first relay I. The vibrations of the coil, corresponding to the received signals, are applied through the "tripod" links to a simple microphonic contact M.

The resulting current variations are next amplified by means of a local battery B, and communicated through a transformer T to a second similar relay II. In this instrument the moving-coil vibrations are applied to a box microphone M_1, comprising two electrodes containing carbon granules.

Microphonic Amplification.

The output from the microphone M_1, after further amplification by means of a second local battery B_1, are passed on through a transformer T_1 to a third moving-coil relay III. By this time the current variations are sufficiently powerful to energise, through the moving-coil and tripod attachment, a large diaphragm D in direct contact with the air.



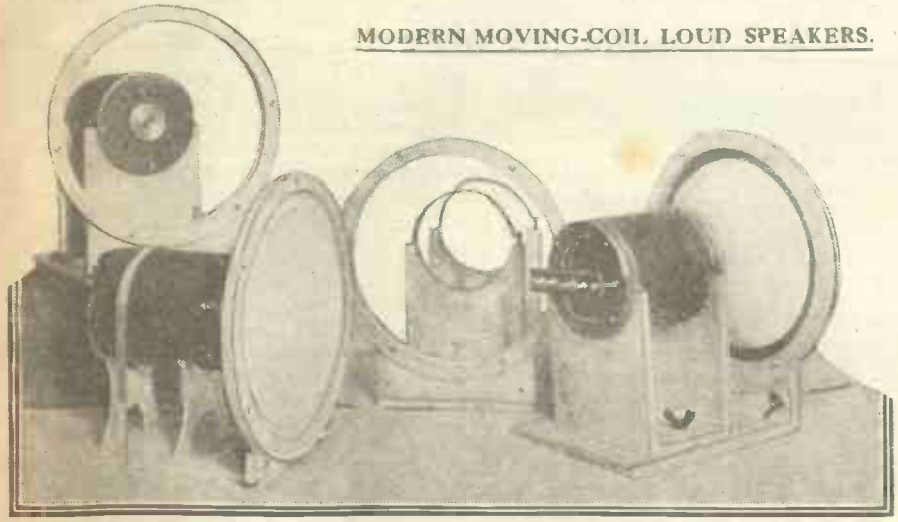
THE 'LODGE' MOVING-COIL SPEAKER INVENTED IN 1898. FIG. 1.

The action of the last instrument is fundamentally the same as that of the modern disc or cone loud speaker. Alternatively Sir Oliver suggested that the output currents from the relay II could be applied directly to a horn speaker H, by means of a change-over switch S. This showed a keen appreciation of the different tonal qualities of the two types of instrument in question.

Even at the present day the large-diaphragm speaker operates more efficiently

(*Continued on next page.*)

MODERN MOVING-COIL LOUD SPEAKERS.



A group of moving-coil loud-speaker elements in various stages of assembly. Sir Oliver Lodge invented a moving-coil loud speaker so long ago as 1898—many years before there was such a thing as broadcasting or even wireless telephony.

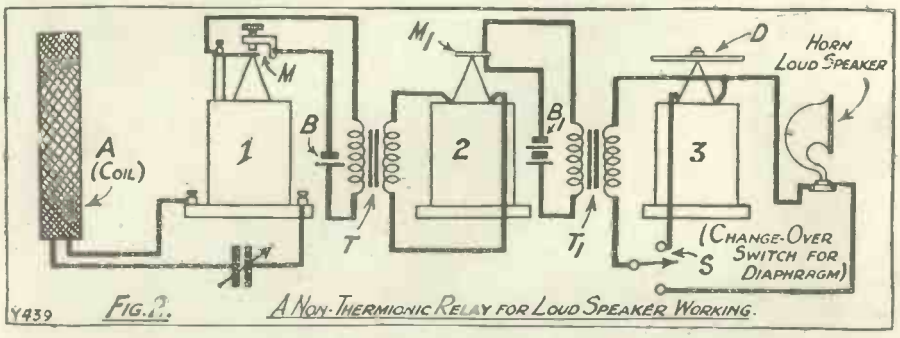
THE G.O.M. OF RADIO.

(Continued from previous page.)

on the lower notes, whilst the horn does better justice to the higher notes. In fact, for those who can afford it the ideal broadcast combination is still a cone and horn speaker connected up in parallel across the output from the wireless set.

series of patents, designed to extend and develop the principle of syntonic or tuned signalling. These improvements were embodied in the Lodge-Muirhead Radio system which was subsequently taken over by the Marconi Co.

He was also responsible for the invention of a number of ingenious forms of coherer. In one of these a pure metal makes contact with an adjustable spring, which is continually vibrated by a fine toothed wheel driven by clockwork, or by a tuning-fork,



Y439 FIG. 2. A Non-Thermionic Relay for Loud Speaker Working.

A year previously, in 1897, Sir Oliver had taken out a master patent for the principle of tuning wireless waves to a definite frequency so as, in his own words, "to enable an operator to transmit messages across space to any one or more of a number of different individuals in various localities, each of whom is provided with a suitably arranged (i.e. properly tuned) receiver."

It is difficult at the present time to appreciate the fundamental importance of the tuning principle as applied to wireless signalling. Tuning has become such a commonplace idea that it is almost impossible to imagine a time when the effect of capacity and inductance in determining wave-length was either ignored or not understood.

Wireless signalling in those days consisted in crashing energy into the ether in mass, and trusting for reception to the pick-up effect of an elevated wire acting merely as an aperiodic collector. Simultaneous signalling on any large scale was impossible under such conditions. There was no such thing as selective working by operating upon a given wave-length until Sir Oliver introduced this conception.

First Radio Tuning.

In the inventor's own words his improvement consisted in the use of novel means for the purpose of producing a prolonged series of electric oscillations, so that the excitation of a particular frequency at the sending station would cause a suitably-tuned receiving apparatus to respond, but would not affect any other receiver not so tuned.

In order to secure this result he introduced for the first time the notion of lumped inductance in the form of a series coil, and lumped capacity in the form of a condenser, both incorporated in the transmitting and receiving aerials. In this way, he converted the aperiodic radiator or collector aerial into a definitely-tuned instrument which, like a pendulum, would respond selectively in favour of energy impulses of definite frequency.

During the next few years Sir Oliver was responsible, either alone or in conjunction with Dr. Alexander Muirhead, for a whole

so as to be constantly maintained in a sensitive condition.

Many Other Patents.

In another form of Lodge detector a thin film of oil is interposed between the contact needle and a globule or pool of mercury, so that as the needle dips into the mercury it is surrounded by a thin coating of the oil. The needle is constantly vibrated so as to continually renew the coating of oil.

The oil normally forms an insulating layer between the needle and the mercury, but breaks down to allow the passage of a recording current whenever a train of signalling waves is received.

Since those pioneer days of wireless development, Sir Oliver has taken out patents for utilising directional wireless as an aid to marine navigation, for improved methods of coupling the oscillating and radiating circuits in wireless transmission, and for a number of other valuable inventions which it is impossible to set out in detail within the limits of the present article.

Readers of Popular Wireless will, however, recall his recent work in connection with the "N" circuit. In this receiver a non-radiating trap circuit is used for collecting the aerial energy and feeding it to the first valve amplifier in such a way as to prevent any possibility of local disturbance being caused by oscillations emanating from the set.

RADIO NOTES OF INTEREST.

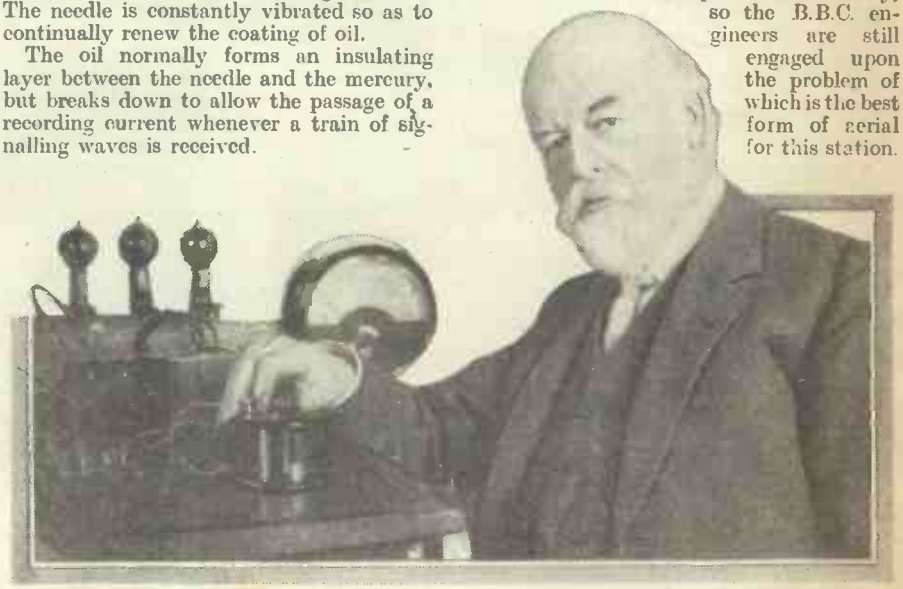
The Melbourne short-wave station, 3 L O, will welcome reports from British listeners on its transmissions upon 36 metres every Sunday from 6.30 to 8.30 p.m. G.M.T.

* * *

A Surrey amateur has recently been in two-way communication with an American scientific expedition to West Greenland. Signals were exchanged on a wave-length of 46 metres.

* * *

The recent rearrangement of the Daventry 5 G B aerial has not proved satisfactory, so the B.B.C. engineers are still engaged upon the problem of which is the best form of aerial for this station.



Sir Oliver Lodge still carries on active radio research work, although his scientific interests are extremely wide, embracing, as they do, practically everything from astronomy to X-rays.

YOUR PANEL.

HERE are some common faults which are to be seen in the arrangement of the terminals and other fittings on the panels of home-made receiving sets. Profit by the mistakes of others, and when building your next set see that these common faults are not included in your own apparatus, otherwise it will look unsightly:

Edges of the panel not straight

Terminals not placed at equal distances from the edge of the panel.

Panel altogether "out of square."

Aerial and earth terminals too near together.

Unsymmetrical arrangement on the panel of the various condenser and other tuning dials.

Valve sockets arranged so that the valves are placed in the most unprotected positions.

Unwanted holes drilled in the panels, and then filled in with composition.

Panel badly labelled.

Pencil marks left on the panel surface.

Built in 1 Hour

The receiver that makes the most efficient use of three valves

Without soldering and with only 20 wires you can build this wonderful receiver — The Mullard Master Three.

The Simplified Plan of Assembly is easier to read than a map and ensures complete success.

One dial brings in station after station, another controls volume. Tuning is as simple as setting the hands of your watch.

Gives you a choice of six or more programmes at loud-speaker strength.

The simplest and cheapest three-valve set ever designed.

Send the coupon to-day and make the Mullard Master Three your 1928 receiver.

POST THIS COUPON NOW!

The Distributors,
"Radio for the Million,"
63, Lincoln's Inn Fields,
London, W.C.2.

I enclose two penny stamps covering postage of one complete set of A.B.C. CONNECTING LINKS given free with simplified plan of assembly for the MULLARD MASTER THREE.

NAME (Block Letters).....

Address.....

.....P.W.6.

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THE "UNIDYNE."

The Editor, POPULAR WIRELESS.

Dear Sir,—It may interest a wide circle of your readers, many of whom are going through the excited "craze" stage and testing circuit after circuit, to know of the high regard in which the good friend, the "Unidyne," is held. Soon after it first came out, which must be over four years ago, I put up a three-valver, but finding the third stage not fully efficient, changed that over to an H.T. valve. Ever since that we have had satisfactory and adequate reception of any one of any ordinary station: Cardiff (30 m.), London (120 m.), Bournemouth, Paris, Langenberg, Frankfurt, Madrid, etc. It is so good that we hesitate to change it. Recently, after getting K D K A and W A H W U L (?) on another two-valve set on low waves, my son took off the 80 and 100 coils from the Unidyne and put a 4-turn coil in the reaction socket *only*, when Cardiff came through at fair strength on the L.S.! Can anyone explain what was happening? Also has any reader found your wonderful Unidyne adaptable to the short waves?

Yours faithfully,
H. O. L.

P.S.—Valves are the original Philips 1·8 v. with 4-v. accumulator cut down by very good barrel-rheostats.—H. O. L.

Fishponds, Bristol.

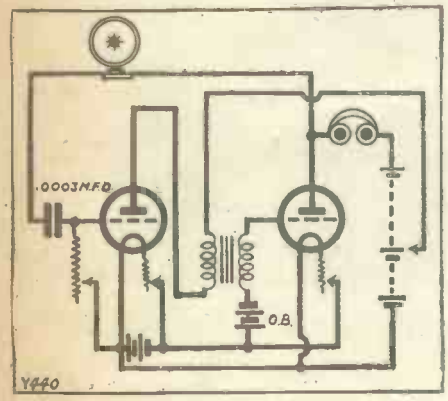
PARLOUR PROGRAMMES.

The Editor, POPULAR WIRELESS.

Dear Sir,—The enclosed circuit, I think, should prove interesting to readers of POPULAR WIRELESS. It provides a very efficient means of relaying music or speech from one part of a house to another, thus offering wide scope for experimenters and, incidentally, a source of amusement for the forthcoming party season.

The sounds are picked up by the loud speaker, amplified by the first valve, passed on to the second, amplified again, and are once more magnified by being returned to the grid of the first valve.

With regard to component values, the grid-leak should be variable, a high resistance being essential for maximum strength. The second valve should be



a power valve, since the volume is truly surprising; H.T. and G.B. are, of course, adjusted accordingly. A second loud speaker may be substituted for the 'phones.

Readers will notice that they may transform an 0—v—1 receiver into this by merely detaching aerial and earth, removing aerial coil, and connecting loud speaker to aerial terminal and one side of 'phones.

Wishing "P.W." every success,
Yours faithfully,

Walthamstow, E.17. J. E. J.

THE "WORKWELL" ONE.

The Editor, POPULAR WIRELESS.

Dear Sir,—I am so pleased with your "Work-Well" One circuit that I am writing to tell you how really well it works. I am a regular reader of your wonder book of wireless, and I am always ready to hook up any of the circuits you specify.

What beats me, I can get the local, which is only 1½ miles away, at good L.S. strength. In fact, I've been using a crystal with one stage of L.F., and your circuit is just as loud and purer tone altogether. I'm using an old Marconi D.E.R. valve.

If I had an up-to-date valve no doubt it would be even better.

I had only got a ·0003 tuning condenser, so, of course, I tried it in place of the ·0005 you specify. It's O.K. on the local, but if I shunt a ·0002 in parallel with the ·0003 I can cut out the local and get 5 G B quite good. Hoping my little experience will be of use to any of your readers, and wishing all the best.

Yours truly,
Bournemouth. J. W. W.

THE "VARIACTOR" TWO.

The Editor, POPULAR WIRELESS.

Dear Sir,—I wish to congratulate you in evolving such a set as the "Variactor." I have made it up in rather a haphazard fashion, but the results are

CORRESPONDENCE.

THE "UNIDYNE"

PARLOUR PROGRAMMES—SHORT-WAVE RECEPTION.

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.

simply wonderful, the volume from both the Daventry stations is great for only two valves. I have used the components specified, but have altered the lay-out, placing the terminals on the panel, also putting three terminals on the panel for connecting the three broadcast tappings to, doing away with the tapping clip.

Using two B.T.H. valves, one H.F. and one power, I can get about twelve stations on the loud speaker, most of them at really good strength. I use 100-volt for the power, and 80 for detector. I generally use my five-valve set, but the "Variactor" at present is my favourite, and I have made up quite a number of valve sets.

Wishing you every success.

Sincerely yours,
A THOMPSON.

P.S.—I may add that I have received twenty-five stations up to the present, all clear on the 'phones, including the twelve quoted above, and I have not finished yet.

Birmingham.

THE "LO-COST" CRYSTAL SET.

The Editor, POPULAR WIRELESS.

Dear Sir,—Just a line to let you know how the "Lo-Cost" Crystal Set works in our part of the world. The moment I saw the circuit in to-day's book, I thought I would like to try it. I went home, and in thirty minutes 5 G B was coming in at excellent strength. It is the best crystal set I have ever tried, and I would just like to thank you for so cheap and wonderful a circuit.

Yours truly,
Ely, Cambs. L. H.

A LOUD-SPEAKER HINT.

The Editor, POPULAR WIRELESS.

Dear Sir,—The following hint may be of interest: Many loud-speaker horns of the crystalline finish type after a time become grey or dusty-looking. These may be revived and restored to their new appearance quite easily and inexpensively. Take a small wad of cotton wool (or a soft rag will do) and soak this in *olive oil*. Squeeze out, so as not to have too much oil in the rag, and gently work this over the horn, working well into the crevices of this particular kind of horn. Care must be taken not to have too much oil on the rag at a time, so as not to leave the work greasy, and *olive oil* must be used.

Yours faithfully,
A. WADDINGTON.

Ightenhill, Burnley.

SHORT-WAVE RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—I had the unique experience of hearing the New Year greeted by two countries on December 31st/January 1st. One being our own country, England, and the other America.

Some time ago in your issue of POPULAR WIRELESS, October 16th, 1926, No. 228, Vol. X, you published an article by R. H. Bradley, giving a few practical suggestions for Short-Wave Reception.

I decided to follow the circuit given and added another L.F. valve. Components I used were Lotus 3-way coil holder, Ormond S.L.F. vernier condensers, ·00035 and ·00025, standard 4-pin valve holders. A glass panel was used with an ordinary baseboard. I had great difficulty in controlling reaction and so fitted a Bretwood variable leak in place of the fixed 2-megohm grid leak, this being a great improvement, as smooth control is essential down on 15 metres.

Detector valve is an S.T.41, which I find excellent for all waves from 25 to 1,800 metres.

For reception of 2 X A F and K D K A I use Igranic plug-in short-wave coils: primary coil No. 4, secondary coil No. 6, reaction coil No. 9.

Results are good loud-speaker strength on a poor aerial. Advantages are that with the use of suitable coils 5 X X, medium and short-wave stations can be received at will.

On this set I received the London New Year service, and then at 5 a.m. G.M.T. I received the New Year ceremony from K D K A at full L.S. strength and also just had time to hear greetings from 2 X A F before they signed off.

I can always receive one or other of the above American stations at good strength. On the occasion of the B.B.C.'s first Australian broadcast I received this station 2 F C direct at weak L.S. strength and kept on until they closed down, which was long after the B.B.C. finished, which proved it was not a harmonic; but I think myself it was a freak because I have only had them once since then.

Hoping these particulars will interest you, and wishing "P.W." a happy and prosperous New Year,

Yours faithfully, C. J. C.

P.S.—I find this set quite suitable for L.S. reception of at least 10 foreign stations.

Liverpool.

DISTORTIONLESS RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—Now that the "long-distance" craze is dying out a little, and real "super"-power valves available, people are inclined to instal apparatus that will give them the utmost purity of tone on the local station and the two Daventrys. Most of these sets employ anode-bend rectification and resistance-capacity coupling in the audio-frequency stages. These sets are generally reliable and give good-quality reproduction.

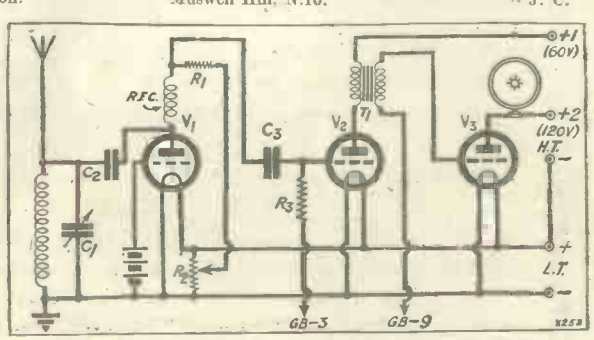
But people who live within a six-mile radius of their local station are often troubled with distortion on loud passages. Then they think that all the trouble is due to the L.F. stages. An occurrence of this nature recently troubled the writer, and was at last traced to the rectifier, which was of the cumulative grid method. The set was a 0-v-2 without reaction, and distortion was very troublesome. I then altered the rectifier to that of the "Diode" or "parallel-anode" method, with the most pleasing results, distortion being entirely absent. The diagram of the complete set is shown.

It will be seen that the tuning apparatus is connected between the anode and the filament. A condenser of ·0003 mfd. couples the aerial and anode. The anode is then connected by a radio-frequency choke to the anode resistance of the amplifier, which *is not connected to H.T. +*, but to the slider of a potentiometer across the L.T. battery. A positive potential must be applied to the grid in order to neutralise the space charge effect.

This method of rectification is the most perfect known, for it has a practically linear characteristic, but unfortunately it is very insensitive, it having a sensitivity equal to that of a galena crystal, but is much more reliable. A transformer may be used after it, but it should preferably have a ratio of 6 or 8 to 1. I might mention that a rectifier of this kind is used in the high-quality receiver demonstrated at the Science Museum at South Kensington. Our set is about five miles north of 2 L O, which is received perfectly, although a stage of high-frequency amplification is recommended for 5 X X and 5 G B. To get the best out of a receiver of this kind high anode potentials on the L.F. valves and a cone speaker are imperative.

Wishing "P. W." every success, and apologising for using so much valuable space;

Yours faithfully,
Muswell Hill, N.10. J. C.



C_1, ·0005 mfd.; C_2, ·0003 mfd.; C_3, ·01 mfd.; R_1, 100,000 ohms; R_2, 400 ohms; R_3, ·5 megohms; T_1, Ferranti A.F.3; V_1, P.M.1H.F.; V_2, P.M.1L.F.; V_3, D.E.P.215.

Traders and manufacturers are invited to submit wireless sets to the "P.W." Technical Department for test. All tests are carried out with strict impartiality in the "P.W." testing-room, under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

OVERHAULING A LOUD SPEAKER.

IN our January 28th issue we published an article having the above title. In acknowledging the usefulness of the many tips given, Messrs. Graham Amplion Ltd., ask us to point out that they maintain a carefully organised Service and Repair Section, and that all their Amplion loud-speaker units bear a label suggesting that Amplion users should take advantage of the facilities provided. Further they say:

"Although a certain proportion of the public who are mechanically minded could no doubt quite satisfactorily undertake simple repairs, we feel that so long as the manufacturers make the necessary arrangements and offer prompt service, it is, generally speaking, more satisfactory that overhauls should be carried out under their own supervision.

"We ourselves seal all our units before issue, and can only accept responsibility for their performance while these seals remain intact our service guarantee being nullified if the units are opened up other than in our own works."

FOR THE ADVANCED AMATEUR.

A book which will be of interest to the more advanced amateur and the radio engineer is "Wireless Principles and Practice," by L. F. Palmer, M.Sc., Ph.D., F.Inst.P., A.M.I.E.E. It is published by Messrs. Longman Green & Co., Ltd., at 18s. net. Of great value to the student will be the extensive bibliographies provided at the end of each chapter.

The book as a whole is an achievement inasmuch as it is a definite breakaway from conventional radio text-book practice. The mathematics particularly are very interesting. The whole field of radio is covered, and within the limitations of the 500 or so pages is very well covered indeed. The many diagrams are excellently executed, and the photographs modern and directly applicable to the subjects covered. It is a book that we have placed on our bookshelf with the assurance that it will not accumulate dust.

A RECTIFIER DIAGRAM.

In our issue of January 28th, an article appeared on page 1088 entitled "A New Dry Rectifier." But Fig. 2 is stated to give full-wave rectification. Actually however, it would provide only half-wave rectification. To give full-wave rectification the "Input" and "Output" should be reversed.

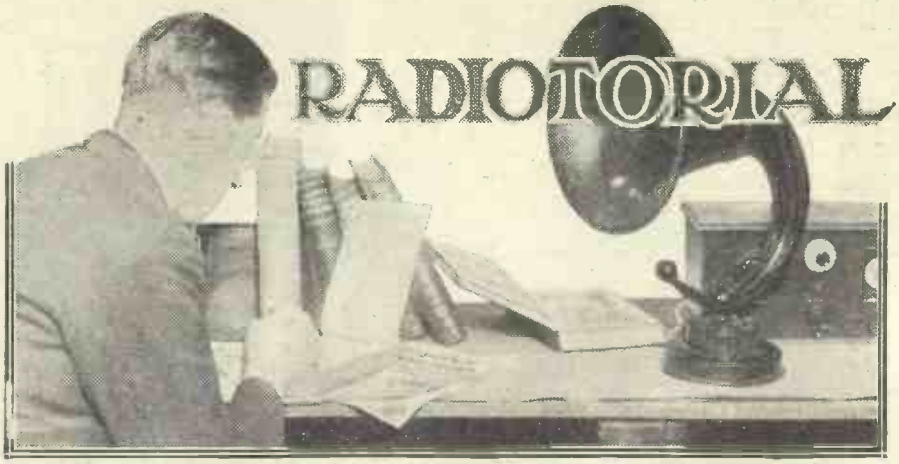
THE IGRANIC SHORT-WAVE RECEIVER.

Until recently there seems to have been only two types of receivers accepted as being suitable for short-wave reception. The one is the plain detector with reaction type which may or may not be followed by low-frequency amplification, and the other is the super-heterodyne or "wave-change" variety. In this latter the short-wave signals are received by an initial rectifier where they are, in effect, transformed into long waves and then passed on for high-frequency amplification.

But there is a very big gap between the "super-het." and the straight-forward Det.-L.F. type of receiver, and hitherto it has been thought that more or less straight-forward high-frequency amplification was ineffective on the higher frequencies.

Short waves seem to come over so well that they can be received from vast distances on a simple detector and one L.F., or Det.-2 L.F. sets, but generally speaking, such receivers have to be worked very close to the point of oscillation, and tuning is critical, and there is very little margin.

(Continued on page 1215.)



All Editorial Communications to be addressed to The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon 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.

CUTTING OUT THE H.F. VALVE.

"HENRY" (Hackney).—"I don't want much. All I want is London and Paris—I don't care if I never hear anything else at all. But do you think I can get Paris? Not without whoops and shrieks like Red Indians rampaging on the warpath, all the time!

The man I got to look over the set says it's too powerful. He calls it a tuned anode and 2 L.F. (whatever that means!), and he says I ought to write and let you have the enclosed diagram and get details of how to cut out the tuned anode. Can you tell him how to do it? And will it be easier to tune and, most important of all, shall I get Paris?"

It will be much easier to handle if you "cut out the tuned anode." This will make it into a three-valve set instead of a four-valver, and with it you should get good loud-speaker results from both London and Paris, with an easy change-over and simplicity of tuning.

The best method of permanently cutting out your H.F. valve is to proceed as follows: After disconnecting all the batteries, remove the wires that join the tuned-anode coil to the anode condenser, plate of the valve and to H.T. plus, etc., thus leaving that coil holder without any connection for the time being. Disconnect the ·0003 anode tuning condenser, as this will not now be needed.

Now by two extra leads join the aerial coil's plug and socket to the plug and socket respectively of the anode coil holder.

Join the grid socket of the first valve holder to the lead which goes from the plate of the first valve to the ·0002 fixed condenser (the condenser which, on its other side, is joined to the grid of the second valve, and to the grid leak).

Pull the aerial coil from its usual coil holder, and always use it in the old "tuned-anode coil" holder instead, tuning on the aerial tuning condenser, as formerly.

Finally, you may need to reverse the leads to the reaction coil. The set can then be used as a three-valver (Det. and 2 L.F.) and will give either the Paris or London programmes, when suitable coils are plugged in. It will be much easier to handle than formerly, and will also be more economical to run.

"FALLS OFF WITH A CLICK."

C. M. P. (Portsmouth).—"I have a three-valve set, using all Cossor valves (new), the last one being a power valve. Can you inform me why reception suddenly fails, with a 'click,' but can afterwards be heard as if in the distance?"

This is a grid circuit fault, generally due to a faulty grid leak or grid condenser. If your second or third valve uses a grid leak, the insulation of the condenser

(*Continued on page* 1204.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 1202.)

fixed between this and the plate of the preceding valve may be faulty, giving rise to the symptoms described.

Alternatively, the trouble may be due to the grid circuit of the first valve, the likeliest place to look in this instance being the grid leak itself. It may be of too high a resistance, or it may be insecurely connected in its clips, or with faulty leads, with the result that there is no path for charges on the grid to leak away to filament.

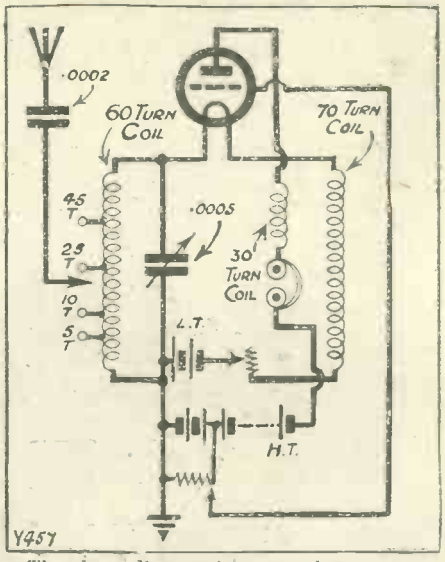
UP THE POLE.

R. G. (Walthamstow, London, E.).—"It took three of us all Saturday afternoon to get the mast up, and we half-killed the builder's man who helped us, because the mast leaned on him when he was pressed against the wall. But my dad gave him 3s 6d., and he seemed pleased. But we didn't notice till he had gone that the aerial line had come out of the pulley, and now we have got the mast up, but no aerial on it. Can we get an aerial up it in any way, or will it mean the pole coming down again?"

Generally in such cases it means pulling the pole down and putting it up again. If this proves necessary, don't trust to the halyard, but when it is threaded through the pulley, tie its two ends together to form an endless line passing over the pulley-wheel.

There is not much hope of getting another threaded pulley-wheel up to the top of the mast as it stands, unless it has long stays fixed right to its top. (Though much may sometimes be done with patience, props, and fishing-rods.) But if long stays run from the mast-head to the ground, it is sometimes possible to pass a running noose *over* all these, and then by judicious tightening from the house end, to make the noose run up the stays, carrying the pulley with it towards the top of the mast. Hard pulling is not practicable owing to the side-strains, and we should be inclined to have the builder's man in again, to assist—providing, of course, that he will come after his last experience!

WHAT IS WRONG?



The above diagram is supposed to represent the connections of a One-Valve Filadyne circuit. But it is wrong, and would not work properly.

Next week the correct diagram will be given, and, to test your skill, we shall continue to publish every week a diagram in which a mistake (or mistakes) has been inserted. The correction will be published the following week.

No prizes are offered, but by following this series and trying to solve the problems, week by week, the reader cannot fail to learn a lot about radio circuits

EASY.

"Puzzled" (Farnham), in a postscript, says: "If I-wet my finger and put it on the O P terminal, the set howls and squalls like anything! Awful!!! How can I stop that?"

We are surprised at you, "Puzzled." Why not carefully dry your finger and keep it away from O P? (This is the famous N T T T T Y system—i.e., Never trouble trouble, till trouble troubles you).

PROTECTING THE FILAMENTS.

"Old Stager" (Nottingham).—"For you to appreciate the fright I had I must tell you that I started with a crystal set which I built up from particulars in one of the very first numbers of 'P.W.,' and I have been making sets ever since. As better and better designs came out two or three times every year, I altered my set, and one day, when I had the glorious sensation of picking up American broadcasting direct, I thought I really had the perfect set. Since then I must have changed it at least twenty-four times! I graduated up from that simple crystal set through the one-valve stage, through the two and three stage, and now I am the proud possessor of a super-power four-valve set which represents the cream of my reading Popular Wireless for all these years. But pride, it is said, goes before a fall, and although I have never before burnt out one single valve, I had a rude awakening last night. I was showing the set to some admiring friends, and had a piece of wire in my hand with which I had been shorting the aerial condenser across the wave-trap. Something distracted my attention and the wire accidentally fell from my hand into the set. There was a bright spark, and four of the finest valves which the heart could desire went west at one blow! I suppose it is not much use locking the stable-door now that the horse is gone, but looking up my old 'P. W's' I discovered

(*Continued on page* 1206.)

THE PROOF OF MILLIONS

PRICE **2/6** *100 FEET*

Including Wooden Spool
Which facilitates unwinding.

STORM-PROOF
SNOW-PROOF
WIND-PROOF

FURTHER OUTLOOK UNSETTLED

The B.B.C. Announcer often forecasts unsettled weather and issues a gale warning, but if your aerial be SUPERIAL—the King of Aerials—you may rest assured that whatever the conditions it will not let *you* down—neither will it come down. SUPERIAL has great mechanical strength and resistance to corrosive influences, and for this reason it was selected by the explorers in a recent ARCTIC EXPEDITION as the only possible aerial in the world made to withstand the rigours of the ARCTIC regions.
SUPERIAL for long-distance reception—of extra heavy vulcanised insulation. Fix up SUPERIAL.

MONEY-BACK GUARANTEE

Try It now, then you will know why it is so popular. Ask for SUPERIAL—THE KING OF AERIALS. But you must agree to return it if it does not prove 'up' to every claim made for it. If your dealer has sold out he can get some more, or we will send direct to you on receipt of P.O. or cheque. **Your cash will be immediately refunded if you are dissatisfied in any way. SUPERIAL is the quality Aerial—the highest possible quality—THE AERIAL WHICH ABOLISHED INSULATORS AND OTHER UNNECESSARY AND COSTLY APPURTENANCES.**

WHAT SOME OF OUR CUSTOMERS SAY:

"We do not praise our set as we know all the good results are due to your wire."

"Yesterday I replaced your Aerial and again rejoice in the actuality and nearness which the expensive Aerial quite failed to give."

"Using a bare copper Aerial we could not receive anything whilst in Port, but with your Aerial we have been receiving Daventry (180 miles) and Bournemouth (80 miles) on a crystal set."

"I have only 32 feet of Aerial in all, but I get topping reception."

"On the same set on a bare copper Aerial I do not receive half the number of stations."

CERTIFICATE OF EXCELLENCE.
From the Radio Institute, New York.

"Superial was tested in the Laboratory of the 'Evening Mail' Radio Institute, New York, U.S.A., and found to agree with the standards set by the Institute, and that the design is based on sound engineering practice.
"It has been awarded the Radio Institute's Certificate of Excellence."
(Signed) Lester Rutter, Director,
Radio Institute, New York, U.S.A.

SUPERIAL
THE KING OF AERIALS

THE NEW LONDON ELECTRON WORKS, LTD.,
EAST HAM (Dept. 19), LONDON, E.6.
Telegrams: Stannum, London. *Telephone: Grangewood 1408.*

Some more extracts from testimonials:

"I have tried every kind of Aerial, but there is nothing like yours."

"The demonstration with your wire was a great success, and everybody heard perfectly."

"I paid 15/- for an Aerial, and it is not nearly so good as yours."

"Your extension wire seems to steady the wireless set."

"Using 'Electron' Wire as an INDOOR aerial, without any insulators, the results were astonishing."

"I removed my original aerial of 7/22 hard copper, and re-erected it with your cable, and results are much better and more stable."

"Friends who have listened are surprised at the results and the ease with which the wire is put up."

PROVE IT FOR YOURSELF AT OUR EXPENSE

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 1204.)

a warning against this very thing, and the advice that a flash-lamp bulb should be fitted in the H.T. negative lead to prevent a burn out. Does that advice still hold good with a modern set when screening boxes are earthed ?

Hard lines ! We don't know which is harder—when it is a novice that gets caught, or an "old stager" like yourself. The flash-lamp bulb is an old dodge, but it is a good one, and would have saved your valves and your pocket. Personally, we always advise the fitting of a fuse of this kind in a multi-valve set. You may never need it, of course, but if you do you will need it very, very badly !

"FRED'S FAULT."

S. N. (Andover, Hants).—"And my brother Fred said he would connect it up for me, but when I got home it wasn't working, and I looked at the set and I saw what he had done, and I went for him. And no wonder it wouldn't work, because he put the accumulator on the two terminals where I put 'phones, when I want to cut out the L.F. and listen on one valve. So the L.T. plus was joined inside the set to the transformer primary (end marked H.T.+), and the L.T. negative was connected to the transformer terminal marked P. And the H.T. battery was joined up, and I thought everything was burnt out. But to my relief the set seems to go all right, now I've connected it right again, but I should like to know if much damage was done really ?"

Fortunately, "Fred" didn't do much damage, though his inexperienced handling might easily have burnt out a valve. However, by putting it on to the two 'phone terminals, the only harm he did the L.T. battery was to run it down a little. With the primary of the transformer connected across it, it would lose a little current—far less than the valve takes—but this would be the only damage sustained, so, fortunately, for all practical purposes the wireless is as good as ever it was.

America—and then Silence !

L. H. L. (Handsworth, Birmingham).—"I completed your 'Sydney Two' set on the evening of December 24th.

After about three-quarters of an hour's searching I picked up an American station, which was held at quite good 'phone strength from 11 p.m. till about 2.15 a.m.

"The following morning, from 11 a.m. to 1 p.m., I heard several amateurs and numerous Morse stations. Since switching off that morning I have been unable to get a sound on the short waves. But when the earth clip is removed from the coil 5 G B and 5 X X can be heard together. Apart from this, I can get nothing at all.

"The set is built to your instructions except that the rheostats and potentiometer are panel mounted and the reaction condenser is a slow motion S.L.F. ·0003 instead of ·00025. I have dismantled the set and rewired it. The grid leak and ·0002 condenser have been renewed. The transformer has been changed and three high-frequency chokes have been wound. (Two with D.S.C. wire and one with enamelled of a slightly thicker gauge.) The moving condensers do not appear to short when tested with a battery and lamp, and the valves, earth and aerial work perfectly on another set. I am at a loss to understand what can have gone wrong, and I should much appreciate your advice."

From your description we think you are up against one of those mysterious little faults which by its very simplicity is difficult to trace. The fact that the set worked well on Christmas Eve, and that it picked up an American station as soon as it was made and before you had really got the hang of the controls, indicates that it was working satisfactorily then, and therefore the fault must have developed since.

From long experience in tracking such troubles we are inclined to suspect one of the moving contacts. There are several of these in the set, and unless you can see that the valves light up properly we should first of all look at the L.T. switch and at the two rheostats, making sure that the filaments are getting their correct current. If you have a voltmeter place it across the legs of each of the valves (not across the legs of the valve holder, but across the legs of the valves themselves) thus making sure that the correct voltage is being applied across the filament itself.

If the valves are of the type which do not show when lit up and you have no voltmeter on hand, clean the valve legs, and if possible open out the contacts so that they make good connection when the

(*Continued on page* 1208.)

"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 offer an *unrivalled* service.

Full details, including a revised scale of charges, can be obtained direct from the Technical Query Dept., "Popular Wireless," 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.

IMPORTANT NOTICE

WIRELESS VALVES

PROCEEDINGS for infringement of Letters Patent No. 184446 were recently instituted by Marconi's Wireless Telegraph Company Limited against William Leonard Sames (sued as British Radio Supplies) and also against S. Kalisky (Aldgate) Limited (trading as Entertainment Supplies Company).

The Defendant in the former proceedings consented to an Order, dated 3rd January, 1928, and made in the High Court of Justice, Chancery Division, *inter alia* restraining him from infringing the said Letters Patent. The Defendants in the latter proceedings *inter alia* gave an Undertaking to Marconi's Wireless Telegraph Company Limited, dated 22nd December, 1927, not to infringe the said Letters Patent.

WARNING

TO DEALERS AND USERS

NOTICE IS HEREBY GIVEN by Marconi's Wireless Telegraph Company, Limited, The British Thomson-Houston Company, Limited, The General Electric Company, Limited, that legal proceedings will be taken against any company, firm or person selling or using valves which infringe any patents owned or controlled by them or any of them.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 1206.)

valves are plugged in their sockets. It is absolutely essential, also, that the grid pins of the valves are making really strong, firm contact with the grid sockets of the valve holder, as the whole operation of the set depends upon this contact carrying the signal voltages to the grid of the valve.

If the valves are making really good contact with the sockets there are other moving contacts which call for very special consideration. The grid leak, for instance, must be absolutely secure in its clips, and not only must it be wired strongly and directly to the grid terminal of the valve and to the ·0002 mfd. condenser at one end and to the potentiometer at the other end, but all these terminals must make efficient metallic internal connection with their component parts.

The grid we have already dealt with, making sure that the grid legs really do get a firm grip upon the valve legs. The plate-leg contact is equally important. As you have changed the grid condenser we do not suspect this component, but have you carefully overhauled the potentiometer?

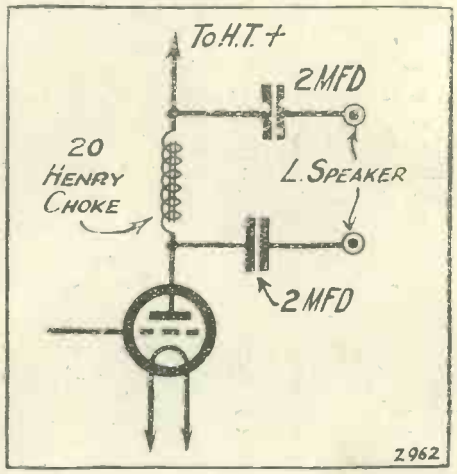
Possibly its slider is not pressing down firmly upon the turns of wire, in which case the whole of your grid circuit will be "in the air," instead of connected to the filament circuit via the potentiometer. All the foregoing points must be satisfactorily accounted for, and then, if the trouble still exists it probably lies in one of the flexible leads used to connect the coil holder. A broken lead here can cause no end of trouble, and we should not be at all surprised to learn that this is the explanation of the fault.

Potentiometer failure, due to bad contact between the wire and slider, is an equally common cause of trouble, so that apart from the ordinary snags met with in home-made sets, such as dry joints or other chance contacts there are quite a number of little points you will have to watch carefully before the trouble can be tracked to its origin. However, we have received so many glowing accounts of the performance of the "Sydney Two," that we do not doubt you will get the set to work quite satisfactorily when you have located the particularly tricky fault which has developed, and we are especially confident of your success in view of the fact that you succeeded in picking up America in the only hour or so that the set has been working properly. We quite expect that when it does go it will bring in Sydney with plenty of punch behind him.

"A NASTY SPARK."

S. V. K. (Dover).—"The set goes perfectly, but what worries me is a nasty spark nearly every time I take out an H.T. plus or H.T. negative plug. I can see this little spark at the battery socket. And it seems to me there must be a waste of current somewhere. How can I stop it?"

LOUD-SPEAKER "FILTER" CIRCUIT.



In the "What is Wrong?" diagram last week, the value of the choke was given as 20 microhenries, and that of the fixed condenser as ·2 mfd, instead of as shown above. (If only one fixed condenser is available, the one joined to the plate terminal may be omitted.)

You have a large fixed condenser connected across the H.T. battery, and it is the current required to charge this that causes the spark. Disconnect the condenser and you will probably find that the "nasty spark" has gone. If reproduction seems just as clear as formerly, the condenser can be left disconnected.

VALVE FOR THE FILADYNE.

"Experimenter" (Accrington).—"I am always trying different hook-ups, and recently I came across a diagram of the Filadyne—and nearly had a fit! Will it really work, with 'phones and H.T. and reaction connected to grid, and the plate to earth? I should very much like to try it, but have only got old valves to use in it (because the family want the main set on all the time). Will an old D.E.6 be all right for the Filadyne?"

Get busy on that Filadyne right away, "Experimenter," for the old D.E.6 is a pearl of great price in a Filadyne set, and we expect that the "fit" that you got from the diagram is nothing to the surprise that the set itself will give you!

The last Filadyne one-valver that we tried a D.E.6 in gave twenty-four different foreign stations, clear in the 'phones, the first time the dial was rotated! (With the Marconi-Osram D.E.2 L.F. and an Ediswan D.R.2 it was good, but the old D.E.6 was in a class by itself as far as Filadyne results were concerned.)

FLASH-LAMP BATTERIES.

"Flashy" (Leeds).—"I've got seven flat flash-lamps, like you put in flat pocket batteries, and four of those ordinary tall, round batteries that they use for ringing door-bells. It's a one-valve set, and is marked 30-60 volts H.T., so can I use these batteries for the H.T.? If so, which is negative and which is positive, how much voltage have I got, and does it matter how they are joined, so long as it is positive to negative all through?"

In the flat flash-lamps the long contact strip is the negative one. In the tall round batteries the negative terminal is the one on the outer edge (not the one

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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 1208.)

at the centre, which is the positive). The tall round ones are single cells, each about 1½ volts. Each small, flat battery contains three small cells, connected in series, so that the voltage of these is 4½ per flash-lamp.

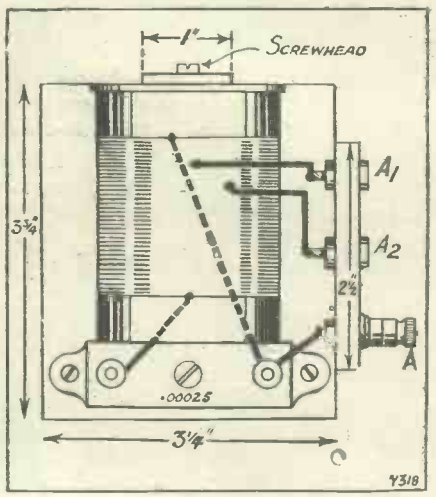
Your seven flash-lamps will give you a total of about 31½ volts, joined as you suggest, and the four big cells will add only another 6 volts. The important point about connections is to make them firm, and get positive to negative all through the battery. Probably the large cells are hardly worth putting in, as their voltage is so low, though they will last much longer than the smaller type.

THE "P.W." WAVE-TRAP.

S. T. (Fulham) and OTHERS.—"Where can details of the 'P.W.' Standardised Wave-Trap be obtained ?"

These details were given in "P.W." for November 19th, 1927, and for the benefit of readers unable to obtain a copy they are summarised below:

The standard trap is assembled upon a small wooden baseboard, measuring 3¾ in. by 3¼ in. and about ¾ in. thick, the intention being that this baseboard shall be screwed down directly upon the wooden base of the receiver. The coil is mounted on this in a horizontal position, with its centre at a height of two inches above the bottom of the small baseboard. This point of the height of the coil is of importance in cases where the trap is screened, the position of the trap inside whatever screen is used naturally being a matter which must be watched. The coil is wound upon a piece of ebonite, Paxolin, Pirtoid, or similar good material, 2 in. in diameter and 3 in. long, and this can be mounted in any convenient fashion which does not entail the use of large pieces of metal. In the trap illustrated, the method is to fix an ebonite end disc into the tube, and attach this by means of a screw to an upright strip of



three-ply wood, whose lower extremity is similarly secured by means of screws to the edge of the little baseboard.

The coil consists of sixty-four turns in a single layer of either No. 28 D.C.C. wire or, alternatively, the same number of turns of 9/38 Litz wire, the material to be used depending upon certain considerations which will be explained in a moment. As the coil is wound, tappings are made in the sixteenth and twenty-fourth turns, these being the alternative positions for the aerial tap, the ends of the winding being secured by the simple procedure of passing them through two small holes drilled in the tube at the correct points, while the two tappings may be made in a variety of ways. For example, in the case of the solid wire, the whole coil can be wound without making any tappings whatever, and then the sixteenth and twenty-fourth turns can be prised up slightly with the blade of a pocket-knife, and two short pieces of match stick about half an inch long slipped under them. The wires thus lifted up can be scraped bare of cotton covering by means of a knife, and the appropriate leads soldered on to them.

In the case of the Litz wire, however, a somewhat more elaborate method must be adopted, since it must be remembered that in making connections to a Litz coil at any point, it is essential that a good soldered joint should be made to every strand of the wire. In this case, then, the simplest way is to regard each tapping as a finishing point of the coil, cutting the wire and passing the end through two small holes as before. Then drill two more small holes further round the tube, and secure the end of the wire from the reel as before, and carry on winding until the next tapping point is reached, where the process should be repeated. At each tapping point, therefore, the coil will be broken and two ends will be left sticking out. The ends of the strands should then be bared at these points, and all carefully soldered together, the two ends next being soldered to each other and to the connecting wire.

This point brings us to the question of whether Litz or solid wire is better. The answer is that Litz should by all means be used by the constructor who feels that he has had enough experience of soldering and handling fine wire to be certain of making a really perfect joint at each point. (At one time it was believed that Litz wire was not of much value on the broadcast band of wave-lengths, but more recently research has shown us that even on these waves there is a very definite advantage to be gained by the use of this stranded material.)

It is, therefore, desirable that it should be used in this case, provided that the constructor is quite certain that he can guarantee a perfect joint.

This is absolutely vital, and if you feel the least doubt about it by all means use the solid wire, and be sure of a coil which is at least reasonably good, instead of running the risk of one which is definitely bad (which may easily be the result of an unskilful attempt to use Litz).

Mounted upon the baseboard immediately beneath the end of the coil is a small variable condenser of the compression type which is now becoming so popular for work of this sort. The one actually used in the trap illustrated was a Formodensor, a product of the Formo Company (Arthur Preen & Co., Ltd.), the capacity of this component depending upon the wave-length of the station it is desired to eliminate. If the wave of your local station is below 400 metres, a ·00025 mfd. or ·0003 mfd. will be required, while if it is 400 metres or over one of ·0005 mfd. should be chosen. (The alternative capacities of ·00025 or ·0003 mfd. have just been given because in some makes only a ·00025 mfd. is available, whereas in others a ·0003 mfd. is produced and, as a matter of fact, either will serve.)

These components have a screw-down adjustment which can be performed by means of a screwdriver and, of course, the condenser can be left permanently set to the correct capacity once this has been found.

Screwed to the edge of the baseboard of the trap is a small piece of ¼-in. thick ebonite, 2½ in. by 1½ in., carrying a terminal and two sockets such as the Clix or Eelex types, these being for the external connections to the trap. In use, the lead from the set to the trap will be connected to the terminal, while the aerial lead will terminate in a plug which will be inserted in one or other of the sockets, according to the number of turns on the coil which it is desired to use for coupling purposes.

A Handy Device.

It may, perhaps, be as well to point out here that this standard trap forms a very useful component for all sorts of purposes, in addition to its uses of a "shutter out" of the local station. It provides, in effect, a complete tuner for simple purposes, with a moderately selective coupling scheme for the aerial and earth. Thus, if one wishes to rig up a stand-by set in an emergency, all that is necessary is to connect a valve or crystal and 'phones across the tuning condenser in the trap, connect earth to the terminal and aerial to one or other of the sockets, and the receiver is complete.

When a screening box is used, a suitable hole must be drilled in the box, when a long-bladed screwdriver can be inserted and the adjustment made quite easily.

THE "ECONOMY" FIVE.

(*Continued from page* 1182.)

through one of the holes, a piece of Systoflex covering. You can, if you like, use Systoflex throughout.

Perhaps you will be a little puzzled by the fact that there are three connections to the variable condensers C_2 and C_3.

C_2, for instance, has two leads taken from the upright terminal pillars to the screens. These pillars, however, are both joined to the same set of condenser vanes (the moving vanes), and the two leads were only employed with a view to improving the rigidity of the screens and simplifying the wiring. In the case of C_3, the lead from the second screen could just as well have been taken to the pillar to which the reaction condenser lead is connected. It is merely a matter of convenience in wiring.

Operating Details.

Now a few hints on the operation. Connect up the batteries. Join the aerial lead to terminal A_2 and the earth lead to E. For the lower B.B.C. wave-band place a No. 35 coil in the primary coil holder (aerial coil), and a No. 60 in the secondary coil holder. Insert two standard split-primary H.F. transformers in the 6-pin bases

In sockets V_1, V_2, and V_3, place three valves of the H.F. type, such as the Mullard P.M.5X, Marconi or Osram D.E.L.610, Cossor 610H.F., etc. In socket V_4 insert a valve of the L.F. type if your transformer has a high ratio, or a valve of the H.F. type if the instrument is one of those having a ratio in the neighbourhood of 3–1.

For V_5 you will need a power valve, and if the volume you wish to handle without distortion is very large, a super-power valve will be better. Adjust the grid bias according to the makers' instructions for the particular valves and H.T. voltage you are using.

Switch on the valves and try the following H.T. voltages: H.T + 1 and + 2, about 80 volts; H.T. + 3, about 120 volts.

Neutralising The Set.

Place the reaction condenser at zero, and rotate the vanes of the neutralising condensers to the "out" position. Now try adjusting the three tuning condensers. You will probably find that directly the three circuits are brought into tune the valves will oscillate, and if you touch one of the sets of fixed vanes with your finger you will get a loud "plop." If so, start adjusting the neutralising condensers a little at a time, all the while testing for oscillation by touching the fixed vanes of the tuning condensers When the neutralising condenser vanes are about $\frac{1}{3}$ to $\frac{1}{2}$ in mesh, you should find a point at which oscillation ceases, i.e. touching the tuning condenser fixed vanes will only produce a "click." Then rotate the reaction condenser slightly, and endeavour to find a position for the neutralising condensers which will permit the maximum amount of reaction to be used without the set oscillating.

The receiver may be said to be neutralised when the final setting of the two neutralising condensers gives perfect stability over the wave-band covered by the particular set of coils and H.F. transformers in use.

WHAT has become of the Australian stations of late? The writer has only heard 3 L O once during the last fortnight, and 2 F C seems to have retired from business altogether. Not so the Americans, and fresh detachments of the W G Y brigade seem to appear on the scene occasionally. The latest is 2 X A I, working on about 42·5 metres, and has been heard by several readers at about 11 p.m.

Why does 5 S W operate at 24 metres? That question is being asked by most of our short-wave enthusiasts in the Dominions who take a real interest in 5 S W; more so, I venture to say, than anyone in this country, in an official position or otherwise. The 24-metre transmissions cannot be heard over such a wide space of time each day as they could if they took place on, say, 30 metres, for 24 metres comes well within the band of "daylight waves." Apparently 2 X A D (on 21·96 metres) is also not nearly so popular in the colonies as the 33-metre 2 X A F. Why so low, 5 S W?

Transmission "Tails."

The designers ot the high-power commercial short-wave stations are still experiencing trouble with "tails" to the transmissions, caused by the arrival of two or even three sets of wave-trains, one of which arrives direct while the others have been either once or twice round the world before being refracted or reflected downwards. So strong may the first set of these tails be in extreme cases that it is impossible to send at any speed without running into all kinds of trouble with the recording apparatus. If you listen to W I K on 22 metres you will sometimes notice his "tails" very prominently displayed. On some occasions they sound like a faint echo, giving the signal that well-known "hollow" effect, but at other times they are so strong that the "W" becomes a "P," the "I" an "S" and the "K" a "C." It took the writer quite half a minute recently to discover that the mysterious station sending "P S C" was W I K.

"Fade Out" Experiments.

It would be interesting to know how much could be done to eliminate the "fade-out" after dark of short-wave stations within a certain range by experimenting with different designs of aerials for both receiver and transmitter. At the present time the French amateur stations seem to disappear at about 4.30 p.m., although one or two solitary stations will sometimes continue to "break through" until half an hour later. The writer has kept schedules with two stations in Stockholm who are extremely close to one another, and has found that one is audible for a good hour later than the other after dark, although during daylight they are almost indistinguishable.

W. L. S.

NEWS FROM SAVOY HILL.

(Continued from page 1186.)

The solo artistes are Walter Widdop, the famous tenor, and Arnold Trowell, who is regarded by many as the finest British 'cellist. The public will, of course, be admitted to the concert, and we have been asked to state that tickets will be available at 5s. 9d., 3s. 6d., and 2s. 4d., the usual popular prices fixed by the B.B.C. A week later, on Tuesday, February 21st, Sir Henry will be conducting the tenth of this season's concerts of the Liverpool Philharmonic Society, which is to be relayed from the Liverpool and Daventry Experimental Stations. The programme is a particularly interesting one and includes Elgar's symphonic poem "Falstaff," which it will be remembered the composer conducted at one of the National Concerts in the Albert Hall last year, a choral work, "Sea Drift," for baritone solo, chorus and orchestra by Delius (a work which has not yet been broadcast), and another new orchestral suite by Dohnanyi. The soloist will be Roy Henderson.

Mr. Lloyd George.

A special St. David's Day programme is to be broadcast from Daventry (5 X X) on Thursday, March 1st. It opens at 8 p.m. with a Welsh Community Singing Festival, relayed from Rhos and supplied to the Daventry aerial via the Liverpool Station. The festival, of which listeners will hear an hour, will be followed at 9.20 (after the reading of the second General News Bulletin) by the speeches at the Welsh National Dinner of the Cardiff Cymrodorian Society, relayed from the City Hall, Cardiff.

The Rt. Hon. Lloyd George, M.P., is the guest, and his health will be proposed by the president, Mr. Gwilym Hughes. The response by Mr. Lloyd George will then be broadcast both from the Daventry and London stations, after which 5 X X listeners will hear further speeches from the dinner, namely, that of "Wales To-day and To-morrow," proposed by the Lord Mayor of Cardiff, with a response by Mr. John Rowlands, C.B.

(Continued on next page.)

NEWS FROM SAVOY HILL.

(Continued from previous page.)

The Leicester Band Festival.

A part of the fifth annual Leicester Brass Band Festival is to be broadcast from London and other stations between 8 and 9 p.m. on Saturday, March 3rd. The festival is to take place in the De Montford Hall and is an exceedingly important event in the Midlands. The festival claims to be the third largest in the whole country for any purpose, and to hold pride of place as the largest in the world held purely for charity.

It is arranged in aid of the Leicester Royal Infirmary, and upwards of fifty bands from all over the country take part. The playing of the test pieces begins at 11 o'clock in the morning and is carried on uninterruptedly until about 7 p.m. The actual part to be broadcast will be a specially arranged performance in which twelve selected bands, each of twenty-four performers, will take part.

5 G B and the Children.

Striking confirmation of the tremendously widening interest of listeners in the Daventry experimental station is found in the big increase in the membership of the Birmingham Radio Circle. Since the old 5 I T transmitter was displaced by 5 G B, the circle has added to its numbers by leaps and bounds, which is all the more surprising when the flourishing state of radio circles at other stations, and particularly at some of the relays, is remembered, and regarded as it must be, as an integral part of their work.

Recruits to the 5 G B circle, from all over the British Isles, are enrolling daily and the total membership now exceeds 12,000, of which more than 1,000 joined during the last three months. Children's letters are coming in at the rate of between 80 and 90 a day. About a year ago it was decided to endow a Radio Circle cot in the Children's Hospital, Birmingham, the sum required being £1,000, of which £600 has already been received. The keenness of children is one of the most encouraging aspects of a station director's work, and Birmingham's young listeners have already raised sufficient money to provide numerous hospitals and institutions with wireless sets.

PLEASE MENTION "POPULAR WIRELESS" WHEN REPLYING TO ADVERTISEMENTS

APPARATUS TESTED.

(*Continued from page* 1200.)

The slightest fading or falling off in reception conditions and the station is lost, and one single stage of fairly effective H.F. amplification would make all the difference.

For some time past the Igranic Company has concentrated on the subject of high-frequency amplification on the short waves, and at last they appear to have solved a problem which has faced many research workers in the past and produced an efficient and practical three-valve set incorporating a stage of high-frequency amplification. It is by no means a standard arrangement, and incorporates a special scheme of neutralising, and very special precautions have been taken to isolate the H.F. components. The sample set submitted to us was tested under the supervision of W. L. S., our well-known short-wave correspondent.

REPORT FROM W.L.S.

We have recently had on test the new short-wave receiver incorporating one stage of neutralised H.F. amplification, produced by Igranic Electric, Ltd. This receiver is perfectly conventional in appearance, and there is nothing to suggest that it is intended for short-wave work. The whole design and lay-out is extremely neat, and one feels at once that the wiring has been reduced to a minimum and that nothing could be further simplified. There are three controls on the panel—aerial tuning, anode-tuning condenser, and reaction control—in addition to a small neutralising condenser, a 'phone jack, and a key switch. Full instructions for neutralising the set and making the few initial adjustments necessary are supplied with the set, and it is sufficient to say here that if they are acted upon (and they are perfectly clear and concise) the operator can hardly fail to be satisfied by the results. The aerial tuning condenser becomes little more than a vernier control, the operation of tuning with the anode condenser and reaction condenser being no more complicated than is the case with an ordinary short-waver with no H.F. This, of course, after the H.F. stage has been correctly neutralised.

Two sets of coils are provided, covering between them a range of about 15-70 metres. The set oscillated smoothly over the entire range with several different types of valves in the H.F. and detector sockets, and the background was commendably silent.

The Igranic concern is certainly to be congratulated on making the H.F. valve do some real work (for it certainly does), and this receiver probably foreshadows very important developments in the use of H.F. for the short waves. As it is, this one stage gives a considerable gain in both sensitivity and selectivity.

Actual stations heard on test included 2 X A D and 2 X A F (Schenectady), 3 L O (Melbourne), and amateur stations in all six continents, including two in China and several in Argentina and Brazil.

The set is altogether a really good investment for the "DX man" who wants to get all that is going without undue complications, but who has sufficient intelligence to use the three controls to the best advantage.

Messrs. Igranic supply kits of parts and instructions for building this interesting set. Recently they have produced an H.F. choke which, when incorporated in the hook-up, enables the set to operate on ordinary broadcast wave-lengths. Special "B.B.C." coils, covering 250 to 525 metres are also available at 30s. the set.

COLUMBIA H.T. BATTERIES.

During the past three or four months we have had a number of Columbia High-Capacity H.T. Batteries on test. These were sent to us for the purpose by J. R. Morris, of 15, Kingsway, London, W.C., who handle these well-known accessories.

The batteries are of the type No. 4780; 60-volters, which retail at 22s. 6d. each. They have given almost abnormal outputs under arduous laboratory conditions, and if used for ordinary radio receivers would have very long lives.

Despite their high capacities they are not particularly bulky, as they incorporate a special construction which makes them very compact.

TECHNICAL NOTES.

(Continued from page 1186.)

Zampa. The electro-magnetic unit is supplied separately and also the special paper for making the cone. A diagram and full instructions are supplied with the latter, and the materials are adapted for making cones of three different diameters, 3 ft., 2 ft., and 1½ ft.

In this way the home constructor can make up for himself, with very little trouble and expense, an efficient cone loud speaker, and furthermore, he can, at negligible extra cost, try the effect of the three different diameters of cone, using, of course, the same electro-magnetic unit. The cone, when finished, may be varnished and decorated in any way which the constructor may think fit.

The cost of the home-made article is quite a small fraction of that of corresponding commercial articles, whilst the efficiency should not be seriously less; in fact, a careful and experienced constructor should be able to make a cone loud speaker in this way equal in efficiency to the manufactured instrument

Condenser Materials.

A condenser should be made with insulating material as good as possible, having regard to the cost of the article and the other conditions, such as available space, and so on. Naturally, extra efficiency is always to the good, even though it may be in excess of the requirements of the particular case, provided, as I have already indicated, that it does not involve other drawbacks.

TEST TRANSMISSIONS FROM MELBOURNE.

THE short waves are forever springing surprises on one. The latest, and certainly the most pleasant that I have had for some while, occurred on a recent Sunday evening between 6.30 and 8.30.

As a general rule, at least in the writer's estimation, the absence of atmospherics and that familiar "lively" noise can usually be taken as an indication of a bad evening for distant reception. Yet, curiously enough, it was on such an evening as this that a very strong carrier wave was located on about 32 metres. The carrier resolved appeared to be that of a station transmitting a choir, and the voice of the soloist was sufficiently clear for it to be recognised as English.

Knowing full well that harmonics are prevalent on short waves and in view of what certainly appeared to be a bad night, it was no small wonder that the announcement was awaited without very much interest. Imagine the surprise when an announcement issued from the loud speaker to the effect that it was 3 L O, Melbourne, testing on 32 metres!

Note This Coincidence!

From this announcement (at about 7.45) until the end of the transmission, signals remained reasonably constant and were at all times readable from the loud speaker on three valves.

It seems more than a mere coincidence that the night, or rather morning, of the Dempsey-Tunney fight was similarly almost free from atmospherics, and yet on this occasion as well the writer received over four hours broadcasting from 2 X A F on the loud speaker.

For the benefit of short-wave enthusiasts, the Melbourne station announced that test transmissions on 32 metres would be given on Monday mornings from 4.30 to 6.30 Melbourne time (6.30 to 8.30 G.M.T., Sunday evenings).

Reports on these transmissions should be addressed to station 3 L O, Melbourne, Australia.

C. T. K.

COMPONENTS THAT HAVE MADE POSSIBLE THE SIMPLEST SET IN THE WORLD

IT has taken months of careful investigation to find just the correct components to achieve the remarkable success of the MASTER 3. But it has been well worth while. Tone, Volume, Distance, they're all there in a master set which costs very little and which any one of you can build in one hour. You don't have to worry about soldering, and the job that previously took hours is now a matter of minutes. Anyone who has heard the R.I. and Varley Bi-duplex wire-wound Resistance Capacity Coupler will have no doubts as to the quality of reproduction in the MASTER 3. The National Physical Laboratory Curve, taken under normal working conditions, shows the amplification to be absolutely constant over the whole range of audible frequencies, with the result that the high and low notes are equally rendered, giving that perfect musical balance which adds such realism to wireless reception. The R.I. and VARLEY General Purpose Transformer has played a big part in the success of the MASTER 3. This wonderful little transformer—ratio 4 to 1—can hold its own against the most expensive transformers to-day, and it costs only 15/-. "Popular Wireless," January 7th, writes: "It must have been very skilfully designed for it gave results far superior to those its price would lead one to anticipate. We must admit it falls very little short of transformers in the one-pound class."

Your local dealer can supply these R.I. & Varley components—if you experience any difficulty write direct to us enclosing his name and address and your order will have our immediate attention.

Bi-duplex Wire-Wound Resistance Capacity Coupler. Type A. Price 20/-

General Purpose Transformer (ratio 4 to 1) Price - - - 15/-

Mullard

The Master Three

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R/R

REGISTERED AT THE G.P.O. AS A NEWSPAPER.

AWAY WITH THE FOUR-VOLTERS (See Page 1226.)

Popular Wireless

Every Thursday PRICE 3d.

No. 298. Vol. XII. INCORPORATING "WIRELESS" February 18th, 1928.

Special Articles This Week

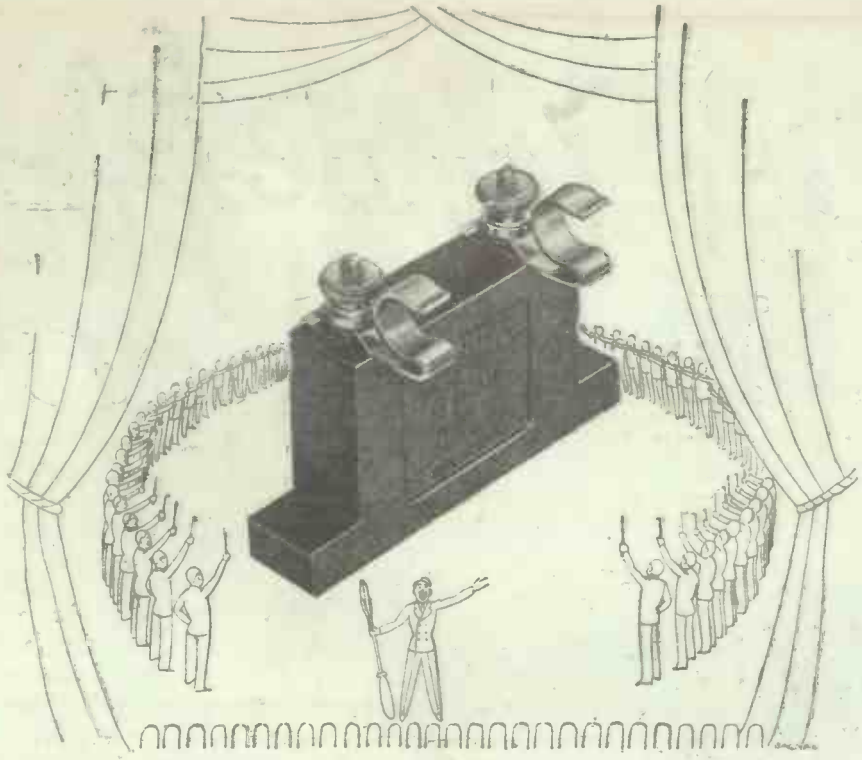
EFFICIENT SHORT-WAVE COILS AND CHOKES
(A long, brightly illustrated article, showing you simple methods of construction)

Concerning Condenser Connections. H.T. Battery Economy

HOW TO BUILD THE "CRYSTATUBE"
(A novel valve-crystal set)

THE CONSTRUCTION OF A WAVE-TRAP CRYSTAL SET

Dr. Alexanderson, an American scientist, has carried out several promising television experiments during the past few months. He is seen in our cover photo (centre) watching a demonstration of his devices being carried out by engineers of the American General Electric Co.



The Solderers' Chorus

THE vast army of constructors, expert and amateur alike, hail Dubilier as "the perfect condenser."

They have done so for years past.

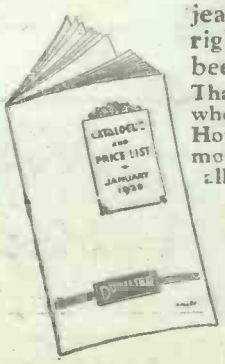
They know that Dubilier Condensers are old and trusted friends worthy of their implicit confidence because made of very high-class materials by craftsmen who understand what they are about.

They know that no reduction of price has been sought by the skimping of details.

They are themselves painstaking and jealous over the sets they bui'd and they rightly expect that the manufacturer has been so over the components he makes.

That is why Dubilier Condensers are demanded wherever wireless sets are constructed.

How else to account for the fact that there are more Dubilier Condensers sold than there are of all other makes put together?



All Dubilier Products are fully described in the catalogue shown here. In addition there is a lot of information which you may find interesting. If your dealer has run out of copies we will forward you one free.

Dubilier Mica Condensers.
Types 610 and 620 (vertical):
0.00005 to 0.0009 mfd., 2/6
0.001 to 0.006 mfd., 3/-
0.007 to 0.009 mfd., 3/6
0.01 mfd., 4/-
0.015 mfd., 4/6

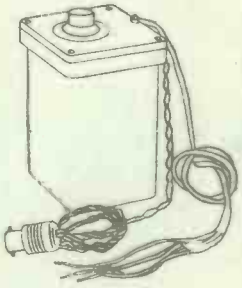
DUBILIER
REGISTERED TRADE MARK

DUBILIER DICTA

No. 7.

In the last notes under this heading we indicated how, if you have electric light, you can eliminate the troubles and misfortunes arising from the use of an outside aerial. But this is not the only way in which you can utilise your electric light supply.

If very often happens that obscure troubles in your set can be traced, on a careful overhaul, to the H.T. Battery. This is apt to receive more neglect than any unit of your set. Its voltage runs down and, therefore, its internal resistance decreases rapidly with inevitable reaction effects—effects which may be negative and productive of reduced signal strength and distortion; or which may be positive, varying with the frequency. This latter reaction produces serious distortion and a "woolly" transmission.



Why not eliminate all these and similar troubles? And why not save the expense of renewing H.T. Batteries? You can do both by making use of the electric current supply from your mains.

All you have to do is connect up a Dubilier H.T. Supply Unit from any lamp holder, at the same time removing the earth connection from the set and attaching it to the earth terminal on the Unit. There is usually no need to alter your aerial connections. You notice hardly any differences to your electric light bill!—

There are Dubilier H.T. Units for D.C. or A.C. mains (in the latter case a Rectifier Unit must also be used). Our catalogue, illustrated opposite, gives full information and working instructions for Dubilier H.T. Units.

Advt. of The Dubilier Condenser Co. (1925), Ltd., Ducon Works, North Acton, London, W.3.

Ⓓ 117

Your duty towards your neighbour!

ONE H.F. STAGE

There is a large Public who are content with reception from the local Station and Daventry, whose requirements can be met by the ordinary 3 Valve re-acted Detector Set of which there are so many varieties advertised with fanciful names. To get more than this inevitably means "oscillation" with consequent howling and annoyance to your neighbours.

The B.B.C. definitely state that one H.F. stage is essential at the following ranges, if loud speaker reproduction is to be anything but "indifferent":—

100-150 miles from Daventry.	5XX.	4 Valves.	1 H.F. stage.
50-100 ,, ,, ,,	5GB.	,,	1 H.F. stage.
Over 15 ,, ,, Main Station.		,,	1 H.F. stage.

These figures obviously allow for that factor of safety which is so necessary if consistently pleasing reception is to be obtained under all conditions.

One neutrodyned stage of H.F. will give that additional sensitivity necessary for more distant reception, with radiation reduced to a minimum.

The Met-Vick 4 Valve A.N.P. Constructor's Set is the ideal solution. With the additional H.F. stage, there is no need to force the set. Using A.N.P. coils the set is stabilised, screening is unnecessary and high voltage factor Valves can be used. Additional selectivity is provided by a Tuned loose coupled aerial circuit, brought into action when required. Delightful to operate and cheap to build, the parts with two sets of coils costing only £9.

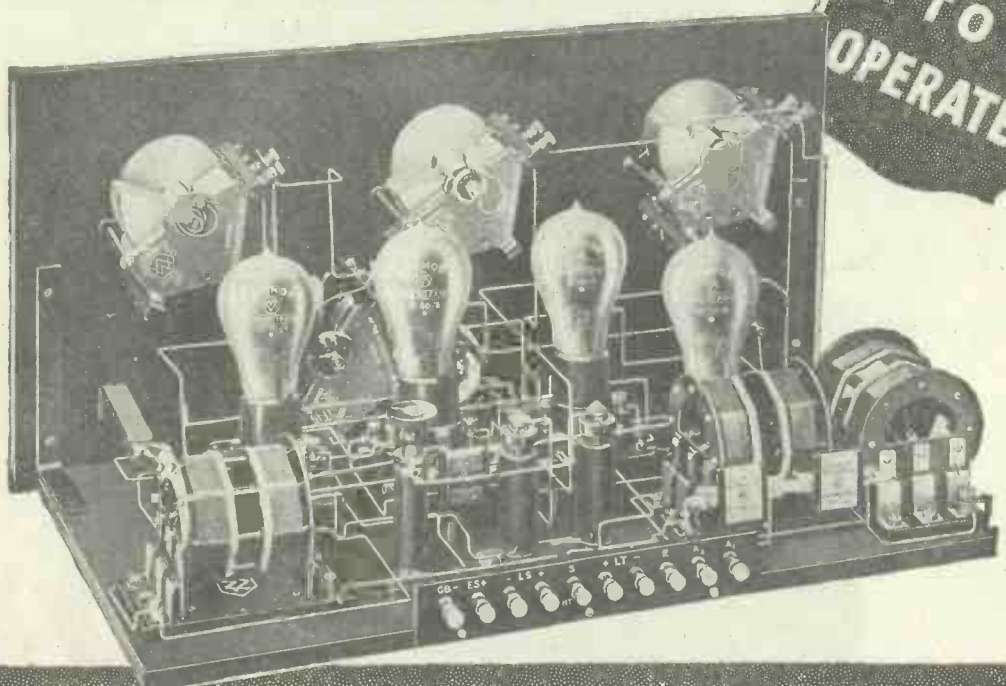
The Met-Vick A.N.P. 4 is pre-eminently the 4 Valve Set of the Day.

If unable to obtain instruction book from your dealer, write for Publication No. 7117/5 or 7117/4 (the A.C. Valve Model) free on request.

CHEAP TO BUILD

EASY TO OPERATE

MET-VICK



RP
10‡

METRO VICK SUPPLIES LTD. 155, CHARING CROSS RD. LONDON. W.C.2.

★ *P.S. See our exhibit-Block 25E, Building "C"-B.I. Fair, Birmingham.*

TEAM WORK

LIKE a flash they pass, round the arena track. The charioteer, poised aloft, holds them in perfect control. Four steeds acting together—like a machine. All in complete unison. Team Work.

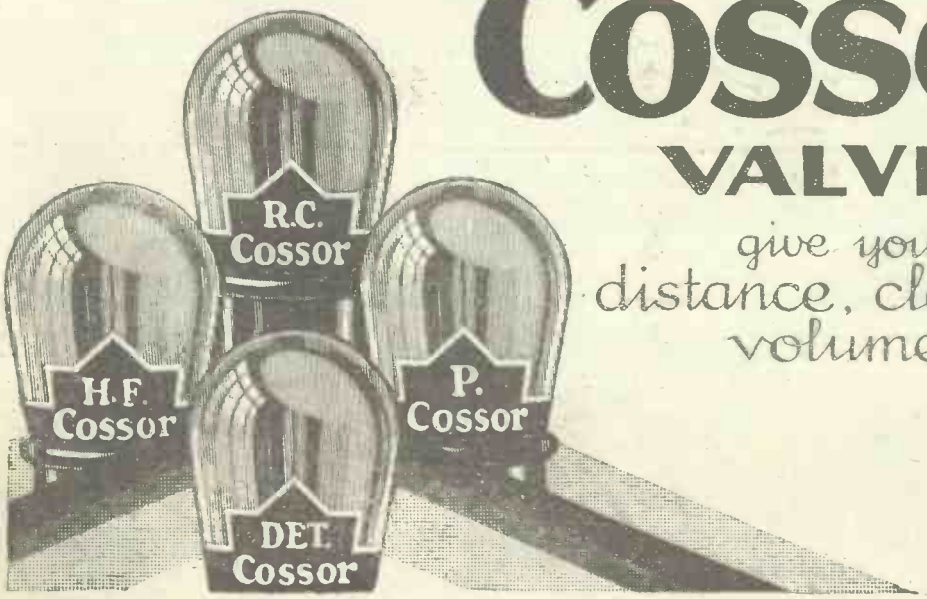
Team work is as essential to success in Radio as in the chariot race. Choose a team of Cossor Valves* and, for the first time, know the full capabilities of your Wireless Set. Because every Cossor Valve is designed to function correctly with its neighbour—acting together as a team—your Set will take on a new lease of life. It will give you purer tone, far more life-like reproduction and greater volume—for less upkeep cost, too.

The Valve that made possible the famous Cossor "Melody Maker"

* Your nearest Wireless Dealer stocks Cossor Valves for every purpose, for 2, 4, and 6 volts. From 10/6.

Cossor VALVES

give you distance, clarity, volume.



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

(A) 1821

Popular Wireless

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RADIO NOTES AND NEWS.

British and Best—A Plot Unmasked—"Muddling Kids' Minds"—This Week's Fables—Marconi Gets Busy—Amateurs, Arise!

British and Best.

THERE is no doubt that we can generally beat the foreigner if we give our minds to the job. A striking proof of the superiority of British products was given to an amazed world on February 2nd, when the B.B.C. let off a programme full of noises attributed to Mr. Gerrard Williams. No Chamber Music ever before radiated comes within a mile of it; Honegger will, I fear, be spurred to worse efforts by this masterpiece of foolery. G. Williams has beaten the highbrows to a bright green finish.

Full Details of W R N Y.

THE proprietors of radio station W R N Y have been kind enough to send me the following information, which I accept with thanks and gladly print. W R N Y transmits on 326 metres (920 kc). The station 2 X A L broadcasts the same programme simultaneously, on 30·90 metres (9,700 kc.). 2 X A L transmits on the following days:—Tuesday, 7 p.m. till midnight; Wednesday, 7 p.m. till 9 p.m.; Friday, 7 p.m. till 11 p.m.; Saturday, 7 p.m. till 10 p.m.; Sunday, 4 p.m. till 6 p.m.; all New York Eastern Standard Time. Reports welcomed at Roosevelt Hotel, 46th Street and Madison Avenue, New York City.

Mixed Zoology.

MY little joke about the Irish orator brings me the following (authentic) anecdote from a reader. A City councillor, protesting against a scheme for a grandiose wireless exhibition, said: "Gentlemen, if we take up this wild-cat scheme we shall burn our fingers with a white elephant." Full marks for that one!

A Plot Unmasked.

HIST! the B.B.C. has added a parrot to the staff. Eighteen months ago it would have been called Uncle Bingo, I suppose. Under cover of the excuse that Captain Eckersley is going to convert the bird to more mannerly ways of speech—because being an engineer his words are always restrained and well-chosen—and then teach it to broadcast talks on the "regional scheme," the B.B.C. is, I believe, pursuing the nefarious plan to make it Chief of the Committee to advise on Spoken English.

Pronunciation.

IT is of interest to read that the "Musical News and Herald" has also noticed that despite the committee of Big Guns, the B.B.C. announcers have various modes of pronouncing the same words, and is specially humorous about their manner of speaking French words. The B.B.C.'s defence of this (see "Notes" for February 4th) is a very strong argument against their own attempt to standardise pronunciation.

Newfoundland Hears Marcuse.

THE only Empire broadcaster, Mr. Gerald Marcuse (2 N M) has sent us a copy of a letter he has received from Mr. T. Cooper, who works at the lighthouse at Random Head, Trinity Bay, which is about 50 miles N.W. of St John's, Newfoundland. Mr. Cooper picked up 2 N M's broadcast on January 1st and was so delighted that he forgot all about codfish and fog for a blissful hour. This example shows the need for and the potential virtue of an Empire broadcasting service.

Where's that Spanner?

THE Bishop of Hereford has been good enough to approve of radio for its help in reconciling dwellers in the country to their uneventful existence. (Plenty of events in the country, though!) In referring to the problem of keeping the people "on the countryside," I think he may have overlooked the enormous influence of the cheap motor-car, which not only takes the people to the country but keeps them on the side—of the road.

Cables Invade Wireless.

THE Conference to consider how to save the Eastern Telegraph Company from the horrors of competition with the "Beam" radio being now in session, it is of particular interest to learn that the Mackay Cable Group has leased the old German radio station at Sayville with the

(*Continued on next page.*)

So easy to spill acid on the carpet! So difficult to remove all trace of it! Yet this can be done, with ordinary washing soda, baking-powder, ammonia, or even soap flakes. Apply one of these immediately and plentifully, till the gassing ceases and the acid is "neutralised," and then wash the carpet thoroughly. If this is done you will save the carpet—and a lot of trouble!

NOTES AND NEWS.

(*Continued from previous page.*)

object of entering the transatlantic radio-telegraph business. At present it is somewhat difficult to see with what stations on this side they will communicate, because the radio companies are not likely to desert each other in favour of a cable combine.

Transmitting Notes.

MR. E. BENHAM, 65, New Church Road, S.E.5, has been allotted the call-signal 2 A M A.

Look out for 2 M V, the station of the Malvern College Radio Society. It will be transmitting (on 150 m. to 200 m.) soon, and possibly on 45 m. also. Besides gramophone records, there will be transmitted the concerts which are given every three weeks at the College. This is real radio enterprise, and the society deserves your attention, and reports, which should be addressed to the Hon. Sec., Mr. A. E. L. Parnis, The College, Malvern, Worcs.

A Breath of Suspicion.

A NOTE of warning is sounded by J. R. W. (Derby). He suggests, and properly so, that confirmation from a foreign station of a certain transmission is not absolute proof of direct reception, because of the growing practice of re-transmission. He himself picked up what purported to be W G Y (379·5 m.) and afterwards was stunned to learn that Stuttgart had been relaying the same programme on 379·5 metres.

A Pretty Problem.

J. R. W. asks how we are to combat the confusion arising from relaying. There is no general solution, of course, except by the use of frame-aerial reception; nothing relayed by a station in Europe from America or Australia would give exactly the same compass reading as direct reception—I write, be it understood, without having exhaustively examined the geographical facts. Then, the question of wavelength would be a very convincing factor, and a good wave-meter would probably go far to remove any doubts. This matter is important and I should welcome readers' opinions.

Needs Supplied Promptly.

A WRITER in the "Richmond Herald" says that there are three urgent needs in broadcasting. (1) Applause; a means of informing the broadcasting authority whether a programme is appreciated. Answer: Unnecessary. No letters of complaint means satisfied listeners. (At no time can *all* listeners be satisfied.) (2) Means of identifying a station. Answer: Call-signal and pronunciation of announcer. (3) Simple measurement of signal strength. Answer: Not necessary. Can you hear the stuff well, or can you not?

Ultra-Violet Rays.

IT appears to be necessary to mention that no interference is caused to reception by ultra-violet radiation. The wavelength of these rays is more than a stone's throw from the broadcast band. Brighton listeners, please copy. The real trouble is caused by the sparking of the apparatus used to produce the rays. This is small consolation, I admit, but in the interests of science I am compelled to record it.

Telepathy Again.

IN a report of a lecture by Dr. F. W. Sumner, of Dorchester, I read: "Just as wireless could send a message from England to Australia, so could mental telepathy send a message." And: "Two thousand years ago human minds could communicate by the subconscious mind in practically the same way as wireless telegraphy to-day." Surprising that a man living so near the Marconi Beam station should have such extraordinary notions of wireless!

"Muddling Kids' Minds."

THAT paragraph of mine, concerning the determination of the B.B.C. to waste our children's school hours, has—like the Sergeant's double dose of vaccine—"*took*." I am told that the teachers resent the suggestion that they are not sufficient; I am told that the L.C.C. is lukewarm as regards radio for its schools, and I am told that a boy who went home from school after being taken off arithmetic to hear about "Dry-rot," was misunderstood by his Spartan pa and leathered for alluding to his lessons in such a fashion. There you are, you see!

SHORT WAVES.

In a London theatre the experiment has been tried of placing loud speakers all over the auditorium. Usually they are seated just behind us.—"Punch."

* * *

It is said that the English people still prefer headphones, despite the American preference for the loud speaker. It has been suggested that the reason for this is that you can't wear headphones and chew gum comfortably at the same time.

* * *

One day, after giving a broadcast, Mr. Leonard Gowings, the well-known tenor, called at his brother's house, but a little niece refused to see him.

"It—it's not Uncle Len," she sobbed. "He's—he's in the loud speaker!"—"News of the World."

* * *

A correspondent has written asking us the best way to get rid of resistance in ohms. The only thing we can suggest is that he should go to lodgings.

* * *

McNab (to Post Office assistant): "Can I no' ha' a wireless leecence for ma crystal set a bit cheaper? I'm quite deaf in one ear."—"London Opinion."

* * *

One of our readers has just joyfully informed us that he can get twelve stations on his set which he built according to details given in "Popular Wireless," viz., 5 X X, 5 G B, and 2 L O—five and five make ten, and two make twelve!

* * *

ANSWERS TO CORRESPONDENTS.

Palmer.—You overlook the fact that the first broadcasting set was made of a rib.—"Bristol Evening News."

* * *

THAT CERTAIN HUM.

There was a young man of Footscray,
Who thought wireless was merely child's play,
So he made a big set,
But all he could get
Was the "hum" of the suburb Footscray.

This Week's Fables.

"THE Daventry Shipping Forecast will now be broadcast, while London takes anything but a little pi-ah-no music." "The Governors of the B.B.C. have realised that the listening public on the whole prefer not to encourage the performance of music never before performed in this country, or of Chamber Music. They have accordingly sacked the Power Behind the Percy Pitt which Puts the Stuff into Programmes."

A New Idea.

FROM a report in a periodical called "Two Worlds," I gather that Mr. H. J. Everett, Trustee of a Spiritualist Church in Brighton, cherishes the belief that if every Spiritualist church in the kingdom were to subscribe to the B.B.C. funds the "movement" would have a justifiable right to some recognition by the B.B.C. for the broadcasting of the propaganda of Spiritualism. We do *not* believe. This child-like innocence must be derived from the second of those two worlds.

Technical Hint.

ABOUT twenty times a week I read in the newspapers that the amateur should look to his high-tension battery when he hears sounds like crackling or frying. But I warn you that this will not always track the offender, because the noise may be due to the cooking of bacon during one of Mr. Cecil Lewis' realistic broadcasts!

Wireless Telephony Extension.

IT is now possible to telephone by radio from Brussels or Antwerp to anywhere in the U.S.A. or Cuba, through Rugby. Rather wonderful, isn't it? The only fly in the ointment is the high maintenance and depreciation of Rugby, which keeps the telephone tolls at such a high rate.

Marconi Gets Busy.

IN this connection the public should be glad to hear that Marconi has recovered from his illness sufficiently to be planning new work, including a solution of the problems involved in telephoning by "beam." He will be on his floating laboratory soon, and as the highly successful "beam" system was evolved from data obtained on the "Elettra," we may be pretty sure that when he goes a-gallivanting on her there is something "in the wind." Telephony to Australia at a third of the price charged by the Post Office for American calls seems to be in his mind.

Safety First.

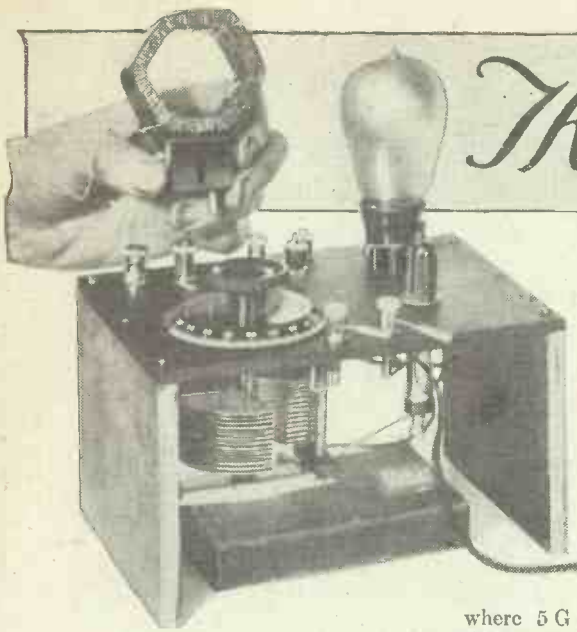
AN ingenious reader, inspired by Mr. R. W. Hallows' recent notes in "P.W." on the subject of "Safeguarding Your Valves," has sent me a little doo-flicker which he has made. Into the butt-end of a departed valve he has fixed a flash-lamp holder, connected across the filament terminals (or pins). The hollow space in the four-pin bushing has been filled with pitch from an old flash-lamp cell. And there is your valve-protector—cost nothing.

Amateurs, Arise!

THE efforts of "P.W.'s" Editor to arouse the R.S.G.B. from the fine old and crusted slumber into which it has gently declined have met with a chorus of approval from active amateur transmitters who have not been mesmerised by that super-boa-constrictor, the Post Office. R. B. (Bilston), G 2 A Y O, goes so far as to suggest the formation of a new society of transmitters, with a magazine on the lines of the American "Q.S.T." I wonder whether Mr. Marcuse, who is Britain's amateur champion, is inclined, and able, to arise and place himself at the head of a new revolution!

ARIEL.

The "Crystatube"



A novel combination of crystal and valve, which provides almost the sensitivity of a one-valver with reaction, but which is as simple to handle as a crystal set.

Designed and Described By A. S. CLARK.

ALTHOUGH the arrangement described in this article is not entirely new, as far as the author is aware, it has never yet appeared in a constructional article. It is intended to take the place of an ordinary crystal set when really good telephone signals are required, not only from the local station but from the Daventry stations as well. It is sufficiently selective to cut out the local station when listening to 5 G B, and sufficiently sensitive to give good results on a poor aerial at a larger distance than an ordinary crystal set is usually expected to work.

Very Definite Advantages.

The arrangement has certain very definite advantages. Whilst giving almost the strength of an ordinary single-valve set on the local station, it retains the simplicity of control and purity of tone of a crystal set. The selectivity can very easily be adjusted to any desired degree, and in cases where 5 G B is heard very poorly on a crystal set, it will be found to give that extra "punch" required for listening to be enjoyable. One of the greatest of its advantages is its cheapness. The very nature of the circuit tends to avoid expense, so that it has not been necessary to sacrifice any efficiency to obtain the desired low cost.

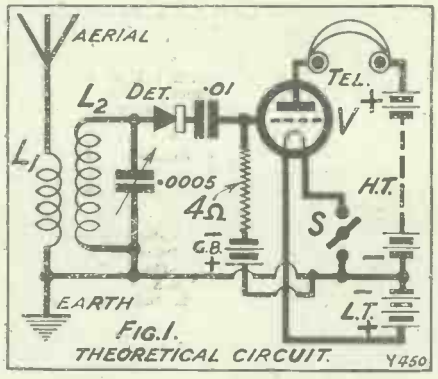


FIG. 1.
THEORETICAL CIRCUIT. Y450

COMPONENTS REQUIRED.

- 1 Panel, 8 in. × 6 in. × ¼ in. (Any good branded material).
- 2 5-ply ⅜-in. wooden supports, 6 in. × 4½ in.
- 1 ·0005 square-law variable condenser (Bowyer-Lowe popular model in original set. Any good make).
- 1 ·01 fixed condenser (Clarke, Dubilier, Igranic, Lissen, Mullard, T.C.C., etc.).
- 1 Ordinary and 1 insulating grid leak clips (Dubilier). (Alternatively, a separate holder, such as the Igranic, Lissen, Mullard, etc.)
- 4-meghom grid leak (Dubilier, Igranic, Lissen, Mullard, etc.).
- 1 Semi-permanent crystal detector (Lion, or other good make).
- 1 "On-and-off" switch (L. & P. in set. Benjamin, Bowyer-Lowe, Igranic, Lissen, Lotus, etc.).
- 1 Panel-mounting coil holder.
- 4 Valve legs.
- 8 Terminals (Plain type on set. Engraved type such as Belling Lee, Eelex and Igranic can be used if better appearance, etc., is desired).
- 2 Battery plugs.
- Quantity of D.C.C. wire and 16-gauge bare tinned wire.

The chief point of the circuit is that instead of the usual method of connecting the crystal detector directly on to the grid of the valve, as is usual with an L.F. valve without a coupling transformer, it is connected via a fixed condenser. The value of this condenser is such that it does not affect the working of the crystal detector, and passes all the necessary L.F. pulsations of current. When the crystal is connected directly to the grid of the valve, hissing and clicks are heard on adjusting, due probably to grid current flowing. This is all stopped by the fixed condenser, but it is necessary to insert a grid leak so as to prevent the grid from choking and thus producing distortion. The grid leak incidentally provides an easy method of applying the necessary grid bias so that the valve may be worked on the best part of its characteristic curve.

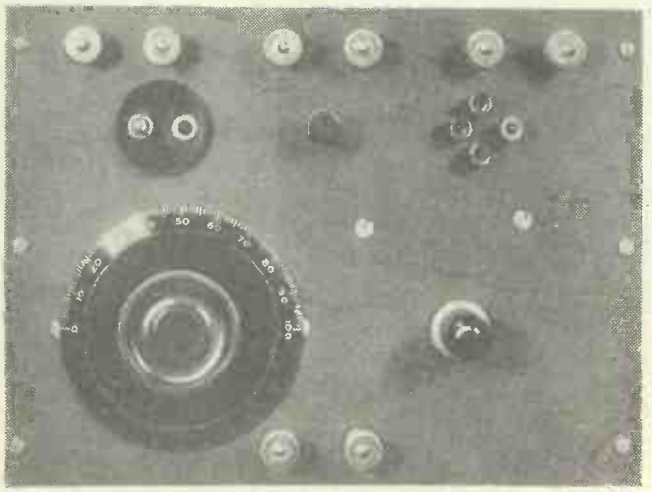
> **"One of the greatest of its advantages is its cheapness. The very nature of the circuit tends to avoid expense, so that it has not been necessary to sacrifice any efficiency to obtain the desired low cost."**

There is a semi-aperiodic aerial circuit closely coupled to the tuned circuit, across which the crystal detector and valve are connected. The selectivity may readily be varied so as to suit all localities and aerials. The smaller the aerial coil, the greater the selectivity. It is as well to have the aerial coil as large as possible consistent with sufficient selectivity to cut out the local station on 5 G B's wave-length.

The semi-aperiodic aerial coil consists of a home-wound hank coil tied to the plug-in coil by means of small pieces of wire. This arrangement, whilst being cheap, permits of the variation of selectivity already described.

Bearing in mind that simplicity and cheapness were to be two of the advantages of this set, no cabinet was employed. Instead, two pieces of wood to act as supports for the panel are used, as shown in one of

(*Continued on next page.*)



Other features of the "Crystatube," the panel of which is shown above, are that it is cheap and simple to build.

THE "CRYSTATUBE."

(Continued from previous page.)

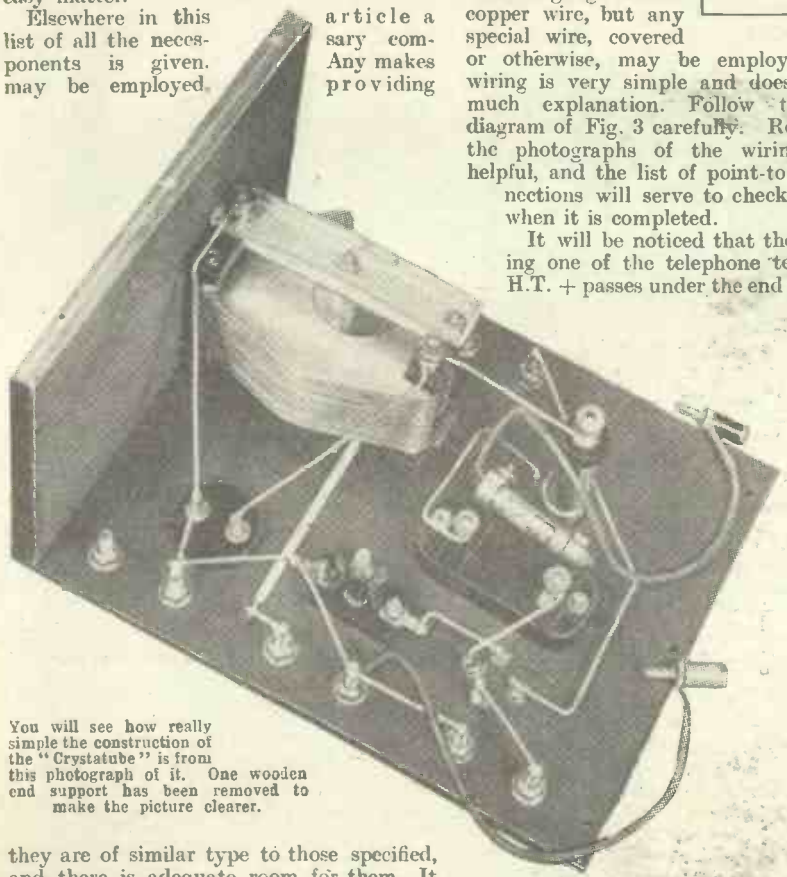
the photographs. These wooden supports are the same width as the panel and are 4½ in. deep, and are secured by six ordinary wood screws.

Although, as already stated, the receiver is arranged for use without a cabinet, one can, of course, be used if desired. In this case the panel should be fitted inside the sides of the cabinet, and fillets to support the panel should only be employed at the two ends, otherwise trouble may be experienced due to the terminal shanks and wiring fouling the wood. The cabinet should be the same depth as the wooden supports previously described, so as to allow plenty of room for a grid-bias battery below the panel.

Easy To Change Coils.

A crystal detector of the semi-permanent type is employed, and an "on-and-off" switch is provided in order that the set may be brought into operation with the minimum of trouble. The two ends of the semi-aperiodic aerial coil are connected to the same terminals as the aerial and earth, thus making the changing of this coil an easy matter.

Elsewhere in this article a list of all the necessary components is given. Any makes may be employed, providing they are of similar type to those specified, and there is adequate room for them. It is obviously important that a really sensitive detector is employed in order to obtain the maximum results.



You will see how really simple the construction of the "Crystatube" is from this photograph of it. One wooden end support has been removed to make the picture clearer.

Having gathered together all the necessary components the constructional work may be proceeded with. First of all, the panel has to be drilled. Mark it out on the back in accordance with the dimensions given on the diagram of Fig. 2, remembering that this plan is drawn looking at the set from above the panel.

After centre-punching all points where holes are to be drilled, the drilling operations may be completed. Where countersunk screws are to be used, the holes through which they are to pass must be countersunk from the front of the panel. If these holes are not countersunk sufficiently the workmanlike appearance of the set when finished will be spoilt. This also applies to a lesser extent if these holes are countersunk too much.

The next thing to be done is to mount the components. There is little to be said about this except that the smaller parts, such as terminals, are best mounted first. When the components are all mounted, all points to which soldered joints are to be made should be heavily tinned, as this simplifies the work of wiring which should now be done.

The set is wired with 16-gauge tinned copper wire, but any special wire, covered or otherwise, may be employed. The wiring is very simple and does not need much explanation. Follow the wiring diagram of Fig. 3 carefully. Reference to the photographs of the wiring will be helpful, and the list of point-to-point connections will serve to check the wiring when it is completed.

It will be noticed that the wire joining one of the telephone terminals to H.T. + passes under the end plate of the variable condenser, and is insulated with a length of Systoflex. It is as well to insulate this wire, even if the particular condenser used does not permit of its running under same. This wire is the least accessible one and should therefore be fitted first. The two leads for the grid-bias battery should be flex wires ending in two ordinary wander plugs.

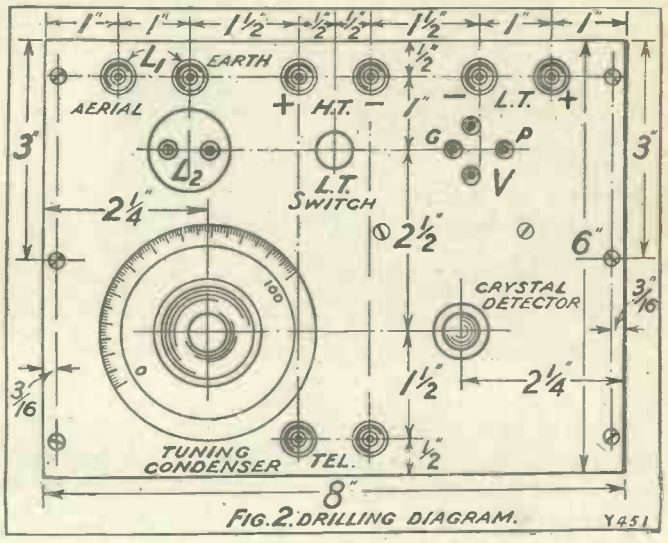


FIG. 2. DRILLING DIAGRAM. Y451

Covering The Wave-Band.

It may be necessary to twist a small piece of thin copper wire under the end of the crystal detector before it is fitted, for making contact to the end nearest the panel.

Having completed the set, attention may be turned to the coils. For the local station and 5 G B a No. 60 will be required, and for 5 X X a No. 250. The semi-aperiodic coil is wound with any convenient gauge of D.C.C. wire in the neighbourhood of gauge 24. For the lower wave-band 15 to 30 turns may be used according to the degree of selectivity required, as has already been stated. In the case of 5 X X, between 75 and 150 turns are required. Both coils are wound on any sort of former, such as a tumbler or a round tin with a diameter approximately the same as the plug-in coil. After winding the coil is slipped off and secured with short pieces of wire before binding to the plug-in coil.

The Valve To Use.

Ordinary centre-tapped or X coils may be employed, if desired. They have the drawback, however, of being more expensive and do not give the same flexibility as far as degrees of selectivity are concerned.

Any general purpose or ordinary L.F. valve may be employed, and an accumulator of suitable voltage for the particular valve chosen will be required. It is advisable to use the maximum H.T. voltage specified for the valve, so as to obtain maximum amplification. Do not use a power valve as it might introduce distortion and will most likely not give such loud signals. It is also unnecessary, as the grid swing applied to the valve is such that an ordinary L.F. valve can adequately carry it without distorting. A 9-volt grid-bias battery will be required, and should be adjusted to the voltage specified by the makers.

Only Two Adjustments.

There is really nothing to be said about the operation, since once the batteries are connected all that has to be done is to turn to the loudest point on the condenser dial, and find a sensitive spot on the crystal.

With such a set it is not possible to write a long test report, and such is not required. The set did all that it was designed to do, as explained in the early part of this article. It was tested about 8 miles S.W. of 2 L O, and a very small

(Continued on next page.)

THE "CRYSTATUBE."

(*Continued from previous page.*)

indoor aerial was employed so as to give a really fair test. 5 G B was heard at clear telephone strength, while 5 X X and 2 L O came in sufficiently strong to work several pairs of telephones at good strength.

On a good outside aerial, late one night, music from a Continental station was just audible. This latter is not mentioned as a feat to be expected, but just to show that the arrangement is really selective and that a good step up of signal strength is produced by the valve.

The Grid-Leak Clip.

It may not be quite clear to some why two different types of grid-leak clips are specified, namely one ordinary and one insulating. Both these clips fit on to the terminals of the fixed condenser in the usual manner, and if one was not an insulator the grid leak would be connected directly across the ·01 condenser. It will be seen from the circuit that this is not required, only one side of the grid leak being connected to the grid condenser. A terminal on the insulating clip makes connection to the other side of the grid leak an easy matter.

Use of Cat's-Whisker Detector.

There is no reason why a crystal detector of the ordinary cat's-whisker type should not be used, and sometimes these are found to be more sensitive than the semi-permanent type, which is an advantage. The latter type was chosen, however, because it remains adjusted to a sensitive spot once a good one is found, and is not easily upset by jolts. The switching on and off of the set is, therefore, not likely to affect it, which is very desirable in an arrangement intended to be simple in operation.

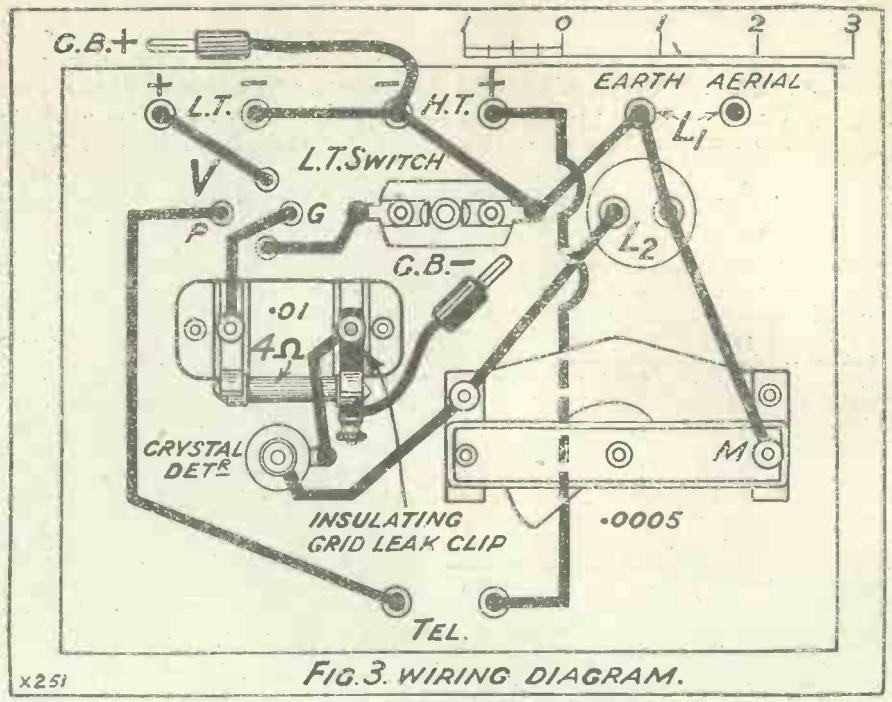
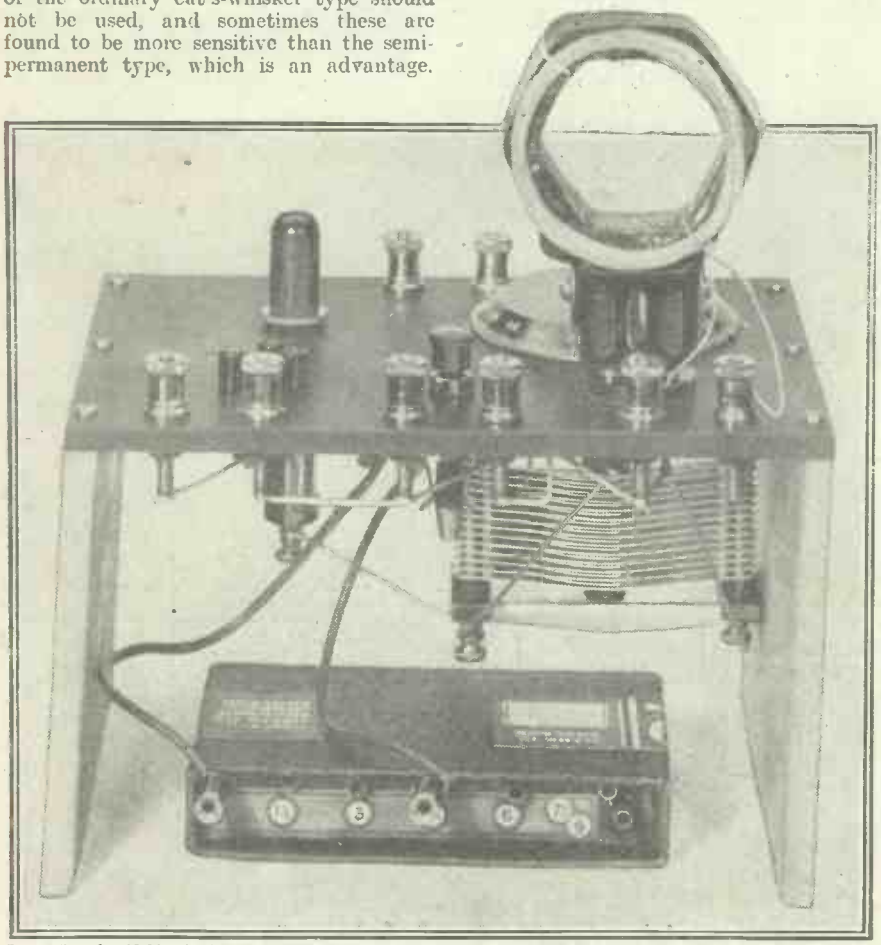


FIG. 3. WIRING DIAGRAM.



The coil and grid-bias battery are in position, and the easy-to-make receiver is ready to use. If you so desire you can fit the set into a case or cabinet.

Range of Reception.

A few words in conclusion on the range to be expected with this set will no doubt be welcome. Of course, the strength of signals will naturally depend almost entirely on the particular aerial and earth system, and, therefore, it is advisable to erect as good an aerial as possible. Height will probably be found of more advantage than length, and the earth should be as short as possible.

POINT-TO-POINT CONNECTIONS.

Join H.T. + to one telephone terminal.
Join L.T. + to one filament socket.
Join L.T. − to H.T. −, to one side of L.T. switch, to earth, to one side of L_2, and to moving vanes of variable condenser.
Join flex lead to H.T. − with red plug for G.B. +.
Join remaining side of L.T. switch to remaining filament socket.
Join grid socket to one side of ·01 fixed condenser and to one side of 4 megohm grid leak.
Join plate socket to remaining telephone terminal.
Join remaining side of ·01 fixed condenser to one side of crystal detector.
Join remaining side of 4 megohm grid leak to flex lead with black plug for G.B. −.
Join remaining side of crystal detector to fixed plates of variable condenser and remaining side of L_2.
This completes the wiring.

With an average outdoor aerial good reception from a main station may be expected up to about 20 miles, and between 60 and 100 miles from the Daventry stations. With a small indoor aerial about two-thirds the above distances can safely be reckoned. Reception from relay stations will, of course, be possible up to short distances compared with that from an ordinary local station.

AWAY WITH THE 4-VOLTERS!

The 4-volter has had its day, and now it is time to say "good-bye," and to decrease the number of valves on the market by removing this intermediate type.

By KEITH D. ROGERS.

AT the present moment there are something like 400 valves on the British market. Of these there are approximately 350 (excluding special valves) which are available for the choice of the average listener—he who uses anything from a one to four-valve set. The rest of the valves are more expensive—the special types, such as the large super-super-power valves, which are almost young transmitters.

So poor John Citizen has to scratch his head and ponder well and truly before he can make up his mind to take the plunge and choose, say, *three* out of the 350 for his new loud-speaker shaker. What a hope! No wonder he is bewildered.

". . . The 4-volter has fallen between two stools—that of economy and good results on one side, and that of super-results and expense on the other. It has neither one nor the other to offer in itself."

But let us be serious. There really are too many valves on the market—far too many. And why do we have three types—three voltages—to add to the confusion? We have 2-volters, 4-volters, and 6-volters. Surely some of these are superfluous?

What Figures Show.

Sales figures show that the 2-volt valve is by far the most popular. Next comes (a long way behind) the 6-volter, and finally (still further back) we find the 4-volter. The actual figures are somewhere about 65 per cent 2-volts, 23 per cent 6-volts, and 12 per cent 4-volts.

Why, then, do the makers keep the 4-volter on the market? It is a relic of the days when ·06 amp. valves were brought out, the salvation of the man with difficulties in charging accumulators, and of him that had to use dry batteries. They were full of "pep," but microphonic, and have long been replaced by really good valves taking ·075 to ·1 amp. at 4 volts, instead of the awkward 2·8 volts they used to require.

But we now find that the 2-volter has also so much developed that, with the exception of the super-power valve (used by remarkably few people), it is every bit as good as the 4-volter. So far it is not quite equal to the 6-volt valve, especially where large grid swings have to be dealt with, but it is certainly as good as the 4, and it requires but *half* the power to operate it.

The 6-volt valve is more or less a luxury valve for the discriminating enthusiast who needs punch, and plenty of it. The man-in-the-street cannot afford the luxury of a 6-volt L.T. battery, plenty of H.T., and 6-volt super-power valves. Why should he? He can get very good results on one-, two-, three-, and four-valve sets with 2-volt valves, a 2-volt battery, and moderate H.T.

He doesn't want to work a Rice-Kellogg; he uses a good make of hornless loud speaker. His results are worth listening to, and are obtained cheaply. If he wanted a Rice-Kellogg, and could afford it, he would use 6-volters. He doesn't want it, and he can't afford it, so he does the next-best thing. He uses 2-volters, and is perfectly happy.

Unnecessary Expense.

In other words, the 4-volter has fallen between two stools: that of economy and good results on one side, and that of super-results and expense on the other. *It has neither one nor the other to offer in itself.*

Take the L.T. question separately. For 2-volt valves we can use 2-volt accumulators at 17s. 6d., and they will last a long time on each charge on the average set. If dry cells are needed, then two will supply a ·1 valve, or valves, for a good time, and allow a useful "safety" margin of potential of 1 volt for voltage drop.

When 4-volt valves are used, a 4-volt battery is required at twice the price, and it lasts only the same time; while for dry battery work we only have half a volt "safety" drop, and three cells are needed.

Thus the comparative costs are 17s. 6d. against 35s. for initial L.T. supply, and about 1s. against 1s. 6d. for charging, each battery, whether 2- or 4-volt, requiring charging at the same time. For all this extra expense, what does the average man get extra in results? *Nothing that the ear can detect.* And, after all, he is listening with his *ears*, and not with sensitive *meters*.

	2-volt.	4-volt.	6-volt.
H.F. (screened grid)	Good	Not yet on market	Good
H.F. (neutralised) ..	Fair	Fair	Good
Detector	Good	Good	Good
R.C. Valves.. ..	Good	Good	Slightly better than 2- and 4-volts
Ordinary L.F. ..	Good	Good	Ditto
Super-power ..	Quite useful	No better than 2-volters	Good
Cost of batteries and running costs	Very moderate, well worth results obtained	High, considering results. Total results no better than with 2-volters in most cases	High, but enables superlative results if "power" is needed

Four-volt valves may give a slight increase in power, measurable on a valve voltmeter, but you cannot *hear* that increase, so it is as good as wasted. 6-volt valves give, in many cases, audibly better signal strength, and here, as I have said before, the enthusiast who wants the last ounce comes into his own—and pays for it. For ordinary household purposes the increase obtained by the use of 6-volt valves, instead of 2-volters, is not worth the expense, while that obtained by the 4-volters is negligible. No wonder 65 per cent of the British listeners prefer the 2-volter.

Let us take the valves one by one, stage by stage. We have H.F. first. Well, here, if the listener requires the best thing, he can use a screened-grid valve, and he will find that there are 2-volt valves being made equal to the 6-volt screened-grid valves, and there are no 4-volt screened-grid valves yet on the British market.

Unsatisfactory Compromise.

As detectors, the 2-volters are quite as good as the 4; as ordinary R.C. valves they are equally as good. For L.F. work carrying ordinary signals they are certainly not beaten by the 4-volter, and it is only in the last stage, if super-signals are required, that the 2-volter fails. And *here you need a 6-volter* to be any good at all; the four is merely an unsatisfactory compromise.

So we could tabulate the evidence of results and efficiencies as shown below.

Thus you see that there is really no reason why the 4-volter should not be taken off the market—gradually at first, so that stocks for those few who favour 4-volts were still available, though, in cases where accumulators were used, these could have their cells connected in parallel, and 2-volters could be employed with a saving in running costs.

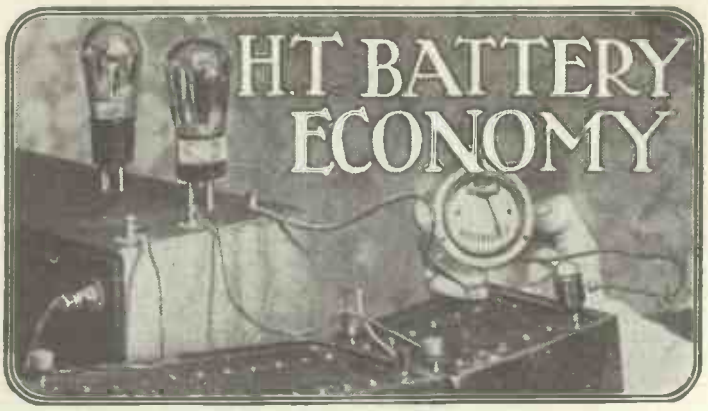
The number of valves on the market would be decreased from over 400 to about 300, and the task of the man in the street, when he wanted to choose a valve, would be proportionately simplified. The man who has to use dry cells would not be affected, as the 2-volters have low enough filament consumptions to enable him to carry on perfectly satisfactorily.

Then we should have two classes of valves to suit the two classes of listeners; 2-volters for the economy man, the ordinary household listener, and the 6-volters for the ultra-noise fiend and the experimenter who wants more power.

A White Elephant.

For well over a year the 4-volter has been more or less of a white elephant, a clog on the market. It has been taking up space in factories and dealers' shops, and has worried the wireless journals no end (adding, as it does, to the already unwieldy list of "valves to choose from"); and it now endows no benefits on the listener. The days of the ·06 2·8-volt valve, the forerunner of the 4-volter, are over. Why, then, should this obsolescent intermediate voltage be kept on?

No; the 4-volter has had its day! It came at a time when valves were scarce, accumulators dear, and filament consumption high, and it then offered us certain advantages. Those and more advantages are now available from the 2-volt valve, and we can say "good-bye" to the 4-volter without regret.



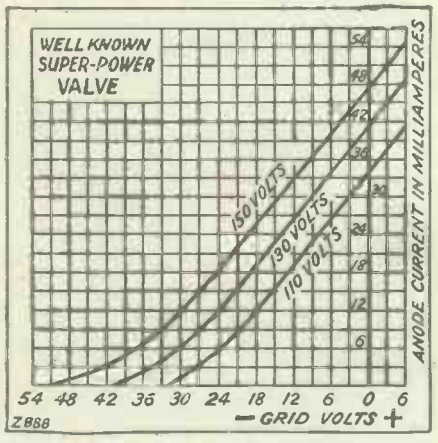
A super-power valve should be used when loud signals are to be handled, but it need not be so very expensive to run if you use it in the way suggested in this article.

By W. JAMES.

A LARGE number of amateurs use a super-power valve in the last stage of their receiver. Many of them fit such a valve because they want loud signals without distortion, the argument being that most distortion can usually be traced to the last valve. This is quite true, of course.

When loud signals are required it is quite necessary to employ a super-power valve in the output stage of your receiver, but it is of equal importance to provide that valve with appropriate anode and grid voltages. Particularly is it necessary to attend to the question of correct negative grid bias, for it is this seemingly trivial thing that determines not only whether the valve is going to be worth while, but whether the anode battery itself will have a reasonable life.

Let us look at the curve of a typical super-power valve such as that provided by the makers with every specimen. Such a curve is given below. We see that when the anode voltage is 130—a normal value, although rather lower than some of us use, the anode current is 40 milliamperes



when the grid bias is zero. The current falls to 27 milliamperes when the grid is biased negative 12 volts, and to 15 milliamperes when the bias is negative 21 volts. Ignoring for the moment the effect of these adjustments on the quality of the signals received we see, then, that the effect of grid bias is most important.

Hard on the Battery.

A dry-cell battery of normal capacity will not stand a discharge current of 40 milliamperes for long. At that rate of discharge its voltage will soon fall off. It will quickly develop a high internal resistance and probably give rise to crackling noises which will spoil reception; in fact, no dry battery of reasonable price will stand the strain of such a heavy current for more than a short time. Even with a grid bias of negative 12 volts the current is 27 milliamperes—less than when zero grid bias was used, but still more than the average battery is likely to stand for any length of time. It is only by using a grid bias of negative 21 volts that the anode current is reduced to the more reasonable value of 12 milliamperes.

We, therefore, see that the life of the anode battery is greatly affected by the grid bias applied to the valve and, in fact, we may say that the value of grid bias determines how long this battery will last.

Now a dry battery of large capacity is a costly item and is, many people will agree, liable to be the most expensive part of a wireless installation. It is apparent, then, that it will not pay us to try different grid-bias values haphazardly. Rather should we decide on a suitable grid-bias value and not alter it without first of all determining from the curve the new value of anode current which will flow. The curve supplied with the valve may not apply precisely to your particular valve, but it is at all events a curve of an average value, and therefore a tolerably accurate guide.

When Changing the Bias.

Be sure to switch off the anode battery or the filament current while changing the value of grid bias, and above all things, do not use too small a value. If you do, the life of the anode battery will be very considerably reduced, and what is almost of equal importance, the power valve itself may have its life shortened.

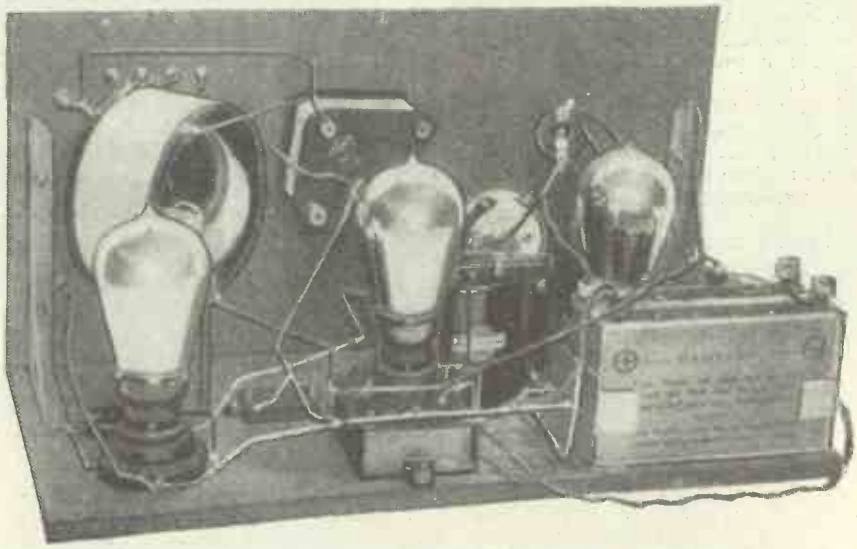
We see from the curve that when the anode voltage is 130 a grid bias of negative 21 volts brings the operating point a little to the left of the centre point of the straight part of the curve. This is normally just as it should be for good quality. Particularly is this true when resistance-capacity coupling is used in the receiver, for we have to endeavour so to bias the grid of the power valve that grid current does not flow.

Grid current is particularly apt to spoil the quality when resistance couplings are used in the amplifier, and because of this, it is usually preferable to apply rather more grid bias than one would for a transformer-coupled amplifier. This is because the distortion due to a momentary flow of grid current is not so pronounced when the amplifier is transformer coupled. In any case it is extraordinarily hard for the average listener to detect the slightest change in quality when the grid bias is varied from, say, negative 21 volts to negative 12, when using this particular type of valve.

Immense Saving.

But there is this immense difference in the results, that whereas when the grid bias is negative 12, the anode current is 27 milliamperes, when the grid bias is negative 21 volts the anode current is only 12 milliamperes. Thus, when the grid bias is negative 21 volts the anode battery will last for a much longer period of time, and will probably give complete satisfaction.

For economical working we shall, therefore, obey the following rules:—1. Use ample grid bias, often as much as 20 to 30 volts negative, depending, of course, on the valve used and the value of H.T. voltage; 2, never remove the grid bias without first switching off the valves.



The grid-bias battery can save you a great deal of H.T. current if properly used. A case the Author sites is of a power valve which will operate well when the anode current is either 27 or 12 milliamperes. The H.T. consumption is more than halved by using a certain value of grid bias!

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

RECEPTION STRENGTH VARIATIONS

WAVE ATTENUATION—ABSORPTION BY TREES.

Reception Strength Variations.

WHEN wireless waves are emitted from a broadcasting station, they gradually diminish in strength or amplitude at greater and greater distances from the transmitter, as everybody knows. A listener within a few miles of 2 L O can receive excellent signals either on a crystal detector or, using a valve receiver, upon a very short indoor aerial, or even in some cases upon the coils of the receiving set themselves without any aerial in the ordinary sense at all.

It might at first be thought that the gradual diminution in the strength of the waves (or "attenuation," as it is more scientifically called) would be the same for all places at the same distance from the transmitter. Thus you might expect that all places on a circle around 2 L O of 50 miles radius would receive waves of the same strength, whilst all places on a circle of a radius of 100 miles round 2 L O would receive waves of the same strength as one another, although, of course, of a less strength than the places on the 50 miles radius.

Wave Attenuation.

As a matter of fact, the rate at which the waves diminish in strength is not uniform at all, but varies in different directions. This is owing to the different rate of absorption of the radiation in different directions (due to variations in the nature of the ground, to the presence of trees and so on).

Some very interesting experiments on this important subject have lately been carried out by Mr. R. H. Barfield, the well-known radio engineer. A carefully designed portable receiving set was used and this was taken to a large number of different places, in different directions and at different distances from London, up to a maximum of 100 miles. In order to keep a check on any possible variations of the intensity of the radiation from 2 L O, a fixed intensity radio apparatus was installed at the radio research station at Ditton Park, Slough (this station, incidentally, has since been destroyed by fire), and the observations were simplified by the fact that the variations in the field strength of 2 L O were found to be negligible.

Contour Lines.

The results of the experiments were "plotted" in an elaborate series of contour lines upon a map, each contour line being, of course, drawn through places where intensities of reception were the same.

The map showed that the field strength within a radius of about 6 or 7 miles from 2 L O was 30 millivolts per meter, whilst in the greater London suburban area the field strength averaged 10 millivolts per meter. At places such as Bedford, Chatham, Tunbridge Wells, and Oxford the field strength had fallen to 1 millivolt per meter, whilst at Peterboro', Yarmouth, Deal, Chichester, and Broadstairs the field strength from 2 L O had fallen to between 1-5th and 1-10th of a millivolt per meter.

An interesting and important point, as already indicated, is that the contour lines are not circles. They are flattened together considerably in the southerly direction, showing that the absorption in that general direction is greater than in a general northerly direction.

Absorption by Trees.

Mr. Barfield suggests that these features of his results may be explained as being due to the well-wooded nature of the English countryside. In fact, individual experiments were made upon the energy-absorbing properties of trees and, from results on a single tree, the total energy-absorbing-property of a given tree-covered area could be calculated. The greatest absorption was found to correspond to the most wooded regions and vice versa. Another rather important point is that no great evidence of screening or other effect due to hills was noticed in the regions investigated, which included the North and South Downs and the Chilterns and Cotswolds. This is rather contrary to the popular belief that hills and uplands interfere considerably with reception.

The general observations were also checked on two other wave-lengths and similar results were obtained.

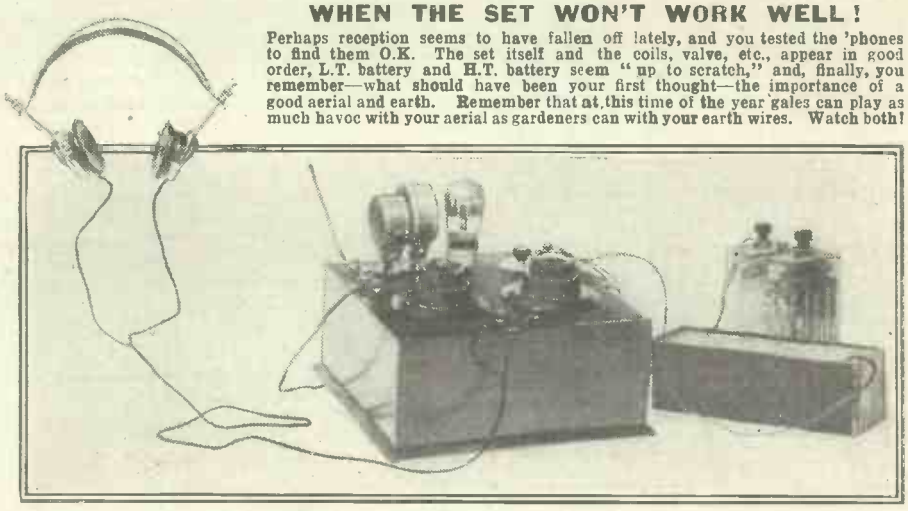
These investigations of Mr. Barfield (which have extended altogether over a couple of years) are undoubtedly a fine piece of work and an important contribution to wireless science.

Of course, there are inevitably many factors in the problem which vary from place to place, and when all is said and done there will always be peculiarities and "freak" features which influence the

(*Continued on page* 1255.)

WHEN THE SET WON'T WORK WELL!

Perhaps reception seems to have fallen off lately, and you tested the 'phones to find them O.K. The set itself and the coils, valve, etc., appear in good order, L.T. battery and H.T. battery seem "up to scratch," and, finally, you remember—what should have been your first thought—the importance of a good aerial and earth. Remember that at this time of the year gales can play as much havoc with your aerial as gardeners can with your earth wires. Watch both!



NEWS FROM SAVOY HILL. FROM OUR OWN CORRESPONDENTS.

AMERICAN PRAISE FOR CARDIFF

MRS. GASKELL FROM MANCHESTER—CAPTAIN CAZALET, M.P., ON RACQUETS.

American Praise for Cardiff.

AMONG the numerous appreciations of The Radiologue, a new form of drama introduced lately by the Cardiff Station, is one from Massachusetts, in which the writer says that, in his opinion, American stations have still a long way to go to catch up with those of the Mother Country.

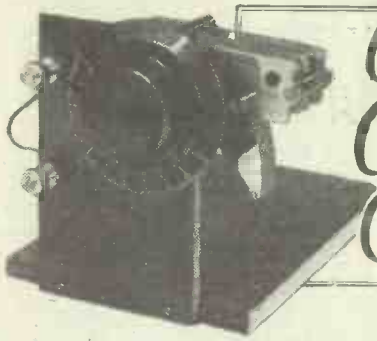
Mrs. Gaskell from Manchester.

A novel programme, and one which should have a particular appeal for Cheshire listeners, will be broadcast from Manchester on Tuesday, February 21st, when excerpts from Mrs. Gaskell's immortal book, "Cranford," the scene in which is laid in the little country town of Knutsford in that county, will be acted and read. There will be four short scenes, each preceded by a short reading designed to explain and describe the events which take place. The dramatisation of the book is by Miss Beatrice Hatch.

Captain Cazalet, M.P., on Racquets.

Capt. Victor Cazalet, M.C., Member of Parliament for the Chippingham Division and one of the foremost exponents of squash racquets, is giving a talk on this

(*Continued on page* 1253.)



Concerning Condenser Connections

How to eliminate capacity-effects and get better results.

By O. J. RANKIN.

IT often happens that a well-tuned station disappears almost entirely when the hand is withdrawn from the condenser dial. This is because the capacity of the hand is included in the tuning, the fading taking place when the total capacity is reduced by removing the hand. A reverse effect is obtained when the hand is placed in close proximity to the aerial circuit leads *after* tuning in a station. Signals then fade but regain their normal strength on removing the hand, or otherwise the excessive capacity. In this case the hand capacity is *added to* the already tuned circuit, whereas in the former example it is *taken away* after being included in the tuning.

The moving plates of a variable condenser are connected to the spindle which, of course, is fitted with a manipulating knob,

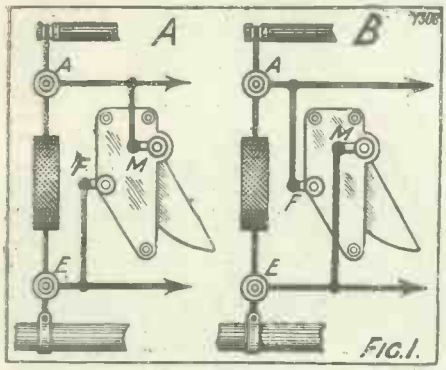


FIG. 1.

or dial, and in order to adjust the condenser it becomes necessary to handle the dial, an operation which unavoidably brings the hand in very close proximity to the spindle and moving plates.

Serious "Unbalancing" Effect.

It will, therefore, be seen that if the moving plates of the condenser are connected to the grid or aerial side of the coil, as at A in Fig. 1, the capacity of the hand (which is "on the earth side") must have a serious unbalancing effect upon the tuning. With certain types of receivers the effect is noticeable only when the hand is withdrawn from the dial, but with others howling occurs every time the hand approaches the dial.

In order to eliminate such trouble the

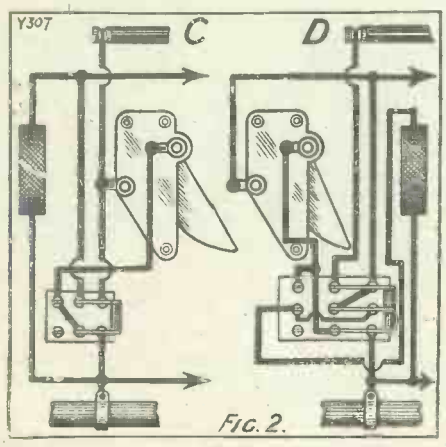


FIG. 2.

condenser should be connected, as shown at B (Fig. 1), so that the moving plates go to the *earthed* side of the coil. "Fixed plates to aerial, moving plates to earth," is a golden rule which should be memorised by all constructors who use either direct or inductively-coupled aerial circuits.

Series-Parallel Switching.

In the case of a series aerial-tuning condenser the rule does not apply, since the moving plates are then in series with the fixed plates, and although it is not possible to connect the moving plates to earth, it is always advisable to connect the fixed plates to the grid, as this often reduces the influence of the hand when making adjustments.

But with many series-parallel switching arrangements, this is only possible when the condenser is switched in parallel with the coil, the *moving* plates going to grid when the condenser is switched in series. This will be seen by following the example given at C in Fig. 2, which shows the most

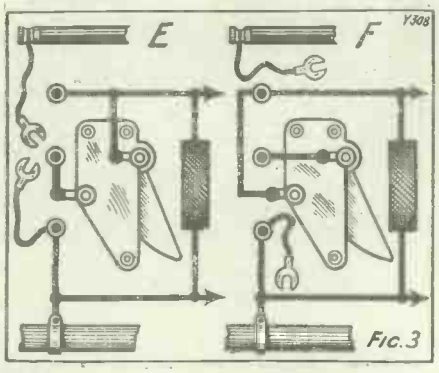


FIG. 3

usual form of series-parallel switching device.

In order that the fixed plates go to grid in both the series and parallel positions a slight modification is necessary, and to effect same many amateurs employ the three-pole switch method, outlined at D (Fig. 2), where the fixed plates go to grid at either position.

The three-terminal method of series-parallel switching is well known to all readers of "P.W." In this case it will be seen that when the condenser is connected as at E (Fig. 3) the *moving* plates go to grid at either position, and when connected as at F the *fixed* plates go to grid at either position. The moving plates should, therefore, always be connected to the centre terminal, as at F.

In the case of a receiver embodying capacity-reaction, such as the modified form of Reinartz reaction shown in Fig. 4,

the condenser is either placed in series with the plate of the detector valve and the coil, or in series with the coil and L.T. negative (earth) lead. In the former case the fixed plates should go to the plate of the valve, and the moving plates to one side of the coil, and in the latter case the fixed plates should go to the coil and the moving plates to earth, as shown.

When coupling high-frequency valves on the tuned-anode principle, the moving plates of the parallel tuning condenser should always go to that end of the coil which is connected to H.T. positive, and the fixed plates to the plate of the H.F. valve (see G, Fig. 5), and in the case of H.F. transformer couplings the same rule applies providing the condenser is shunted across the primary winding, but if the secondary winding is tuned then the connections

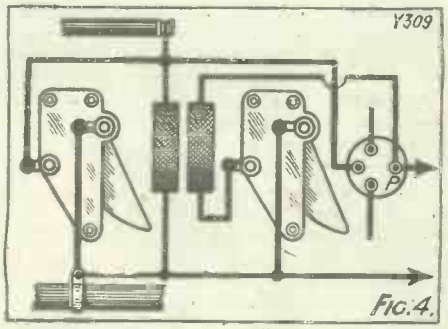


FIG. 4.

should be made, as shown at H (Fig. 5), with the moving plates to that end of the secondary winding which goes to L.T. positive or G.B. negative, and the fixed plates to the end which goes to the grid leak and condenser of the detector valve.

Neutralising Condensers.

In the case of small neutralising or "neutrodyne" condensers, the fixed plate should be connected to the grid of the H.F. valve and the moving plate to the centre-tapped tuned-anode coil, the O.P. of the split-primary transformer, or the tapping on the split-secondary transformer, as the case may be.

In the ordinary way, where the H.F. valve is balanced out on local transmissions and the condenser setting made permanent, the matter is of little importance, especially if the condenser is fitted with an elongated control, but in cases where the condenser is of a different type and mounted on the panel for use as a form of variable reaction it will be well to observe the above rule.

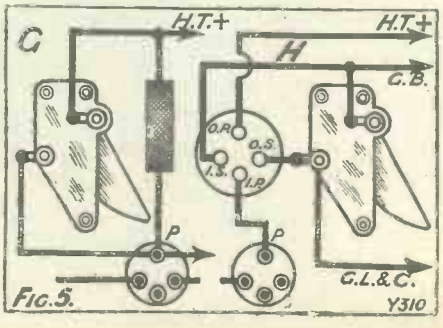


FIG. 5.

RADIO NOTES OF THE WEEK.

5XX and Twin-Wave Stations—Eckersley Explains—Favourite French Stations.

FROM A CORRESPONDENT.

CAPTAIN ECKERSLEY gave a very interesting lecture the other day at the Institution of Electrical Engineers, on the design and distribution of wireless broadcasting stations for a national service. To begin with, he dealt with the technical history of the development of broadcasting in this country and then went on to show that, taking into account both the main and relay medium-wave broadcasting stations, and also 5 X X, it was possible to estimate that about eighty-five per cent of the people in this country were within the service area of at least one broadcasting station.

5 X X Adversely Criticised.

He said that although 5 X X had been adversely criticised, the *raison d'être* for the station could be scientifically justified because of its economy in what he described as "ether channels." Owing to the fact that the wave sent out was subject to small ground attenuation its service area for a reasonable power was large; and even up to a distance of three hundred miles or so fading was not very pronounced, while interference from spark transmitters and the effects due to shielding in mountainous districts were not nearly so pronounced as in the case of shorter wave-length broadcasting stations and, in fact, he estimated that about fifty per cent of listeners relied on 5 X X, and that in ninety per cent of the relay areas of the country no other station was listened to so much as 5 X X.

Captain Eckersley then went on to give as his opinion that those running a broadcasting service should bear in mind, first and foremost, the ideal of cultivating an interest in what was received rather than in the nature of reception, and he expressed the hope that in time the broacast receiver would be looked upon more or less as an ordinary domestic appliance in the household, and not as some complicated and mysterious piece of apparatus which can only be appreciated and touched by experts.

Captain Eckersley made it clear that experiments are still being conducted in connection with the Regional Scheme which, as our readers know, may one day provide the whole country with alternative programmes, but nothing is very definite as yet, in spite of the various rumours which have been going around lately that sites have already been chosen for the stations.

No Signs of Regional Scheme.

It was hoped that at this lecture Captain Eckersley would have something more definite to say about the Regional Scheme; but there are still no signs of anything really practical being done in the near future. Data is still being collected, and 5 G B is still regarded as an experimental station for the purpose of collecting this data, on which the success of the Regional Scheme seems to depend.

It is also interesting to remember, as Captain Eckersley pointed out, that the technical committee of the Union Internationale de Radiophonie had studied the wave-length problem in detail and, out of eighty-four available exclusive wave-lengths between 200 and 600 metres, Britain was given nine, so that, taken in conjunction with the Daventry wave-length, there were available ten "ether channels" in this country.

Doubtful Future.

Provided it were possible to have a number of stations working on a common wave-length, the problem of the provision of alternative programmes would not be very difficult, but, unfortunately, experiments in 1926 designed to test how far such a scheme was practicable resulted unfavourably, and at present it was found that the most satisfactory method of supplying alternative programmes was by the use of twin wave-length stations. This method was now the basis of the proposed Regional Scheme, in which existing stations would be done away with and substituted by high-power twin wave-length stations outside cities previously possessing single broadcast transmitting stations.

Such a scheme would assure every listener an alternative programme, give the selective valve-set user greater variety, and make the field strength over the country as uniform as possible under present conditions.

But whether anything will come of this scheme still seems doubtful.

RED INDIANS AND RADIO.

A grandson of the famous Red Indian Chief Tecumseh, this warrior has abandoned the tomahawk for the microphone. He not only acts as announcer occasionally, but is a favourite singer of Red Indian "melodies."

French Stations Close Down.

A decree law has just come into force in France which may deprive British listeners of hearing many of their favourite French stations. This law prohibits broadcasting by any private broadcasting station except Radiola. This means that many well-known French stations may not be heard again, at least not until the French Government scheme for broadcasting has been agreed upon. The Radiola Station is a private one, but has been given a special concession to continue for some months.

This decree law really came into force early this year, but its effect has only just now been felt, for the French Government have for some time past been considering the advisability of controlling French broadcasting, but although the decree prohibiting private transmissions is now in force, the French scheme, alas, has not yet matured, and consequently French broadcasting may be said to be in a state of chaos.

The License Problem.

The Radiola station is, of course, very well-known to many thousands of British listeners, best perhaps under the name of Radio-Paris. Its transmissions on 1,750 metres are some of the best known on the Continent. The only really official French broadcasting station is P T T, because the Eiffel Tower, although equally well-known, is a more or less official station belonging to the French army. Its transmissions of broadcasting are, therefore, more or less "by courtesy."

There are, according to the "Daily Telegraph," one or two small private stations near Paris and several more important ones in the provinces. Among the latter chiefly known to British listeners may be mentioned Lyons and Toulouse and, according to this decree, they will certainly have to close down for the time being.

The French Government has already considered the possibility of establishing two or three high-power stations as well as eighteen lower-power stations, the idea being that eventually broadcasting in France should become a state monopoly. The trouble in France is that they are finding the necessary licence money difficult to obtain. To-day there is only a normal fee of about one franc per year, roughly twopence. And even then we understand there has been considerable difficulty in collecting it! Compare this with the present state of broadcasting in Great Britain and it will be seen that the lack of co-ordination and method in French broadcasting has resulted in a state of affairs which must make every British listener sympathise with French listeners.

More and More Relays.

Up to the time of writing the French broadcasting stations have had to depend almost entirely on advertisements in order to gain their revenue.

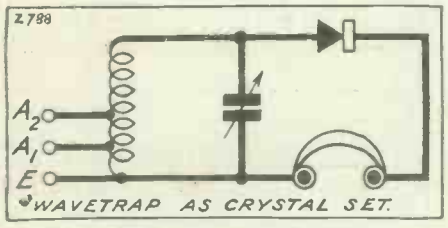
Writing of continental stations reminds us that many correspondents have written in lately expressing surprise that they sometimes receive continental relay stations at greater strength than some of the main stations, but it should be remembered that, unlike our relay stations, many of the Continental ones operate on quite high power—as much as 1·5 kilowatts. Relaying is becoming more and more common on the Continent these days and, for example, Hamburg's programme is relayed by Bremen, Hanover and Kiel, while Frankfurt is relayed by Cassel, Langenberg by Muenster, and Stockholm by Motala and Malmo.

A WAVE-TRAP CRYSTAL SET

You can convert an existing "P.W." Standard Wave-trap or build the combined instrument from the following instructions.
By G. P. KENDALL, B.Sc.

IN describing the compact little wave-trap which has been standardised for use in "P.W." sets (see "P.W." No. 285), I endeavoured to convince the reader that it was a very useful little gadget to have about the house for all sorts of purposes, besides the one for which it is chiefly intended.

It may, perhaps, be of interest to give an example of one of the ways in which it can be employed at a pinch, this being as an improvised crystal set to meet an emergency. Alternatively, of course, you can regard it as a very useful scheme to make it up as your first crystal set, with the great



advantage that when you later embark on a valve set this little unit will always come in handy as a wave-trap, which can be either built into the new receiver or kept as a separate unit for use with any set which may happen to have difficulty in cutting out the local station.

Main Features.

Before showing how it can be converted into a self-contained crystal receiver, it may, perhaps, be as well to remind the reader of the main features of the standard trap. Well, essentially it is simply a coil consisting of 68 or 70 turns of either No. 26 D.C.C. wire or "9/38's" Litz, on a tube 2 in. in diameter and about 3 in. long, with tappings at the 12th and 16th turns, tuned by a ·0005 mfd. compression-type variable condenser (Formodensor, Igranic "Pre-set" type, etc.). By the way, if your local station works on rather a low wave-length, say, below 360 metres, a condenser of ·00025 mfd. or ·0003 mfd. is to be preferred.

The condenser and coil are mounted on a small wooden base, 3¼ in. by 3¾ in. (Note: By an unfortunate printer's error these dimensions were incorrectly given in the original wave-trap article), in a manner which will be plain upon an examination of the photos accompanying this article. To complete the trap all that is needed is a small ebonite terminal strip, 2½ in. by 1½ in., screwed to one edge of the base, and this carries one terminal and two sockets, into which a plug carrying the aerial lead is inserted.

Coil Connections.

The terminal is wired to one end of the tuned circuit, and the sockets are wired to the tapping points, so that the aerial can be tapped through 12 or 16 turns of the winding. These connections can be followed out on the little wiring diagram herewith, which shows the standard trap with the various additions necessary to convert it into a crystal set.

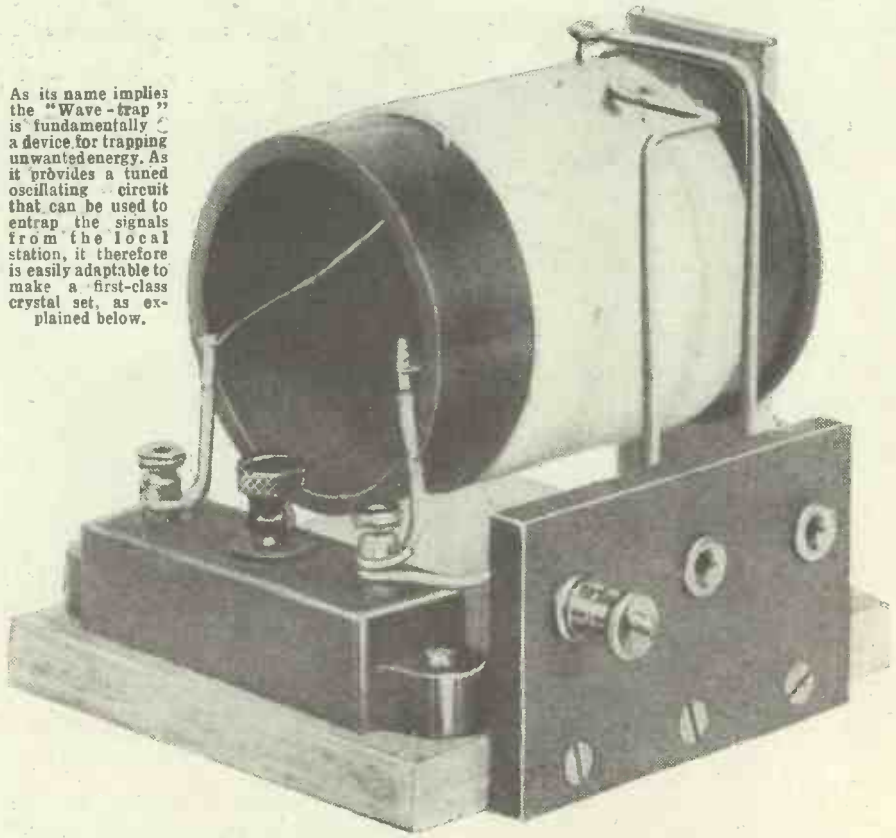
COMPONENTS AND MATERIALS.

- 1 Crystal detector.
- 1 Brass terminal.
- Either 1 standard wave-trap or
- 1 Piece of tube, of ebonite or other good material, 3 in. long and 2 in. diameter.
- 1 Compression type variable condenser, ·00025, ·0003, or ·0005 mfd. (see text).
- 1 Terminal.
- 2 Sockets and 1 plug (Eelex, Clix, etc.).
- 1 Wooden base, 3¾ in. × 3¼ in. × ⅜ in. or ½ in.
- 1 Wood strip, 3½ in. × 1½ in. × 3/16 in. or ¼ in.
- 1 Wooden end piece fitting inside tube.
- 1 Ebonite strip, 2½ in. × 1½ in. × ¼ in.
- 2 oz. or less of No. 26 D.C.C. wire or about 50 ft. of 9/38 silk-covered Litz.
- Wire, screws, etc.

You will see that it is specified that the coil is to be wound with either No. 26 D.C.C. wire or else 9/38's Litz, and the reason for this is that the Litz gives a better coil, but is definitely harder to deal with. The main difficulty lies in cleaning the ends properly

(*Continued on next page.*)

As its name implies the "Wave-trap" is fundamentally a device for trapping unwanted energy. As it provides a tuned oscillating circuit that can be used to entrap the signals from the local station, it therefore is easily adaptable to make a first-class crystal set, as explained below.



This is a "P.W." Standard Wave-trap in its original form. The terminal is for a direct connection to the aerial terminal of the set. The two sockets offer alternative tappings on the coil to the aerial lead plug.

A WAVE-TRAP CRYSTAL SET.

(Continued from previous page.)

and making certain of a perfect soldered joint to every strand, and unless you have had sufficient experience of such work to be absolutely sure of this it is far better to use the solid wire (No. 26 D.C.C.), and be content with a slightly less efficient coil. Remember, a good coil of No. 26 is likely to be far better than a bad one of 9/38's Litz.

POINT-TO-POINT CONNECTIONS.

The following are the connections of the standard trap, arranged to conform to the lettering on the diagram herewith.

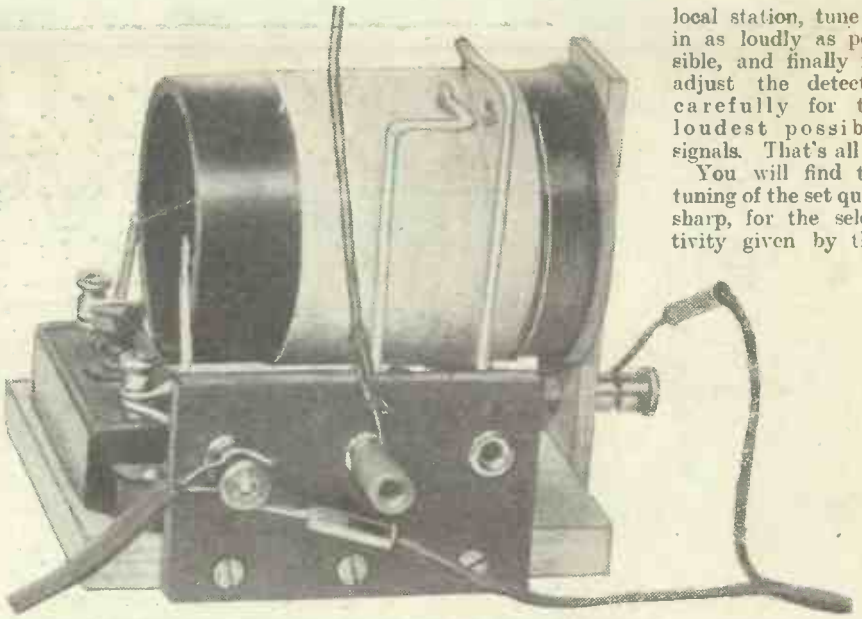
Terminal E to nearest side of condenser and to end of coil nearest to support. Other end of coil to other side of condenser.

Socket A_1 to tapping point located at 12 turns from end of coil nearest support.

Socket A_2 to tapping point located at 16 turns from end of coil nearest support.

This completes the wiring of the trap. To convert to crystal set add the connections given in text.

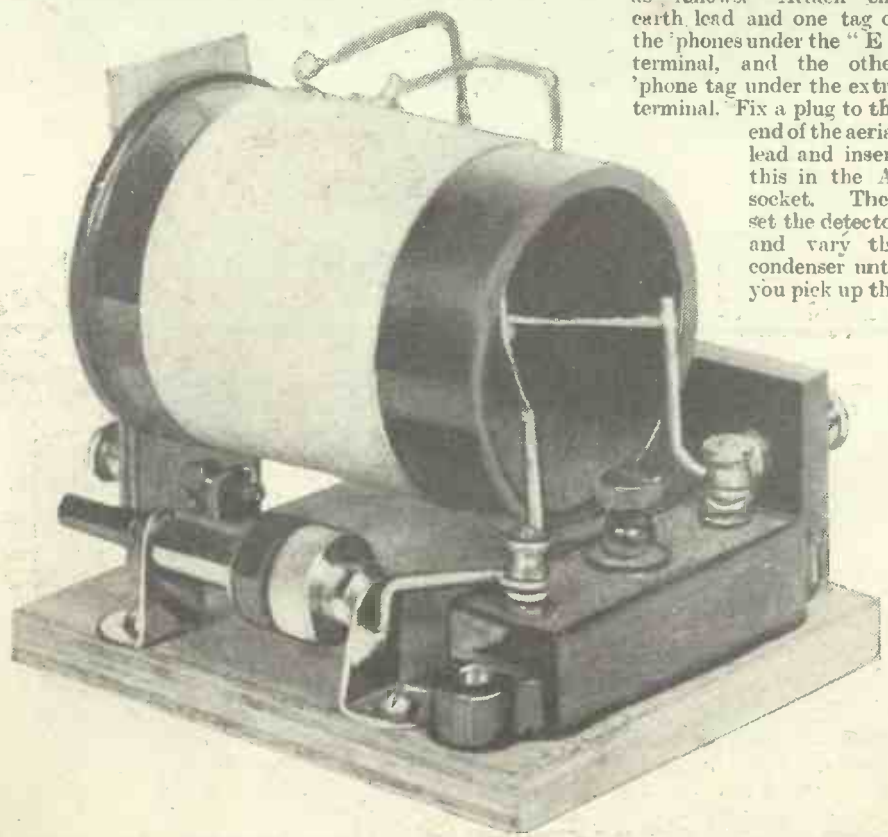
Now we come to the question of the additions to make the trap into a crystal set, and these are very simple. All that you have to do is to mount an extra terminal on the upright strip of wood (3½ in. by 1½ in.) which supports the coil and fix a crystal detector on the baseboard alongside the coil in the position seen in the photos. Then wire these up as follows. One side of detector to extra terminal, other side of detector to nearest terminal of the variable condenser. These connections are *additional* to those of the standard trap given in the point-to-point list herewith; and are all that is needed in the way of extra wiring to convert it into a crystal set. The whole job will probably not take you more than a quarter of an hour.



An extra terminal is mounted on the coil support, and, this being connected to one side of the crystal detector, acts as a telephone terminal. The other telephone receiver tag is joined to that terminal which operates as an earth terminal when the trap is used as a crystal set.

The completed set is connected up for use as follows. Attach the earth lead and one tag of the 'phones under the "E" terminal, and the other 'phone tag under the extra terminal. Fix a plug to the end of the aerial lead and insert this in the A_2 socket. Then set the detector and vary the condenser until you pick up the local station, tune it in as loudly as possible, and finally readjust the detector carefully for the loudest possible signals. That's all!

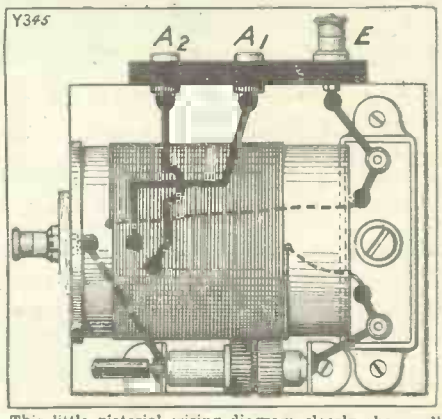
You will find the tuning of the set quite sharp, for the selectivity given by this arrangement is rather above the average, and this will be very useful in those coastal districts where shipping interference is troublesome. For still higher selectivity, of course, you can put the aerial plug in socket A_1, so reducing the number of turns across which the aerial is tapped, but you must be prepared for the fact that signals will in almost all cases be rather weaker when you do this.



Here you see the crystal detector mounted in position on the baseboard, where, although there is no waste of space, it finds sufficient room just under the shadow of the coil.

Daventry Junior.

Finally, a word of warning as to 5 G B. Under favourable conditions (good aerial, and so on) you will be able to hear this station at moderate ranges, but the positions of the tapping points are not ideal for this purpose. They were, of course, located at the most suitable points for use as a wave-trap.



This little pictorial wiring diagram clearly shows all the connections of the useful combination instrument.

To pick up 5 G B, you should, of course, put the aerial plug in socket A_2, and you should make certain that the crystal detector is set for the loudest possible signals on the local station. Next proceed to screw down the adjusting knob of the variable condenser very slowly and carefully, and presently you should find the setting for 5 G B if you are within range.

The Secret of Life

in a battery

It is the remarkable oxygen content of the cells of the LISSEN New Process Battery which makes this fine battery last so long, which builds the voltage up and keeps it high despite the drain imposed by any programme no matter how long.

This boundless energy is chemically generated by means of the new chemical combination and a new process used only by LISSEN. This energy is pure energy—pure D.C. current which only a battery exactly like the LISSEN can give you. You get the best kind of current for radio when you use a LISSEN New Process Battery—smooth, noiseless in its flow, strong and sustained. Every word of speech, every note of music, comes over clear and loud when the H.T. current you are using comes from the LISSEN battery.

Ask for it firmly at any one of the 10,000 radio dealers—take nothing else and your insistence will be rewarded by the power in your loud speaker and a truth of utterance which were never there before.

60 volts (reads 66 volts) - -	7/11	9 volts (grid bias) - - - -	1/6
100 volts (reads 108 volts) - -	12/11	60 volts (reads 66 volts) SUPER POWER	13/6

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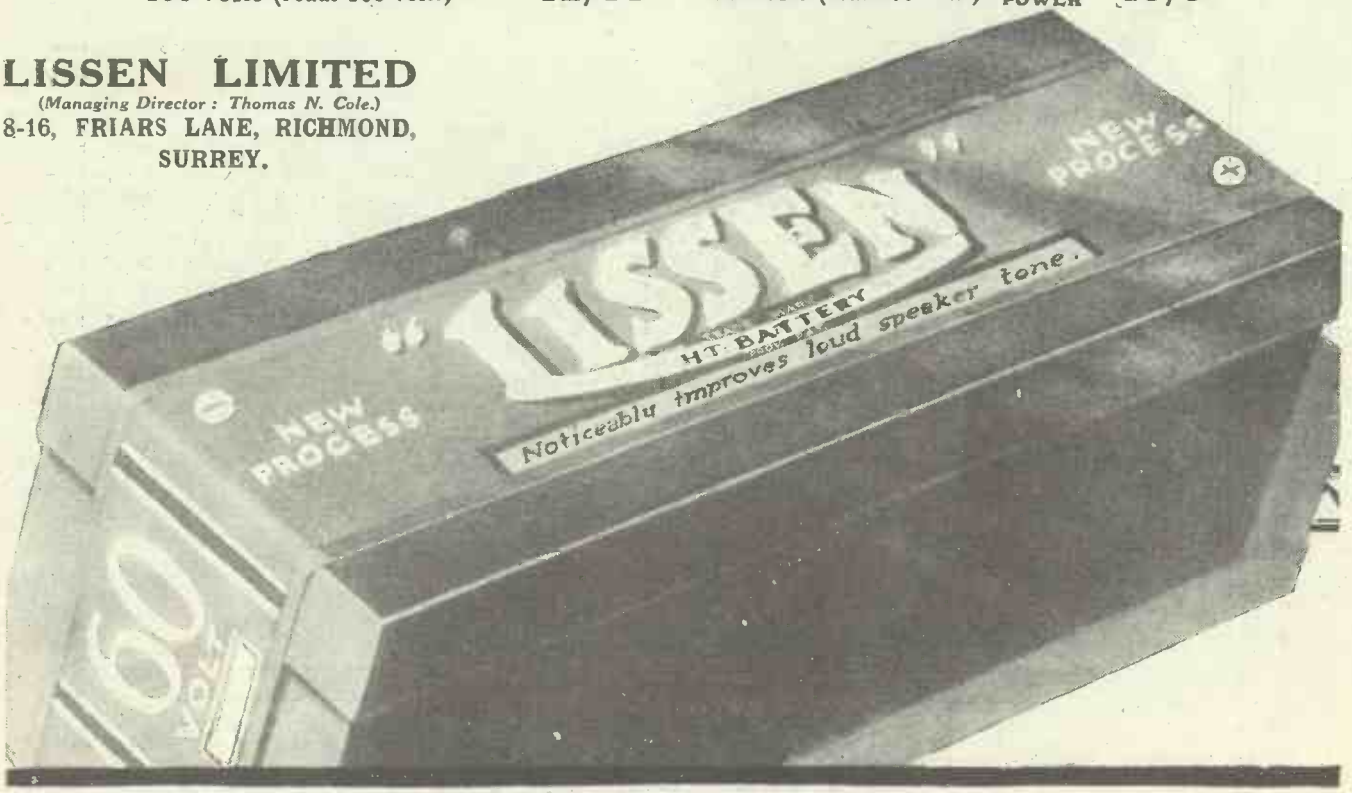


THE "SYDNEY" TWO.

The Editor, POPULAR WIRELESS.

Dear Sir,—I built the "Sydney" Two as described in your issue of November 12th, and am pleased to report that this afternoon I picked up 5 S W.

I heard him first about 2.45 p.m., E.S.T., broadcasting a talk which was followed by soprano solos, instrumental music, and duets by male voices.

About 4 p.m. a piano solo came through very clearly, and was followed by another.

In my opinion the "Sydney" Two is a great little set, and I am confident of picking up Australia some of these mornings when I feel ambitious and want to get up around 4 or 5 a.m.

When I first heard 5 S W his signals were weak, but gradually became stronger up to about 4.15 p.m., when they started to weaken again, and gradually died out. The weather here this afternoon was mild, damp, and foggy.

It certainly gave me a thrill to hear something from my native land, even though I have been a resident of the U.S.A. for the past fifteen years. I look forward with the keenest interest to receiving my copy of POPULAR WIRELESS every week.

Thanking you for your excellent receiver, and wishing you continued success,

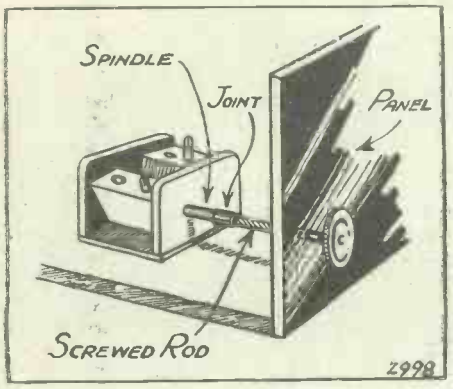
Yours truly,
SAML. A. B.

New Jersey, U.S.A.

A COIL-HOLDER TIP.

The Editor, POPULAR WIRELESS.

Dear Sir,—When mounting the two-way coil holder behind the panel, it is sometimes found that the spindle of the control knob is not long enough to reach from the allotted place on the baseboard to the panel. A way of overcoming the difficulty is as follows: The coil holder is mounted as desired and its knob is removed, a hole is drilled in the required position on the panel, and a piece of screwed rod, cut



to the right length, is screwed into the knob and passed through the hole. It can be joined to the spindle of the coil holder by means of a Meccano coupling which has been drilled out to the right size.

Hoping that this may prove as useful to your readers as it has to myself.

Yours faithfully,
W. H. B. W.

Midhurst, Sussex.

PROGRAMME ON 'PHONES ONLY!

The Editor, POPULAR WIRELESS.

Dear Sir,—I should be glad if you could tell me if the following experience is unusual or not. Possibly there is a very simple explanation.

To be brief. At 10.15 p.m. on Saturday I received here (10 miles out) 2 L O's programme on a pair of Western Electric headphones *which were not connected in any way with a receiving set.*

A few details may perhaps help to clear up what appears to me to be rather extraordinary.

The output from my set (Hale two-valver) is via a jack and plug to a small distribution board which allows a speaker and 'phones to be used simultaneously. On this occasion the speaker was not in circuit.

Wearing the 'phones, I tuned in 2 L O and—still with 'phones on—removed the plug prior to inserting another plug which would carry the output to a speaker in the bedroom above. Imagine my surprise when I continued to hear London (at good crystal strength) though connection to set was broken. Much mystified, I disconnected the 'phone tags from the terminals of the distribution board, and held them in my hands and, though fainter than before, I continued to hear London, there being absolutely no connection whatever between the 'phones and the set. I was standing a foot away from the set at the time, and the set was, of course, on.

Is there any explanation?

Yours truly,
H. A. B.

Eltham, S.E.9.

CORRESPONDENCE.

THE "SYDNEY" TWO

A COIL-HOLDER TIP—A CURIOUS EXPERIMENT.

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.

DX RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—You may be interested to hear of my splendid reception of W G Y early this morning, Sunday, January 15th, on 379·7 metres. My set is a "straight" two-valve detector and L.F. This station was held without one complete fade-out from 1.30 a.m. until 4.15 a.m., at which time I switched off, too tired to listen any longer.

I have previously received many of the usual foreign stations, but this was my first serious attempt at American broadcast. The result, bearing in mind the strength of the signals received, convinces me that reception of W G Y should be a very common occurrence among owners of similar sets. At one or two points the thrum of the band instruments could be plainly felt in the headphones. To the sceptics I would simply say, brush up your installation and try yourself. In this connection I would mention that the many tips given in POPULAR WIRELESS from time to time are invaluable.

In conclusion, many jottings were made of the items heard, but the mention of one may suffice. At 3.15 a.m. the announcer said in effect that the first item to be played from the Polliadaw (this may be incorrectly spelt) Restaurant, Broadway, New York, would be "The March of the Marionettes."

Trusting that my experience will prove an incentive to many more of your readers to try their luck.

Yours faithfully,
ERNEST W. B.

P.S.—My set is the Two-valve designed by Mr. K. D. Rogers in "Best-Way" Series, No. 192.

Southall, Middlesex.

INTERESTING RADIO FACTS.

Miss Mavis Bennett, the popular B.B.C. artiste, started in London with only ten pounds in her pocket, and had her first engagement at the Piccadilly Hotel, under De Groot, where she scored an instantaneous success.

* * *

When the ordinary crystal detector is in use it has been estimated that only one one-hundred-thousandth part of its surface is active. If this small portion of active material could be mounted, a couple of ounces of crystal would be quite sufficient to supply the needs of the whole country.

* * *

The resistance of the ordinary cat's-whisker type of crystal detector is generally of the order of ten to forty thousand ohms.

* * *

There is over half a mile of wire in an ordinary pair of telephones.

* * *

Dr. Lee de Forest, "the man who put the grid into the valve," recently stated that some day it may be possible to build conductors ten miles high to utilise the vast electrical energy that exists as a difference of potential between the upper atmosphere and the surface of the earth.

A CURIOUS EXPERIMENT.

The Editor, POPULAR WIRELESS.

Dear Sir,—I have had rather a curious experiment this last few days which may prove of interest to your readers.

Whilst at work upon an eliminator for A.C. current, my brother and myself had to fix up a coil in place of the mains, as we only have gas at home.

The coil used is just an old ignition coil of the trembler type. We had been at work some time with quite a good light from the gas, when it was noticed that when the coil stopped the light went down. Upon contact being made again, up went the light.

This experiment has been tried repeatedly for days and has never failed yet. When the coil H.T. wire is fixed to the pipe the result is just as when no wire is used at all. Several other dodges have been tried, with just the same result.

I am well aware of the effect of any spark or current at all upon an internal combustion engine as against any other form of ignition, but the effect of a coil upon the gas mantle is most unexpected.

As regards particulars of the case, we have just an ordinary gas light of the inverted type with mantle.

An ordinary ignition coil and a 4-volt L.T. accumulator, one cell of which was used. (If more light was wanted, 4 volts were brought into use.)

The experiment was worked on a table just under the light, and so long as the coil was working a good light was obtained. Our gas supply is low, for if another light is turned on, down goes the first one.

Yours faithfully,
R. S.

Morton Bingley, Yorks.

THE "Q AND A" TWO.

The Editor, POPULAR WIRELESS.

Dear Sir.—In No. 241 of the "P. W." you described how to build the "Q and A" set, which I built.

It was very simple to construct, and when I got it into action I was amazed. The stations rolled in one after another—altogether between 35 and 40, most of which were Continental, Dublin, Daventry, and Radio Paris at L.S. strength. These results were obtained under very good conditions, 100 ft. aerial 30 ft. high, right on the sea coast, and earth 3 ft. deep in very damp soil, 60 volts of H.T., Osram D.E.2 L.F. valves and an Exide 2-volt 40-ampere hour accumulator.

It is a set I would recommend to anybody wanting a valve set, as it is easy to handle, and very selective.

I have since reconstructed it on an American style of panel, and it is still going strong; and although I have tried everything, from a crystal set to a straight four-valver, I have never logged so many stations as I did on the "Q and A" set.

Needless to say I am a regular reader of POPULAR WIRELESS.

Yours truly,
E. C.

County Wicklow, Ireland.

THE "SPANSPACE" FOUR.

The Editor, POPULAR WIRELESS.

Dear Sir,—You may be interested in the accompanying photo—which I took myself—of one of your sets constructed two months ago, the cabinet being made from an old mahogany table. The set is the "Spanspace" Four, which is everything that can be wished for, both for volume and purity. Wishing POPULAR WIRELESS every success,

Yours faithfully,
A. R. CROOK.

Addiscombe.

The skilful work put into the building of the set by Mr. Crook is evident from the complete transformation of an old table into a handsome radio cabinet.

A NINE YEARS' POLICY FOR THE B.B.C.

From a Special Correspondent.

FROM the otherwise admirable handbook which the B.B.C. recently produced, there is an important omission. There is no sign of a resolute, well-considered and well-balanced policy for the next nine years. Even the Regional Scheme is treated so tentatively and hypothetically that there might be grave doubt as to whether anything would ever come of it. As for taking full advantage of their Charter Powers in progressive expansion throughout the whole period of their licence, the Corporation are strangely silent in a book which they describe as an Encyclopædia of Broadcasting. Someone must fill the gap. I cannot believe that Savoy Hill is concerned only with the present. I have a shrewd suspicion, however, that Savoy Hill is still too subservient to the mandarins of the Post Office. Anyway, here goes!

The Regional Scheme.

The B.B.C. should complete its Regional Scheme not later than August, 1929. If the Post Office stands in the way, the B.B.C. owes it to the public to keep it fully informed of this obstruction. If the Post Office does not stand in the way, and the scheme is not completed by August, 1929, then something will be wrong with the B.B.C., and there is pretty sure to be a parliamentary enquiry.

The B.B.C. began talking about alternative programmes away back in 1925. If the old company had been firm enough, it could have forced the hands of the Post Office sufficiently to have enabled the new scheme to be completed by next summer, 1928. But a whole year was lost through Post Office procrastination Now there are both money and facilities, there should be no hold-up.

And secondly, the B.B.C. should decide to inaugurate a regular service of Empire Broadcasting by not later than September 1st, 1928. This should allow for programmes round the clock. Between now and then there is ample time to complete all reasonable experiments, to conclude arrangements with overseas authorities and to organise the necessary staffs both technical and programme. Captain Ian Fraser, C.B.E., M.P., should be put in charge of the Empire Broadcasting Department of the B.B.C.

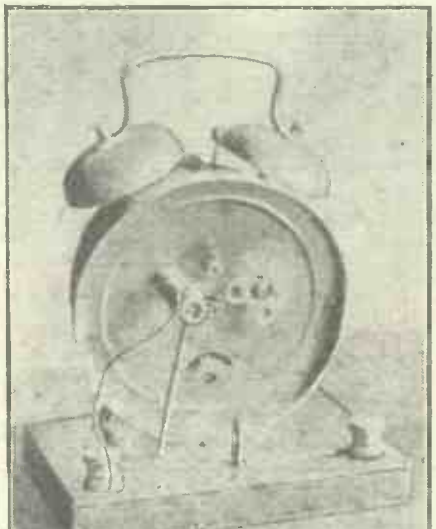
Future Programmes.

On the programme side the B.B.C. should be looking forward to the production of about twelve really great programme events during the next nine years. These should not only be of value as stunts; they should also be a direct contribution to various branches of art. Each should enrich the greatest literature or the greatest music of the age. These outstanding events should be handled on a world-wide scale, enhancing British prestige.

The London Wireless Orchestra, and the London Wireless Military Band should be put on an established permanent footing, with a view to creating for them within ten years a position of unchallenged supremacy throughout the world. The B.B.C. should be looking ahead now to the recruitment of these organisations, five or six years hence and later. With a little foresight and showmanship, the money being absorbed on these organisations now could be much more usefully expended.

Continuous Expansion Inevitable.

The B.B.C. should lose no time in planning and establishing a great central building for its activities. It was understood about eighteen months ago that the Broadcasting Company contemplated erecting a new building in Kingsway. Unfortunately, nothing came of this proposal and no reason was given for its abandonment. Since then, instead of taking a bold line and solving the whole problem economically, the B.B.C. have been making costly and largely ineffective alterations in the building they now occupy at Savoy Hill.



This simple automatic switch for switching on the set at any time was made from an alarm clock by one of our Birmingham readers. When the alarm "goes off" the vertical arm swings over and makes the necessary contact.

And, as these alterations are inadequate before they are completed, new buildings are taken and sections of the staff are being scattered all over London in the manner of one of the temporary Ministries during the war. In a laudable desire for economy, the administration of the B.B.C. never seems to be able to look ahead.

As long as two years ago, a high official at Savoy Hill told me that the organisation and staff were then stabilised on a permanent basis. I laughed at him. A year ago another and even higher official told me the same thing I laughed still louder. The B.B.C. has only begun. It must face up to continuous expansion. The pity is that it seems so reluctant to accept its high destiny. It waits until events force its hand, and then "panic measures" are inevitable. What I am pleading now is that at last the B.B.C. should take a long view and plan accordingly. The new central building is a paramount necessity. It should be handled in a large way and in a way admitting flexibility and almost indefinite extension. Put in hand at once, this new headquarters of British broadcasting would be completed by the end of 1930.

Britain Being Beaten.

Another line in which the long view is required is in the recruiting of artistic talent. Long before the licence of the B.B.C. expires the German and American broadcasters will have so developed the technique of microphone entertainment that all their artistes and speakers will be trained solely for the microphone, and will devote their whole time to this side of entertainment. By moving now and taking a long view the B.B.C. may well manage to get ahead of both the Germans and the Americans. What is wanted is an active, widespread, and progressive campaign for new artistic talent and material. The B.B.C. should have a properly organised section whose sole duty it would be to seek out new talent and develop its possibilities.

So far as one can judge, the system at present seems to be purely negative and passive In fact, several artistes have told me that they have had to fight their way through a barrage of red tape in order to get to the microphone. Apparently, at present, Savoy Hill waits in serene expectation for good material to turn up. This is the wrong attitude. The B.B.C. should always be on the alert to find and then to nurture promising artistic talent.

Extend S.B. Items.

Then as to controversy, the long view should be that all controversial subjects may be discussed over the microphone, whether by debate or by one-sided exposition. It is not clear at present that the B.B.C. proposes to go all out in securing this programme material—essential to the vitality of the service in a fully developed form.

There has been some incidental reference to the possibility of European S.B. This should be sketched out in concrete terms. Not later than the middle of 1928 European S.B. should be an accepted feature of normal broadcasting. By 1935 European S.B. should have become World S.B., just as it had emerged from British S.B.

Akin to the progressive development of S.B. is the extension of what the B.B.C. calls its outside broadcast organisation. The latter is responsible for such features as the "Menin Gate Ceremony," and all great occasions taken from outside the studios. In five years' time, the B.B.C. should have about a dozen self-contained mobile O.B. squads ready to proceed to any part of Europe at a moment's notice. No event of international importance should be omitted from the programme on one or other of the various alternative waves.

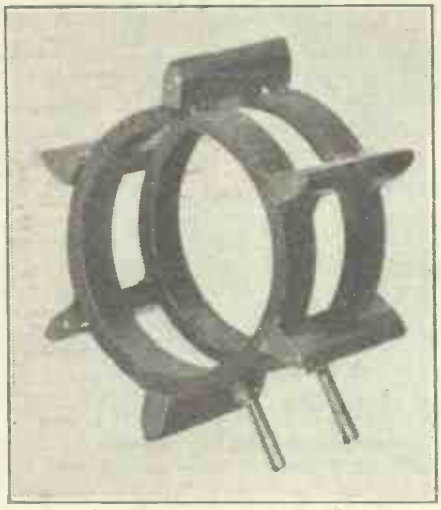
The above, in brief, is a working practical policy for the B.B.C. What has it got to say about it?

EFFICIENT SHORT-WAVE COILS & CHOKES

First-class short-wave coils can be turned out with ease and at exceedingly small expense, as this article will show.

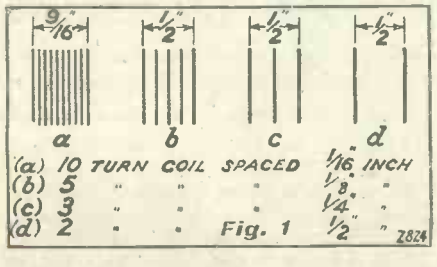
By R. W. HALLOWS, M.A.

THE essential characteristics of a good short-wave coil are: (1) *Low losses*, due to (*a*) first-rate insulation, (*b*) low self-capacity, (*c*) minimum amount of dielectric material, and (*d*) small high-frequency resistance; (2) *Inductance Efficiency* and (3) *Constancy*. If the insulation is not good there will be direct losses due to leakage over the surface of the former between the contact points.



A built-up former for small coils.

Ebonite formers have been used successfully for wave-lengths of 10 metres and below, that is for frequencies of 30,000 kilocycles and above; the insulation problem therefore solves itself. Low self-capacity is important since it reduces losses and increases the tuning ranges of the coils.



The use of ribbed formers helps automatically to reduce the self-capacity, since each turn is in contact with dielectric material at only six points. For reception down to about 40 metres, or even a little below, it is not absolutely necessary to prepare the formers in any way except by drilling them and cutting notches in the ribs to retain the windings in position. I have actually obtained on favourable nights good reception from 2 X A D on 22·02 metres with coils wound in this way; but the real test of a coil is to be found in its performances not on good nights but at those periods, which do occur every now and then, when signal strength is considerably below normal.

Need for Spacing.

Losses of any kind are then shown up, though they may not be detected on good nights when signals are coming in powerfully. There is no doubt that the removal of as much as possible of the material of which the formers are composed is a very great all-round improvement. The various methods of doing this will be described later.

Spacing the turns also helps materially towards the achievement of low self-capacity; but the amount of spacing that can be usefully employed is limited by another consideration of a different nature, which is best illustrated by a concrete example. If on a 3-inch former we wind 20 turns spaced $\frac{1}{16}$-in., a slide rule based on Nagaoka's formula* shows the inductance of the coil as 38 microhenries. Using the same former, but making the spacing $\frac{1}{8}$ in., 20 turns give only 25·5 microhenries.

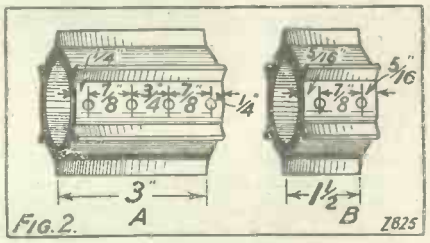
A Necessary Consideration.

To obtain an inductance of 38 microhenries on this former with a spacing of $\frac{1}{8}$ in. between 26 and 27 turns would be required. We thus see that the greater the spacing the smaller is the inductance value *per turn* of the coil; or in other words that to have the same inductance as one with a smaller spacing a widely spaced coil must contain more turns. Now more turns mean more wire, and more wire means more resistance. Further, a coil of given diameter becomes less efficient if its windings exceed a certain width. As a result of winding up and testing out dozens of short-wave coils on the formers referred to, I find it satisfactory to keep the total width of the windings, whatever the number of turns, to between $\frac{1}{2}$ in. and $\frac{9}{16}$ in.

Fig. 1 shows how this may be done with windings containing 2, 3, 5 and 10 turns, which are all that are required for the complete set of short-wave coils. By keeping the total width of windings practically the same in all cases one does not change the important ratio:

$$\frac{\text{width of windings}}{\text{diameter.}}$$

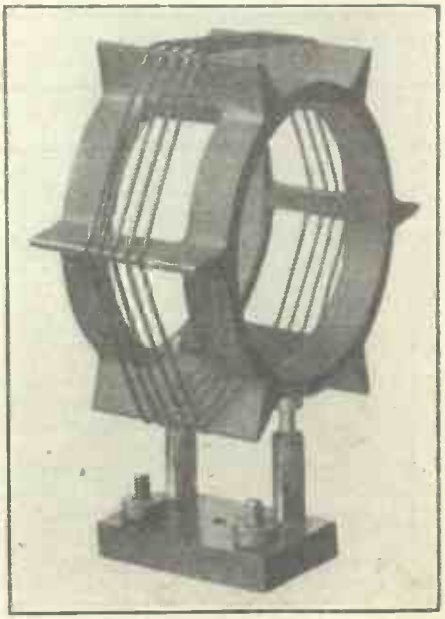
Another exceedingly useful result follows: a rule of thumb can be obtained for the tuning range of such coils. With an efficient ·00025 mfd. variable condenser in parallel



the useful tuning range in metres is from a minimum of four times the number of turns to a maximum of nine-and-a-half times.

By this formula a 10-turn coil should tune from 40 to 95 metres: actually the range of the one seen in the photographs with an Ormond straight-line frequency ·00025 mfd. variable condenser and a Cossor high-frequency valve is from approximately 38 to

(*Continued on next page.*)



A 5-turn spaced coil with its holder.

* Norman Lea's Inductance Calculator for Air-Core Solenoids, an extraordinarily handy and accurate instrument.

EFFICIENT SHORT-WAVE COILS AND CHOKES.

(Continued from previous page.)

94 metres. The 5-turn coil has a rule-of-thumb range of from 20 to 45 metres and an actual one of 19 to 48 metres. The 3-turn coil's rule-of-thumb range is from 12 to 27 metres, and its actual range from 12 to 28½ metres. The rule of thumb thus works out remarkably well and it is of considerable assistance in obtaining a first very rough calibration of coils after they have been made.

The next point to be considered is that of the wire used for the windings, for this

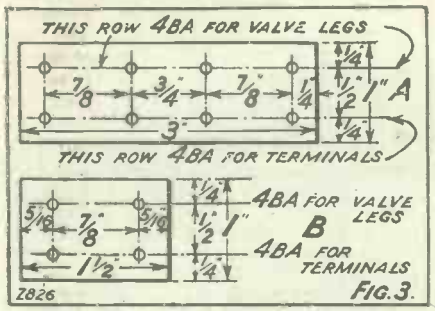


FIG. 3.

affects both the high-frequency resistance and the constancy of the coil. One not infrequently sees bare tinned wire used both for the windings of coils and for point-to-point connections in short-wave receiving sets. There could be no greater mistake. It must be remembered that the higher the frequency the more pronounced is the skin effect.

Avoid Tinned Wire.

The frequencies encountered during reception on the very short waves are such that one may feel quite sure that their penetration into the body of the conductor is almost infinitesimal; certainly they do not go deep enough to reach the copper that lies beneath the tin covering. The copper, in fact, might just as well not be there for all the use that it is electrically. Now, even pure tin is a very poor conductor in comparison with copper. Its relative resistance is 8·184 times as great, and if we take copper as possessing 100 per cent conductivity that of tin is by comparison but 12·22 per cent. If an alloy is used for the coating the figures will probably make a still worse showing.

The use of tinned wire has really much the same effect as would be produced by employing plain copper wire of very fine gauge, or even resistance wire of fairly large diameter! No. 18 or No. 20 untinned copper wire is entirely satisfactory both for coil windings and for connections in the set. It is desirable that the surface of the wire should be protected by a covering, but cotton or silk are not suitable for the purpose owing to their hygroscopic qualities, which affect the constancy of the coils. Both these materials collect moisture from the atmosphere, whose presence affects both their insulating qualities, and their dielectric constant.

Coils Sizes.

Such a covering might, of course, be baked and shellacked, but this is undesirable since shellac itself contains water, and its use introduces an undesirable amount of additional dielectric material. We are left with enamelled wire, and this is by far the best material to employ in the short-wave receiving set.

The six coils required for the set are the following: SINGLE COILS (Aerial)—No. 1, 2 turns; No. 2, 3 turns; No. 3, 5 turns. DOUBLE COILS—No. 1, grid 10 turns, reaction 10 turns; No. 2, grid 5 turns, reaction 5 turns; No. 3, grid 3 turns, reaction 4 or 5 turns.

Fig. 2 shows the way in which the formers of both single and double windings are drilled and tapped. This process should always be undertaken first, whether the formers are to be "skeletonised" or not. The spacing of ⅞ in. between the pins at the ends of the windings of both single and double coils serves a handy purpose, since it means that instead of a double coil two single coils may be used in the double holder (the lay-out of which is seen in Fig. 3), if it is found more convenient to do so.

There are two recommended methods of reducing the formers to skeleton form, both of which are illustrated in the photographs. The first will appeal to those who possess lathes and are fond of turning. It has the great advantage of being quick and requiring comparatively little labour. If the work is to be done in the lathe, care should be taken when ordering formers to ask for lengths specially selected for their trueness.

Since the formers are made by the extruding process, some of them are apt to be a little thicker in the walls on one side or the other, which, of course, makes them run slightly out of the true in the lathe. The former is mounted in a self-centring chuck, preferably by placing the jaws inside it and expanding them. The best tool to use is a boring bar such as that employed for turning out the insides of the cylinders of model engines.

Leave a rim at either end 7/16th in. wide and two rings each 5/16th in. wide, containing the holes for the two middle valve pins. This allows three cuts, each ½ in. in width, to be made right through the tubular portion of the former. The panels between the fins are thus turned right out, and we are left with a former consisting of four narrow rings, upon which the ribs rest. This makes an exceedingly strong foundation for the coil, which it is quite difficult to deform at all, even by squeezing hard with both one's hands.

The second method of getting rid of superfluous dielectric material will probably

Reaction and grid coils for short-wave work.

be used by a wider circle of constructors, since no lathe is required. Coils made up in this way are also illustrated in the photographs. The former having been drilled and tapped, lines are scribed right round the tubular portion 7/16th in. from either end. In the panel which contains the tapped holes for the valve pins further lines are scribed to mark out the strips which will act as supports for the two middle pins.

Removing Surplus Ebonite.

Fig. 4 shows the way in which the cutting out is done. Holes are made with a ¼-in. or similar drill at the corners of the rectangles to be cut away, and the material is then removed roughly by means of a small keyhole saw. This having been done, a file is used to trim up the former. The amount of ebonite that can be removed in this way without unduly weakening the

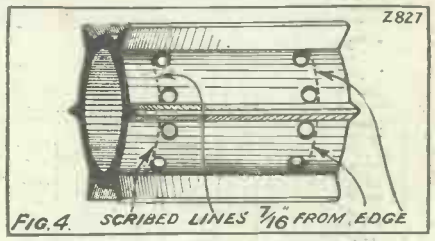
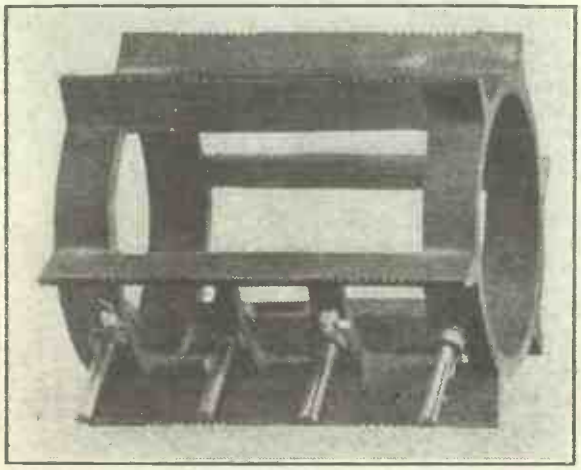


FIG. 4. SCRIBED LINES 7/16 FROM EDGE

former is surprisingly large. The weight of an untrimmed 3-in. length is, on the average, just under 3 ounces; the average weight of the double-coil formers shown in the photographs is about 1¼ ounces.

A skeleton former of the "paddle wheel" type produced by a third method is seen in another photograph. In this case the former is made by building up and not by cutting out. It is a very handy way of making single coils, since it is a good deal less laborious than either of the cutting-out methods, and it can also be employed for making formers for double coils.

(Continued on page 1241.)

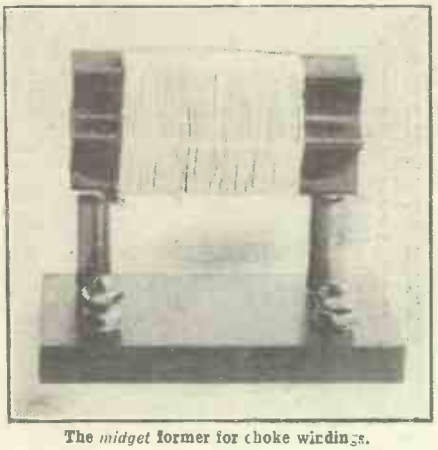


A solid former that has been skeletonised with a keyhole saw and file.

EFFICIENT SHORT-WAVE COILS AND CHOKES.

(*Continued from page* 1238.)

The method of making a single-winding former will be described; double formers are built up in exactly the same way. Cut off two rings, each 5/16th in. or ⅜ in. wide, from a piece of ebonite tube with an external diameter of 2¼ in. Make a 5 B.A. tapped hole in each of these and insert a valve pin. Splay the prongs of



The *midget* former for choke windings.

the pins well out, so as to make them a tight fit for the legs, and mount them in a single-coil holder. Next cut out six strips of ⅜-in. ebonite, each 1½ in. in length and ⅜ in. wide.

Fitting the Strips.

With a file taper these off until they are more or less triangular in section. Melt up some Chatterton's compound in an old spoon over a spirit lamp, apply a little with a matchstick to the ends of one of the strips and press it down on to the rings, taking care to keep them parallel as you do so. Put on the other five strips in the same way, spacing them as nearly equally as possible. When all are in position pull the former carefully out of the holder and place it in a basin full of cold water. This will cause the Chatterton's to set hard, and in quite a short time it will be found that the former is ready for winding.

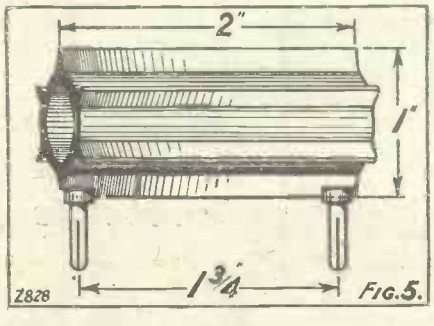


FIG. 5.

For double formers four rings are, of course, required and the strips that form the ribs must be 3 in. in length. One hint about working with Chatterton's compound—though it sticks to nearly everything else it will not adhere to anything wet. If, therefore, you wish to remove a superfluous blob you can do so easily with a wet knife; again, you can fix your fins very securely by pressing a little of the compound against the base of each with a wet finger.

The formers having been prepared by any one of the methods suggested, the next process is to notch them for the turns. The actual spacing required is seen in Fig. 1. Notching is best done either with a small hacksaw or with a warding file. Do not make deep cuts; only very shallow ones are needed to keep the turns in position.

Having notched the ribs of the former place a soldering tag under each of the valve legs and screw them in tightly. Bare the end of a reel of enamelled wire—No. 20 may be used for the 10-turn coil and No. 18 for the others—and tin it. Whatever you do, do not use a corrosive flux. By far the best flux for wireless purposes is finely-powdered resin, which may be applied with a fine camel-hair brush. Solder the end of the wire to the tag and wind on the turns as tightly as possible.

H.F. Chokes.

It is best to get a friend to pay out the wire from the reel. He should run a pencil through the hole in it to act as an axis and should keep up the pressure by using his thumbs as brakes. When all the turns are on do not immediately cut the wire. Bare a small portion in the right place, tin this, and solder to the "out" tag. Then cut off short. If the coil is a double one, put on the second winding in exactly the same way.

Coils made in the way described will be found to possess as high a degree of efficiency as can be desired. I have used them for some time now for reception on wave-lengths down to about 5 metres, and so far I have not found anything that will give better results. One of their strongest points is their robustness. Since each turn is supported at six points, they will withstand quite rough handling without suffering.

If any reader should be so unlucky as to crack or break a former, either by dropping it after it has been wound or owing to a mishap during the process of cutting out, it is usually quite an easy business to repair it with Chatterton's compound. One of the formers seen in the photographs actually did become a casualty before the coil was completed.

We now come to high-frequency chokes for use in short-wave sets. So far as I know, there is at present no commercial choke which can be used for the purpose, for all of them seem to be designed for the broadcast band.

Small Diameter Required.

On the short waves the choke is of paramount importance. Upon it depends to no small extent the smoothness of the reaction control, and smooth reaction is the most important quality that a short-wave set can possess.

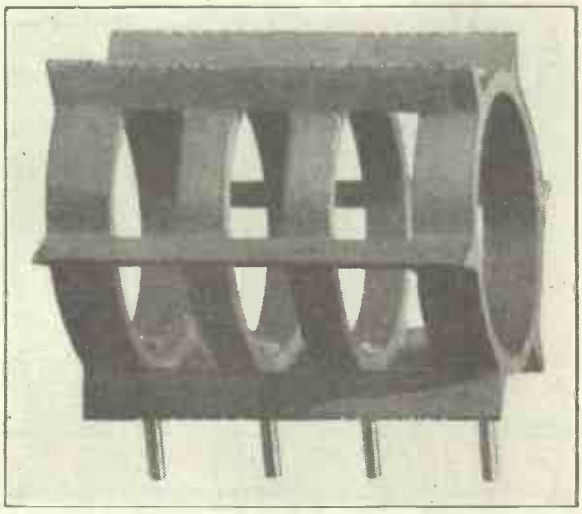
The most desirable qualities in a high-frequency choke for short-wave work are low self-capacity, suitable inductance value and small field. The last is exceedingly important, for if the field is big unwanted cross couplings may take place, leading to exceedingly queer results. For this reason, the diameter of the choke should be kept as small as possible. Chokes may be wound upon ebonite tubing 1 in. to 1¼ in. in diameter, but the best material for the purpose that I have come across is the Becol *midget* six-fin moulding seen in one of the photographs. This has an overall diameter of 1 in. and the windings are in contact with the dielectric material at only six points.

The Choke Former.

Fig. 5 shows the way in which a 2-in. length of this material is prepared. A small flat is filed at either end of one of the fins and 5 B.A. tapped holes are made ⅛ in. from each end. Into these are screwed valve pins with soldering tags beneath their shoulders. For wave-lengths between 40 and 100 metres an excellent choke may be made by winding on 150 turns of No. 36 insulated copper wire. For still shorter waves chokes containing 50 and 100 turns of the same wire should be made up.

The drilling lay-out of the holders for both single and double coils is shown in Fig. 3. The base of the holder for double coils consists of a strip of ¼-in. ebonite 1 in. wide by 3 in. in length. Into one row of holes are screwed valve legs whose shanks are cut so short that they do not protrude on the underside.

The second row of holes are deeply countersunk on the underside. Into each of them is inserted a 4 B.A. ½ in. countersunk bolt, locked by means of a nut. The nut for securing connections to the

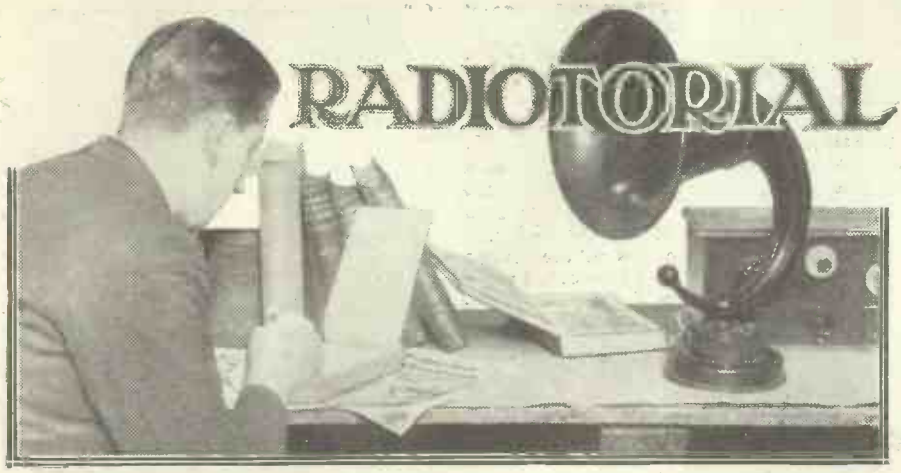


A lathe was employed to remove all superfluous material from this former.

terminals may be of the milled headed type, but I would recommend that an ordinary hexagon nut should be used instead.

It is impossible to make connections really tight with milled-headed nuts turned down by the fingers; hexagon nuts on the other hand, when tightened down with a box spanner, make very sound connections which are not liable to work loose. The single-coil holder is made in exactly the same way, and the holder for the chokes is constructed on the same lines, the only difference being that the valve legs and terminals are spaced 1¾ in. instead of ⅞ in.

The use of valve pins on the formers themselves and of valve legs on the holders makes the high-frequency chokes readily interchangeable.



RADIOTORIAL

All Editorial Communications to be addressed to The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

"After I had hooked up one of your three-valve straight circuits (1 det. and 2 amplifiers) in 1926, I had sufficient sense to let well alone, or I wasn't clever enough to hook up another, and the old set gave us London nightly. Perhaps I hadn't enough money then, or the wife wouldn't let me, but the main factor remains I never worried you, did I? (Thank goodness, No! said the Queries Department in unison.) Well, here I am at last, about to do my best!

(*Continued on page* 1248.)

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.

BRITISH PROGRAMMES IN PORTUGAL.

W. E. W. (Rue Valle Formosso de Cima, Braca de Prata, Lisbon, Portugal).—"I am an old reader, ever since 'P.W.' commenced, and I have now placed my order with the 'Tabagaria Englesa,' the newsagents out here, threatening them with sudden death if they fail to produce it every Friday when I call.

"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 a revised scale of charges, can be obtained direct from the Technical Query Dept., "Popular Wireless," 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.

APPARATUS TESTED

A TAPPED H.F. CHOKE.

FOUR-ELECTRODE VALVES.

A THREE-VALVE COUPLER.

AN EXCELLENT TRANSFORMER.

Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Department for test. All tests are carried out with strict impartiality in the "P.W." testing-room, under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

A TAPPED H.F. CHOKE.

THE Zampa Tapped H.F. Choke is manufactured by the Mic Wireless Co., Whitehorse Place, Market Street, Wellingborough. The winding is carried on a skeleton former in ten small bunches, the whole being enclosed within a transparent protective covering. On the top of the component is a small switch having five studs and one terminal. The other terminal is on the base.

The object of the switching is to enable the device to be suitable for a very wide band of wave-lengths. In ordinary Reinartz reaction circuits, on a medium wave-length, varying the switch has no appreciable effect. This, of course, is only to be expected, as in such an instance the H.F. choke is not a particularly vital component. On higher and lower wave-lengths, the switching has a marked effect. At 1,800 metres a peak was noticeable on one tapping, but this vanished and the choke became perfectly efficient when the switch was moved over to the maximum position. This Zampa choke enables a very useful range to be covered. It functions efficiently in a short-wave receiver operating on 32 metres, and was quite as useful in other sets tuning up to Daventry and stations of even higher wave-lengths. It is certainly just the component for the universal type of set. It is well made and nicely finished, and if it is not as compact as some H.F. chokes it does not bear an unwieldy appearance.

AN ADDRESS WANTED.

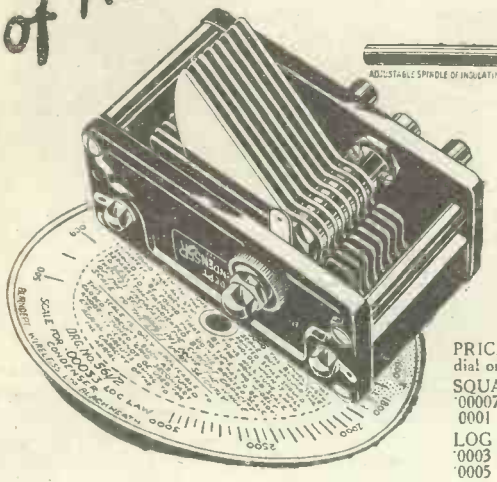
The Dubilier Condenser Co. has received a letter from a Mr. W. K. Lyth with reference to the Dubilier K.C. Condenser, but Mr. Lyth omitted to give his address, and we have been asked to give him a reminder to this effect.

FOUR-ELECTRODE VALVES.

As was pointed out in a recent "P.W." article, the four-electrode valve is likely to have a very interesting future. By employing the extra grid for space charge dispersal purposes one is able to duplicate the characteristics of a three-electrode valve with but a proportion of the anode voltage. For instance, a super-power valve of the normal type, having an amplification factor of 3 and an A.C. resistance of about 3,500 ohms, needs about 150 volts for its proper operation. With a four-electrode valve an amplification factor of a similar figure or

(*Continued on page* 1246.)

NEW Burndept Components of Advanced Design—



PRICES, without dial or knob:

SQUARE LAW
·00007 mfds., 13/6
·0001 mfds., 13/6

LOG LAW
·0003 mfds., 15/-
·0005 mfds., 15/6

Improved Variable Condensers

COMPLETE freedom from hand-capacity, extremely low losses, and vastly improved design in every detail are features of the new 1928 BURNDEPT Variable Condensers. They are constructed with spindle and end plates of insulating material, have a metal earth shield, and incorporate new-type bearings which "stay put" but are easily adjustable. The "Square Law" Condensers, designed for Capacity Reaction and Short-wave Sets, are used in Admiralty Receivers made by BURNDEPT. The "Log Law" Condensers, as used in the BURNDEPT "Screened Four," are suitable for H.F. circuits, are easily ganged, and are provided with printed wave-length scales which give a definite setting for any given wave-length. Full particulars on request.

Complete with drilling template, 4/-.

Screened Grid Valve Holder

This holder is adjustable to the varying sizes of the same type of screened grid valve, and is so designed that the valve can only be inserted in its proper position. All connections are clearly marked, and both terminals and soldering tags are provided. Constructors who are going to make use of the screened grid valve will find it very advisable to use this Valve Holder to ensure good results. The component is made of finest polished bakelite.

BURNDEPT

OFFICES: BLACKHEATH, LONDON, S.E.3.
SHOWROOMS: BEDFORD STREET, STRAND, W.C.2.

A.J.W.

RESERVE!

THE Arab knows how to appreciate the reliability, endurance and reserve of the Camel.

The instructed public appreciates for the same reasons

EXTRACT FROM A RECENT LETTER.

30th January, 1928.

"Will you please send me another of those batteries like you sent last week? A neighbour of mine is already attracted by the difference in the set, and wants his improved accordingly! Wonderful how a good thing takes on."

SIEMENS RADIO BATTERIES

60 *volts* - - 8/6
100 *volts* - - 14/-
Power 60 *volts* 15/-
(*As illustrated*).
Power 100 *volts* 25/-

Obtainable at your Dealers.

Siemens Brothers & Co., Ltd., Woolwich, S.E.18.

Made throughout at Woolwich.

APPARATUS TESTED.

(*Continued from page* 1244.)

even higher could be obtained with a lower impedance by applying half or less the anode voltage. Messrs. Aneloy Products, of 36, Hindman's Road, East Dulwich, London, S.E.22, have produced a new range of modern four-electrode valves, the majority of which we have carefully tested. We found their characteristics and operating abilities substantially as claimed by the makers. They are certainly most attractive propositions, and we see nothing against their use. They are cheap to buy and they are decidedly cheap to operate. All interested readers should make a point of writing to Messrs. Aneloy Products for their new leaflet on the subject of these new four-electrode valves.

A THREE-VALVE COUPLER.

The Graham Farish Mfg. Co., of 17, Mason's Hill, Bromley, Kent, recently sent us one of their three-valve couplers. This is a device carrying the majority of the components necessary for a three-valve amplifier or set. The insulating base measures 6¾ in. × 3¼ in. × ¾ in. There are three groups of valve sockets marked V1, V2 and V3. These comprise the valve holders. The fixed condensers are carried in the base, while on the top of the latter are four pairs of clips for the two anode resistances and two grid leaks.

There are nine terminals, and these are all plainly marked. Two of these are linked together by means of a metal strip which can be removed in order to bring into circuit a reaction coil which can be used in an ordinary set hook-up. A leaflet is supplied giving the circuits for a crystal detector with a three-valve amplifier, a three-valve amplifier for general purposes, a gramophone pick-up amplifier, and a straight three-valve set incorporating the unit.

The price of the unit is 12s. 6d. and this is probably less than the cost of the cheapest makes of individual components should they be purchased separately. The design is good and the unit is very well made. On test we found it perfectly satisfactory. The only additions required in the case of a three-valve receiver, detector and 2 L.F., are a coil holder with two coils, a variable condenser and a grid leak and condenser.

Thus on counts of both cheapness and compactness, this Graham Farish device should appeal to many constructors. The valve holders are not of the "non-pong" variety, but it would be a simple matter to mount the whole unit on Sorbo rubber or some other such "cushioning" material if microphonic noises were experienced.

SOME RADIAX COMPONENTS.

Messrs. Radiax, of Palmer's Place, Holloway Road, London, N.7, recently sent us a range of their components. The more important and distinctive of these are low-loss H.F. transformers and coils with accompanying six-pin bases. These are wound on finned ebonite formers and the pins are widely spaced. Another attractive Radiax item is a neutralising condenser. This is for either baseboard or panel mounting and has semi-circular vanes of hard brass. It is very well made and the action has just the smoothness and positive nature necessary for a component of this kind. But it would be an advantage if the control knob were removed farther away from the vanes or an extension handle arranged.

AN EXCELLENT TRANSFORMER.

As readers will no doubt have noticed, the R.I.-Varley general-purpose L.F. Transformer has figured in quite a number of "P.W." sets. Therefore, it was hardly necessary specially to test the sample recently submitted to us by the makers for this purpose. However, we did so and obtained the good results expected.

This R.I.-Varley L.F. Transformer, which sells at the very reasonable price of 15s., is, in our opinion, an excellent proposition. Notwithstanding its fairly light and medium-sized construction, it has a very high order of efficiency. Neither its dimensions nor its price is an index to its capabilities. There is no need to confine its use to small sets, for it will handle moderately heavy current without saturation. That it will do this and handle the wide range of frequencies as well as it does points to very skilful design.

The manufacturers state that until recently this transformer has had such a sale that they have been unable to keep pace with orders, but that having perfected their works organisation they are now in a position to cope with the demand. There is certainly a place for this high-class transformer at a moderate price.

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 1242.)

I admit I've had *more* than my money's worth up to date from 'P.W.,' if only for the interesting reading matter, and to be kept informed about the chaps who had trained their sets to fetch America and New Zealand, etc., by simply turning the dial indicator!

Missing the Home News.

"If I went near mine it used to protest in a loud voice, and Captain Eckersley would immediately come to the 'mike' and say 'Please don't do it!' I used to look indignant and agree with my next door neighbour every morning about that —— individual in Clapham Common district who had an eight- or ten-valve set that oscillated in every valve (hope he doesn't see this letter! Poor neighbour! I'll bet his loud-speaker purity has gone up one hundred per cent since I left!).

"You will gather that none of your technical editors have anything on me when and where wireless is concerned. (I could look quite as good as A. Johnson Randall, Esq., turning the wrong dial indicator on page 1007 in this week's copy (January 14th, 1928), if I knew where he bought his extra long cigarettes).* But will you help me when I explain that I have recently left London for Portugal, and am missing the news and programme of 2 L O more than I imagined anyone could. Believe me, I have written Uncle Rex letters about programmes that were immediately destroyed in case the radiation from them interfered with the generator and got into the 'mike.' Oh! to hear him sing now!

A "Stand-Offish" Set.

"What *do* I want? Please I want a circuit that will get London or Daventry nightly. I have a lot of 'Farringdon Road' components, but do not expect to be able to use many, if any, but have not unlimited capital. I honestly would like to build the set myself, 'cos I've got thumbs and waistcoat armholes, as other fellows. We have no broadcasting station here, but a well-brought-up spark station, suffering from hydrophobia, so my set must be selective. Very stand-offish. I don't want it to mix up with That Spark Fellow.

"Well! That's that! And my study of the Portuguese language is going to be nothing compared to your designing the Set of Sets for me, is it? Wishing the 'P.W.' better luck with its next batch of correspondence, and eagerly awaiting a reply and the name of the circuit to give us HOME."

We can sympathise with you, W. E. W., and we should like to tell you of a circuit that would bring in 2 L O or 5 X X with sufficient volume to rattle every window-pane in the Rue Valle Formosso de Cima! But we are afraid that your distance from home, and that powerful Lisbou spark station near your aerial, will make it no easy matter to receive a British station with any regularity, even on 'phones. However, the best chance seems to be on the long waves (5 X X, 1,600 metres) or the very short waves (5 S W, Chelmsford, on 24 metres or so).

We have not yet heard whether 5 S W is being picked up well in Portugal, but it is quite likely that it could be received clearly on The "Sydney" Two, a blue print of which was given away recently to every reader. Probably enquiry amongst any of the local radio enthusiasts would settle whether 5 S W is coming in well in Portugal or not.

If not, we expect you would get good reception, occasionally, at any rate, from 5 X X on 1,600 metres, using a straight long-distance set such as the "M.W. Five" which was described in the August number of "Modern Wireless."

Such results have often been obtained more or less regularly at greater distances than your own, but with all reception that takes place far beyond the normal range of the station, as in this case, the picking up of 5 X X is sure to be largely a matter of luck and of local conditions. Placed as you are, we should certainly try, if possible, for you might be lucky enough to pick up the programmes quite regularly.

[* EDITOR'S NOTE: As a matter of fact, the photograph was not of Mr. Johnson Randall, but of one of his assistants.]

THE "PROGRESSIVE" FOUR.

F. F. (Birkenhead).—"I was very interested in the 'Progressive' Four, and decided to build it.

"I have got to the third stage, but have to stop, as the results are disappointing.

"The first stage detector was very good. With the second stage (H.F.) added, hand capacity was very strong, but selectivity was good, also volume, whilst the hands were on the condensers; fading or bad oscillation when hands were removed.

"With the third stage transformer (L.F.) added, hand capacity seemed to increase and selectivity vanish. I am only able to get two or three stations on the loud speaker—Liverpool (local) about three miles, and Manchester (45 miles) fair loud-speaker strength, and 5 G B weak.

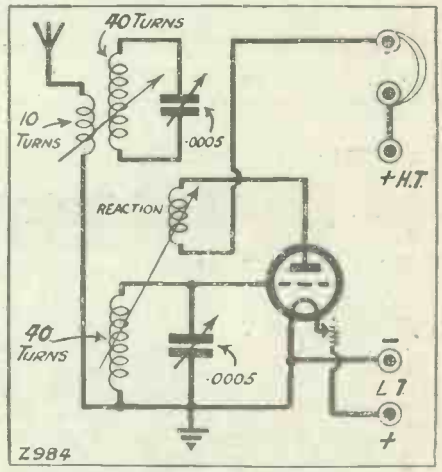
"With the potentiometer added, oscillation can be controlled, but at a big loss of signal strength.

"I have used a three-ply wood panel, with ebonite terminal strip as advised. Wiring is well spaced, using Glazite.

"The two H.F. chokes are home-made, ¾-in. ebonite rod, wound with 1,600 turns of

(*Continued on page* 1259.)

WHAT IS WRONG?



The above diagram is supposed to represent the connections of a selective one-valve set, with wave-trap. But it is wrong, and would not work properly.

Next week the correct diagram will be given, and, to test your skill, we shall continue to publish every week a diagram in which a mistake (or mistakes) has been inserted. The connection will be published the following week.

No prizes are offered, but by following this series and trying to solve the problems, week by week, the reader cannot fail to learn a lot about radio circuits.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 1248.)

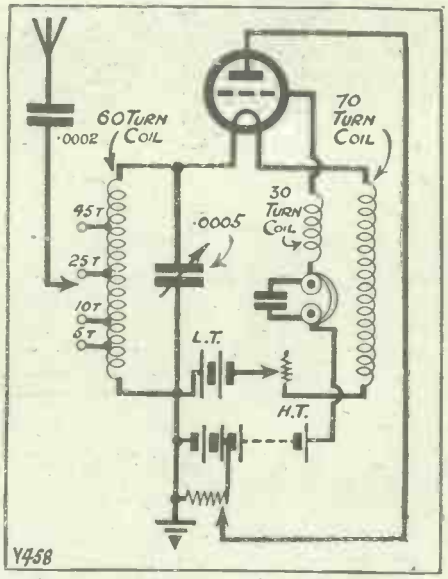
40 D.S.C. wire in four windings of 400 turns ¼ in. apart. Are these chokes to blame? They appear to be efficient.

"I prefer making these small components, where possible, not so much from motives of economy as the interest in making.

"If the hand capacity could be cured, I think the set would be very good, both as regards selectivity and volume, as I can get a great number of stations on the 'phones at good volume whilst hands are on the tuning condensers, but these almost disappear when hands are removed."

The use of the home-made chokes *may* be causing part of the trouble but your biggest mistake was in adding a third stage before the second worked properly. As stated so often in the articles, it is quite useless to complicate the set by adding another stage, if the existing ones don t work properly.

A FILADYNE ONE-VALVER.



The correct connections for a Filadyne One-Valve set are shown above. In the "What is Wrong?" diagram last week, the potentiometer slider was connected to the grid instead of to the plate terminal, the H.T. battery was reversed, and the 'phones-reaction circuit was taken to the plate instead of to the grid terminal.

What you should have done, when you found bad hand capacity resulted from adding the second stage, was to have traced that trouble before going further.

Probably a little experimenting with the grid leads of the first and second valves would have enabled you to put it right. Try changing over the two leads that go to the H.F. tuning condenser, keeping them well away from the panel.

If no improvement results, try doing ditto to the other condenser. Finally try keeping all the leads that come near to the tuning condensers as direct and short as possible, taking especial care that they do not come nearer to the panel than they need. As most readers have had no difficulty whatever in this respect, it is evident that your lay-out, wiring, spacing, or else one of the components, is a bit unusual, and is giving the trouble.

When this is corrected, the three-valve "Progressive" should work smoothly and efficiently. But if it does not, try and nail down the trouble before adding the fourth valve, or otherwise you will never get from the set the fine results of which it is capable.

THE recent A. R. R. L. International Test provided us in this country with an excellent opportunity of receiving the United States amateurs, and fortunately the conditions were extremely good during the first part of the tests. Those who are comparatively new to short-wave work doubtless made their first acquaintance with the Americans in such great numbers! The results will be published in about a month and will be reported on in this column.

The scheme adopted for the test was extremely ingenious—each American station was provided with a "sheaf" of test messages to be forwarded, each to a station in a foreign country, and the replies were to be sent via *another* station in America. For instance, United States 1 A S F sent a test message to British 2 B M, who would write out an answer and send it back, not to 1 A S F himself but to another American, who would in turn try to forward it to 1 A S F. The contest lasted for a fortnight, after which all logs of messages sent and received were sent in to A. R. R. L. headquarters for adjudication.

Many Commercial Stations.

Such tests as this go a very long way to show the reliability of short-wave work, and to confound those who say that it is "excellent while it lasts, but no good for commercial enterprises."

As it happens, these people may easily be proved in the wrong if they take a good listen round the dial on a 20-metre set one weekday! The whole range of waves from 15 to 30 metres is crowded with commercial stations, who all fade away when darkness falls and leave the wave-band to the amateurs!

I venture to prophesy that in a few years' time there will be very few high-power commercial stations remaining on the "ultra-long" waves of the 15,000-metre order. How they will all manage to accommodate themselves in the other regions is a problem, but there is as much "accommodation" between 20 metres and 30 metres as there is between 30,000 metres and 60 metres, so that it looks simple enough on the face of it. The trouble is, of course, that no short-wave band has yet been found which is suitable for communication during the whole 24 hours.

The 20-metre band excels for long-distance work between about 8 a.m. and 8 p.m. at this time of the year, but outside these limits it seems to be of very little use. The 40-metre band, on the other hand, is apparently at its best for really long-distance work between midnight and 6 a.m. It is going to be an expensive undertaking for each commercial station to have three or four separate wave-length adjustments, with time-switching arrangements.

W. L. S.

NEWS FROM SAVOY HILL.

(*Continued from page 1228.*)

pastime from the London Station at 7.25 p.m. on Saturday, February 25th. Capt. Cazalet was a member of the English team against America in 1925.

Vaclav Talich to Broadcast.

It is hoped that the distinguished Czecho-Slovakian conductor, Vaclav Talich, will conduct a symphony concert in the London studio on Sunday afternoon, February 26th. Originally a violinist, Talich studied at Prague, Leipzig and Milan, and played first in the Philharmonic Orchestra in Berlin. Afterwards he became a concert director in Odessa, and then a professor in Tiflis, where he first took up conducting.

He transferred his activities as a choir-master and conductor to Prague and since 1908 has been associated with important theatrical and other work in Jugo-Slavia and Bohemia. In 1918 he became principal conductor of the Czech Philharmonic Orchestra, Prague, with which he toured Italy in 1921, and afterwards Vienna, London, Liverpool, and other places. He is now regarded as one of the outstanding conductors of Europe.

England v. France Rugger Broadcast.

A running commentary on the England v. France Rugby match, which takes place at Twickenham on Saturday, February 25th, will be broadcast from London and Daventry between 2.55 and 4.40 p.m.

Big Sporting Broadcasts.

Forthcoming outdoor sporting events should provide splendid material for interesting broadcasts. One of these is the Oxford and Cambridge Boat Race, which takes place on Saturday, March 31st. The vivid story of the struggle as witnessed and told by the occupants of a motor launch just behind the crews, the cheers of the crowds on the river banks, the deep-throated siren calls as Cambridge claimed yet another victory—all so graphically related and transmitted by a short-wave apparatus from mid-stream to a point on the shore, thence by land-line to the London control-room and the various stations of the B.B.C.—provided a first-class thrill last year. Similar arrangements have been made for this year's event, which as near as can be stated at the

(*Continued on next page.*)

NEWS FROM SAVOY HILL.

(Continued from previous page.)

moment will take place between 9.50 and 10.15 in the morning. Mr. G. O. Nickalls, the old Oxford Rowing Blue who assisted to describe the race last year will do so again, and he will have Mr. J. C. Squire as his colleague once again.

Then there is the Grand National on the previous day, Friday, March 30th. This was another of the outstanding successes of 1927 carried out by Mr. Gerald Cock, Head of the B.B.C.'s Outside Broadcast Department. Geoffrey Gilbey, who described last year's Derby and the St. Leger, will be the commentator.

Football, too, is down for a good slab of programme time, what with the semi-finals and finals of the F.A. Cup Competition and the International Soccer match between England and Scotland at Wembley. At the moment, the broadcasting of these fixtures is subject to the satisfactory completion of certain negotiations, which, it is believed, will be satisfactorily concluded.

European S.B. Begins.

An important development in European broadcasting takes place on Sunday evening, March 11th, when a short programme will be relayed by land-line from Liège in Belgium to London, whence it will be sent out and broadcast from British stations. The proposal represents the inauguration of the scheme for the regular interchange of programmes between this country and the Continent by land-line.

The actual programme will be singing by the Liège Choir. It will be heard between 10.5 and 10.30 p.m., and will immediately follow a studio concert devoted to Belgian music, one of the series arranged by the Union Internationale de Radiophonie, in which each country belonging to the Union honours a member with a special concert. These concerts have been going on for some time and are to continue until the end of the present year, when the linking of the main European countries with satisfactory land-lines and the necessary repeater stations, is expected to be completed.

On the following evening, Monday, March 12th, an even more ambitious idea is to be tried—the relay by land-line of a concert from Cologne, for broadcasting from London and other stations; while on the following night, the programme from 5 G B will be relayed in the same way to Cologne for broadcasting from German stations.

The B.B.C. have asked the Cologne broadcasters for information as to the kind of concert most suitable for German listeners, while a similar courtesy has been extended to the B.B.C. by the Germans.

A Notable Newcastle Programme.

There are, it is said, still some people in Northumberland who never let slip from their memories the fact that Newcastle was once in the hands of the Scots. If such be true it gives greater significance to the seventh of the series of historical programmes entitled "Glimpses of the Past," which Newcastle is to broadcast on Tuesday, February 28th. The programme will deal with a particularly important episode in local history, namely, the imprisonment of that ill-fated king, Charles I., at Newcastle in 1646-47.

TECHNICAL NOTES.

(*Continued from page 1228.*)

ception in particular spots, which are sometimes known as "blind" spots or "dead" areas.

Loud-speaker Quality.

Have you ever noticed how the quality of the reproduction from a loud speaker varies when you use the instrument in different rooms, or even when you move it about from one place to another in the same room? Although in a general way this is a well-known fact, few listeners really take it seriously into account. The loud speaker is usually placed in a position in the room which is most convenient from other considerations, but you will often find that you can get a very much better reproduction by changing the location of the speaker.

The furnishings of the room have a considerable influence upon the output of the sound—and this applies also to a pianoforte and a gramophone, as well as to a loud speaker. Drapings, hangings, carpets, furniture, and so on, all tend to absorb or "deaden" the sound very rapidly. For example, in a fairly empty room, devoid of furniture, carpets, and so on, a pianoforte which is standing on the bare boards will give much more resonant and prolonged sound than otherwise.

If a room has rather a lot of furniture in it and is also heavily draped, the sound will be very much deadened. Generally, the best result is something between that obtained in a heavily-draped room and that obtained in a bare or empty room.

Studio Experiments.

All manner of experiments of this kind have, as most listeners know, been carried out not only by the B.B.C., but in broadcast studios in other countries, and there is still a certain difference of opinion as to whether a heavily-draped studio is preferable to an empty or "clangy" one.

In a heavily-draped studio the voice of a singer is heard in a very "individual" way, without any suggestion of echo and this, although it has some advantages from the broadcasting point of view, is really somewhat unnatural, since it does not correspond with the way in which we are accustomed to hear the voice in our ordinary experience.

A certain small amount of blaring or intermingling of succeeding sounds and

(*Continued on next page*).

TECHNICAL NOTES.

(Continued from previous page.)

echoes is really more natural, since it adds "colour" to the music or sound. The correct amount of damping must be obtained to prevent deadening the music (too much damping) or to obviate difficulties due to reverberation (too little damping and too much echo).

Considerations of this kind, which are highly important in the broadcasting studio, are also quite important to the broadcast listener, and it is well worth while to try a few experiments with the loud speaker in different positions, and facing in different directions, so as to obtain the best reproduction.

The Snag in Selectivity.

In these days of multiple stations and DX reception the advantages of selectivity are constantly emphasised, but I think it is not generally appreciated that selectivity may be overdone.

Of course, you know that (speaking generally) in a wireless circuit (as in other vibrating systems) the lower the resistance (or whatever corresponds to resistance or damping) the sharper the resonance. The current at resonance in a tuned circuit is greater the greater the voltage induced in the circuit, and is less the higher the effective resistance of the circuit. The capacity of the condenser, or the inductance of the coil, used in the circuit does not affect the calculation once the induced voltage and the resistance are known.

Since a high-frequency amplifying valve may be regarded as a voltage-operated rather than a current-operated device, it might seem that best results, that is, greatest amplification, would be obtained by making the coil very large. When we increase the inductance of a coil by increasing the number of turns, however, we also increase the resistance, and the increase in resistance nullifies to some extent the advantage gained through the use of a larger coil.

When Flat Tuning is Better.

The selectivity of a tuned stage in a receiver depends upon the resistance of the circuit. In low-resistance circuits the selectivity, as already mentioned, will be better than high-resistance circuits. This is usually illustrated by means of a curve showing the voltage across the tuned circuit plotted against the frequency. With considerable damping (low selectivity or flat tuning) the peak of the curve is broad, or the lower part of the curve covers a considerable range of frequency: with little damping (good selectivity or sharp tuning) the peak of the curve is sharp, or the lower part of the curve covers a much smaller range of frequency.

Since practically all the resistance in the tuned circuit is in the coil, it follows that carefully constructed and low-loss coils should be used in a high-frequency circuit. A coil can, however, be made so good from this point of view, that it cuts out side-bands, and may, therefore, even distort the received signals, in the sense that it cuts out some of the features which tend to increase their naturalness.

It is generally considered that if the ratio of the reactance of the coil to the H.F. resistance (at the same frequency) becomes much more than the figure of 250, side-band distortion will result.

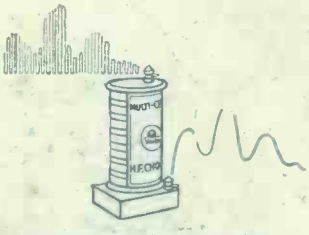
SPECIALISTS IN LOW FREQUENCY AMPLIFICATION

YOU—one of thousands—are satisfied *only* with real QUALITY in wireless reproduction. In the past, tens of thousands were content with very poor reception provided they could tune in a few stations at audible loud-speaker strength. But the time is coming when the public as a whole will insist on really good reproduction, and, what's more, many already know they can get it by using R.I. & Varley components. We have made a special study of all forms of L.F. Intervalve Coupling, because we realise the necessity for QUALITY if radio is to be really worth while.

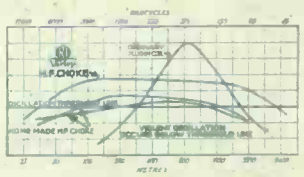
The famous Bi-duplex winding, developed and perfected after years of research, has been incorporated in our Resistance Capacity Couplers, and has resulted in a degree of real tonal purity hitherto undreamt of. The National Physical Laboratory Curves of our R.C. Couplers and Straight Line Transformer show that a wonderful degree of amplification has been attained, together with remarkable uniformity at all audible frequencies. That explains why you can hear the deepest bass notes and yet lose none of the high frequencies when using the R.I. & Varley Transformers or R.C. Couplers.

In this connection it must be remembered that no matter how good an L.F. Transformer or R.C. Coupler may be, distortion is bound to result if the H.F. Choke fails to choke back the H.F. currents efficiently.

Here again our Bi-duplex winding has enabled us to produce a component which for negligible self-capacity, minimum external field, extremely small dielectric hysteresis, and maximum choking efficiency over a very wide range, has no equal on the market to-day.



This diagrammatic sketch illustrates the effective way in which the R.I. & Varley Bi-duplex wire-wound H.F. Choke (9/6) deals with H.F. currents.



Comparative curves showing relative choking efficiencies. It will be seen that the R.I. & Varley H.F. Choke—distributed capacity 25 microfarads—chokes efficiently over a range of from 30–4,000 metres (10,000 to 75 kilocycles).

General Purpose Transformer
15/-

Bi-duplex Wire-wound Resistance Capacity Coupler.
Type A. ..... 20/-.
Type B. ..... 22/6.

"Popular Wireless" writes—"It must have been very skilfully designed for it gave results far superior to those its price would lead one to anticipate. We must admit it falls very little short of transformers in the one pound class."

Straight Line Super Transformer
25/-

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R/It

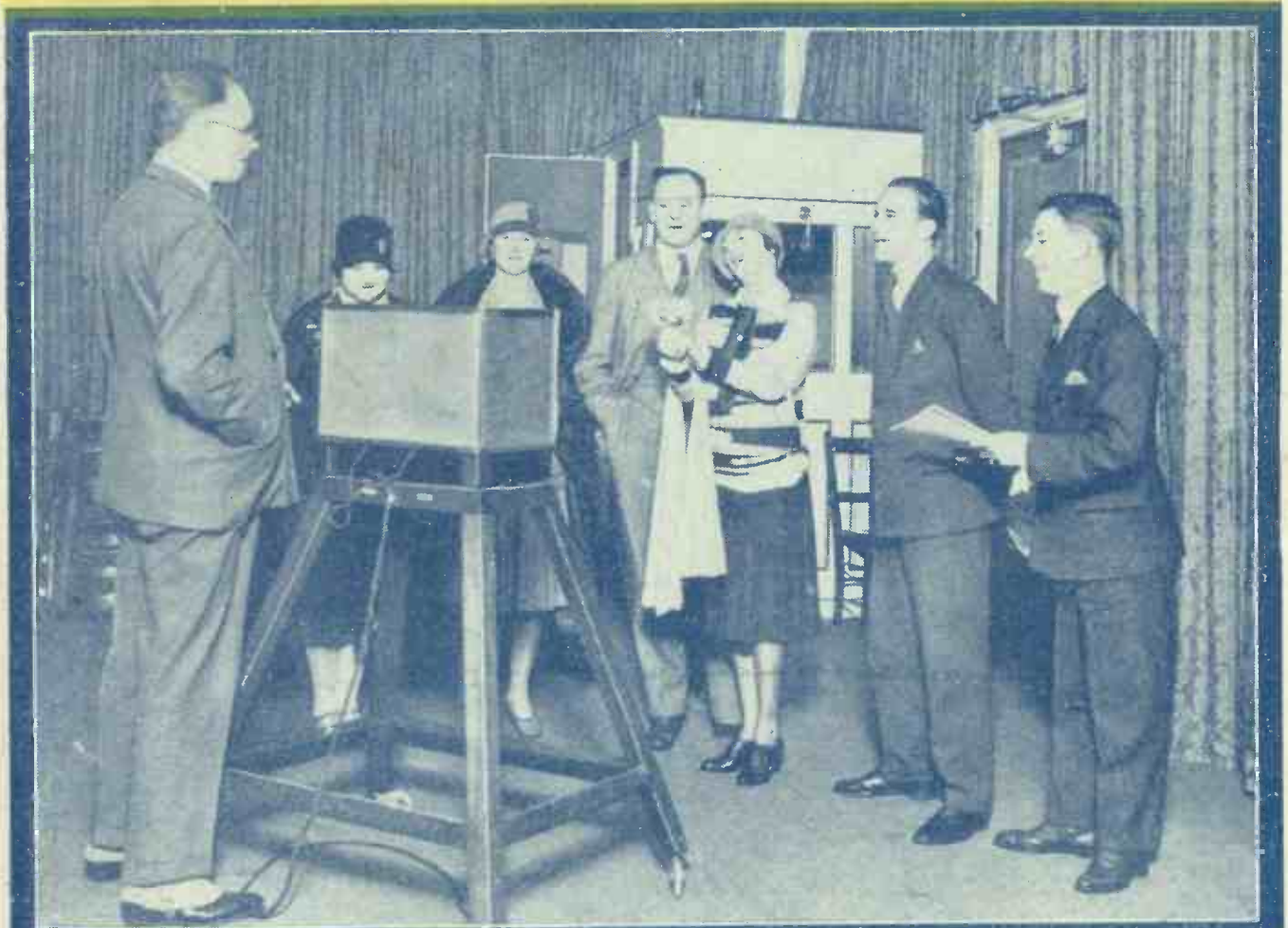
POPULAR WIRELESS, February 25th, 1928. REGISTERED AT THE G.P.O. AS A NEWSPAPER.

"SEEING" ACROSS THE ATLANTIC!

Popular Wireless

Every Thursday PRICE 3d.

No. 299. Vol. XII. INCORPORATING "WIRELESS" February 25th, 1928.



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A very economical receiver, suitable for the reception of short-, medium- and long-wave stations, using home-made coils

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Beware of The Mmfs. "Gingering" The R.S.G.B.

"Charlot's Hour" is a very popular feature of 2 L O's programmes. Our cover photograph shows M. André Charlot and his Company before the microphone at Savoy Hill. Note the "silence cabinet" at the back. In this secluded and soundproof compartment the announcer makes his announcements, with a clear view through the window of the studio and all that is going on in it.

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More power—greater volume—more of everything that counts in an H.T. Battery. Marconiphone H.T. Batteries provide smooth "free-from-crackle" power, giving greater *sustained* volume than you've ever heard before. Right through hundreds of programmes — never a falter — clear, life-like tone until the end.

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PURER tone—more realistic reproduction — band - strength volume—no needle scratch—controllable volume .... these revolutionary improvements can be yours if you fit the Brown Electrical Pick-up to your Gramophone and connect it to your Wireless Set and Loud Speaker. No matter how old your gramophone—how worn your records—this wonderful little instrument will completely transform them. Ask your Wireless Dealer to show you, for the first time, how realistic gramophone reproduction can be. The Brown Electrical Pick-up costs £4.

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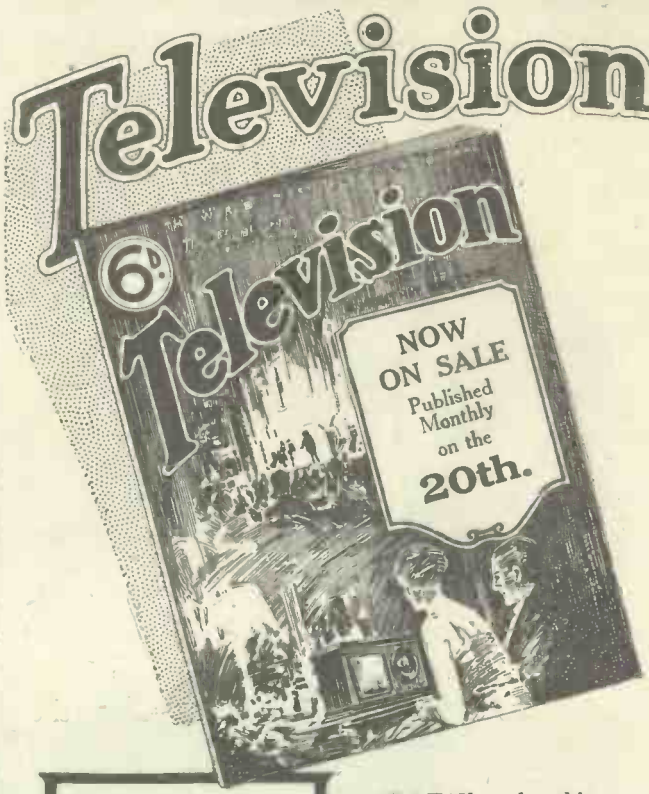

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Glimpses into the Future No. 1. "Television in Warfare." By R. Heath Bradley.

How to Make a Selenium Cell.

Light-Sensitive Cells. Noctovision.

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"Television" will stir your imagination from cover to cover.

You will look for the second number with impatience. Be one of the first to enter this new world. Get your copy of No. 1 now.

Met-Vick Components make the most of a Set

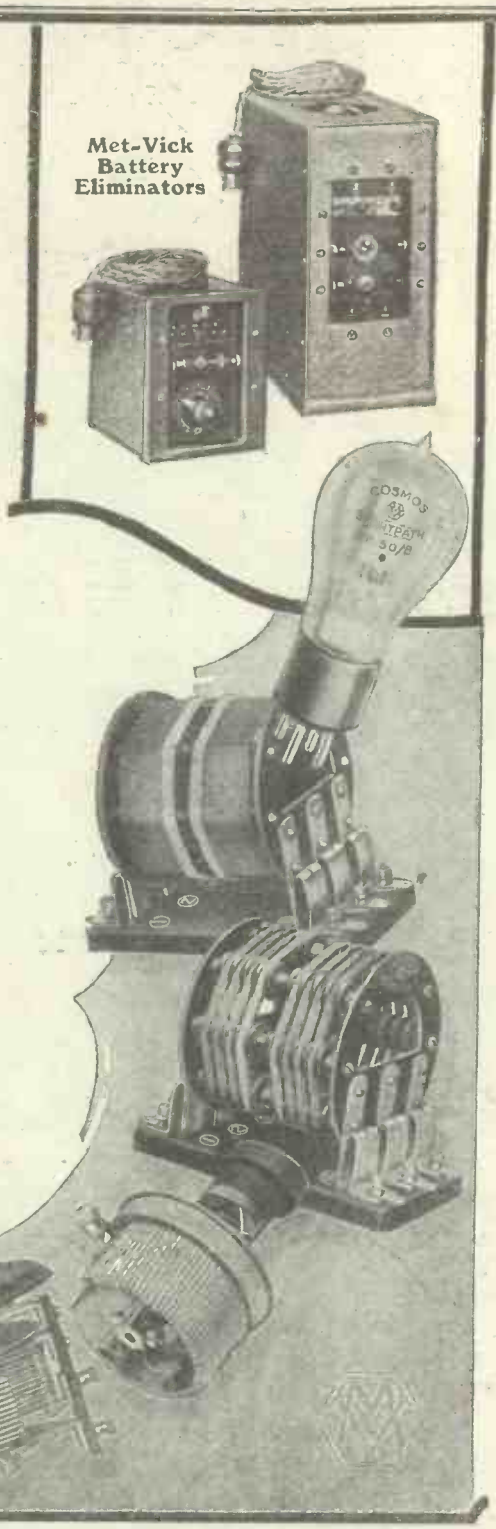
WHETHER you are building the Met-Vick three or four Valve Sets or any other set, you cannot fail to get successful and satisfactory results if your components are Met-Vick. Most of the lines shown here are already well known amongst enthusiastic constructors and listeners; yet for those who have not yet used "Cosmos" Components, here are some details:—

A.N.P. (Astatic - Non - Parasitic) Coils.—These new "Met-Vick" products provide a clever solution of a difficult problem. They overcome, simply and efficiently, the three difficulties associated with H.F. amplification, namely: Magnetic coupling between coils, Stabilisation, and Parasitic Oscillation. List 4117/8.

Resistance Coupling Units.—"Cosmos" ("Met-Vick") Resistance Coupling Units are well known to all wireless enthusiasts. The "V" type can now be obtained fitted with new "Met-Vick" A.C. Valve Holder. The latter is also supplied separately. List 7117/8.

Valves.—"Cosmos" ("Met-Vick") SHORTPATH Valves for 2-v. and 6-v. battery working are available at most good radio dealers. The new "Cosmos" ("Met-Vick") A.C. Valves are also available. These make possible the operation of a set from the electric-light supply without any of the aggravating "mains noises." A special disc adaptor enables a "battery-set" to be easily converted without re-wiring. Lists 4117/3 and 7117/8.

Battery Eliminators.—"Met-Vick" Battery Eliminators are supplied in two models. The H.T.—G.B. Model can be used on various supply voltages of 40-100 periods. Grid Bias tappings are provided at 5, 10, 15, and 20 volts. A high voltage (up to 250 volts) can be applied to the last valve. The L.T. Model gives an output of 5 amperes at 4 volts without hum. List 7117/8.



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(COSMOS)

For a complete description of the full range of Met-Vick (Cosmos) Components, ask your dealer for a copy of Booklet No. 4117/6.

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TEAM WORK.

SILENTLY and swiftly they swing across the stage. Twisting and twirling, tripping and turning. Four acting as one. Each in perfect unison with the rest. Team work.

Team work is as essential to success in Radio as in ballet. Choose a team of Cossor Valves* and, for the first time, know the full capabilities of your Wireless Set. Because every Cossor Valve is designed to function correctly with its neighbour, your Set will take on a new lease of life. It will give you purer tone, far more life-like reproduction and greater volume—for less upkeep cost, too.

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give you Distance

Clarity & Volume

Popular Wireless

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RADIO NOTES AND NEWS.

Sensational News—Interference from Carnarvon?—Our Limerick—The Time . . .—The Place . . .—And the Opportunity—Try Langenberg—Earl Haig and Radio.

Is Criticism Desirable?

A READER, whose letter I esteem because it shows that he is moderate in expression and sees two sides of a question, writes to the Editor suggesting that my criticisms of the B.B.C. are unnecessary and, in fact, petty. My friend does not need to exert himself in order to convince me that the B.B.C. is doing well; I have said as much many times. But on the principle that a good blade is worth a lot of polish, I certainly have been guilty of harping on one or two strings—this metaphor is becoming mixed—because I see one or two indubitable specks on broadcasting.

Faults of a Friend.

CRITICISM, of course, is not necessarily complaint alone nor praise alone; it is an appraisement of merits and demerits, as the critic finds them. It is a test which any perpetrator of matters submitted to the public taste should welcome. "P.W." has always maintained its freedom of thought and speech, and is no lap-dog of any clique or outside organisation. It is a good friend of the B.B.C., but for a discussion of the propriety of being blind to a friend's faults, please see Shakespeare's account of the quarrel between Brutus and Cassius.

Sensational News.

AND mighty good news, too! I understand that the proprietors of the Gilbert and Sullivan copyrights have partially lifted the taboo which they have hitherto placed on the broadcasting of the music of the operas. We shall await with impatience to see what the B.B.C. does about this. Talking of cruel criticism, only to-day I have read in a London evening paper, generally respected for its moderate views, the following, written by its wireless correspondent: "The tears of listeners flow too copiously." Gilbert and Sullivan will dry them.

Interference from Carnarvon?

THERE are still complaints of interference from the high-power station at Carnarvon, and the sufferers have my sympathy. But it is only fair to report that I am reliably informed that broadcasting can be received *on the station* itself, without interference, on quite an ordinary receiver plus a simple wave-trap. The station officials have interested themselves in the matter, and I understand they have frequently visited complainants and helped them to overcome the trouble.

Our Limerick.

OUR unfinished Limerick about the young plumber of Aintree ("P.W.", February 11th) appears to have put the poets on their mettle. The winning line, by E. Y. M. (Leyton), is: "So they hung Captain Eck on a plane-tree." This won by half a hair from "Hence the letters, 'Dear Sir, a complaint re'" by W. H. (Poplar).

The Time . . .

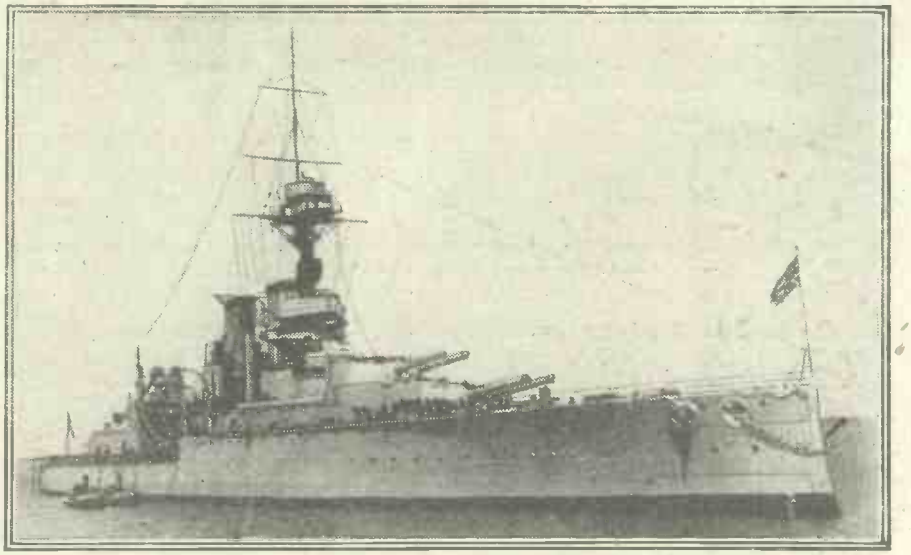
THE time is March 1st, the first of that blustery month when hares go mad, and which contains certain mysterious things called "Ides." It is the time for you to secure an introduction to three sets which have been well tried and proven sound—the Ediswan "R.C. Threesome," the Mullard "Master Three," and the Cossor "Melody Maker." These are all three-valve sets with the reputations of the respective three famous manufacturers behind them.

. . . The Place . . .

THE place is in the March issue of "Modern Wireless," an all-round, reliable and comprehensive shilling radio monthly magazine, a "P.W." grown portly. Whenever I get hold of a new "Modern Wireless" I feel the thrill of the real mag-maniac; pictures and diagrams galore, interesting headlines which arrest the attention, writers with names of weight—that's "M.W." at a glance. A perusal at leisure will convince you that it is "your own magazine." Even the printer's ink smells nicer than is usual. Finally . .

(*Continued on next page.*)

WARSHIP WHICH WORKS BY WIRELESS.



Without a single man on board her, this great warship—H.M.S. "Centurion"—can be completely controlled by radio. She has been equipped by the Admiralty as a target-ship, and by means of the marvellous machinery in her hull she is worked by wireless from another ship, which may be miles away.

NOTES AND NEWS.

(Continued from previous page.)

. . And the Opportunity.

THE great opportunity which will knock at your door on Mad March 1st is that of your being able to acquire *a shilling pictorial blue print of the three sets, plus a magazine worth half-a-crown, for one shilling*, by buying "Modern Wireless." Being optimists, the "M.W." people are hoping the machines won't seize up before enough copies to cope with the demand are run off. Take this tip: place an order now, and so spare your faithful annotator from the pain of imagining thousands of "P.W."-ites kicking themselves because they are too late. Our Mr. Dowding deals in the magazine most thoroughly with these three famous sets.

The Noble Six Hundred.

AFTER that brief spell of business, pleasure. Radio boys and coming "Lindberghs" might note that the R.A.F. wants 600 aircraft apprentices between the ages of 15 and 16. A number of trades are open to these fellows, including that of wireless operator-mechanic. For a healthy lad with nothing else in view at the moment, this is a matter worth considering. The R.A.F. is a service to be proud of. Join the R.A.F. and learn what it is to be a dicky-bird.

In the Skies.

HOW sad it is that the enthusiastic specialist so often lives in the skies, in a wonder-world of his own conceiving. One would have expected that clever engineer, Captain P. P. Eckersley, to have a fairly good contact with the earth. Yet, according to him, British listening has so far been conducted upon a technique in which the average listener has been content to listen to one programme. If he knows, as all the country knows, that no such content has ever existed, why did he adopt that technique?

A German Neutrodyne.

I HAVE received from G. Schaub, of Charlottenburg, details of a four-valve Neutrodyne receiver, which presents rather novel features. The aerial coupling is aperiodic; there is a neutralised H.F. stage, and Reinartz-reaction coupling. Control is provided by one knob only, and the calibration of the scale *is in metres*. Tuning from 200 metres to 2,300 metres is possible without change of coils. There is also a key which prevents the use of the set by anybody unauthorised. I do not often worry about foreign goods, but this looks O.K.

Knights! Try Langenberg.

CRYSTAL users need not think that they are limited to this country, for it appears that Langenberg is specially favourable to them. W. O. (Wandsworth Common, S.W.), with an old set, got Langenberg with no effort at all. The tide of practice has set towards the use of valves, but there is no doubt that by a scrupulous nicety of design a crystal set can give much fun and good results. See our "Lo-Loss" circuit.

A Determined K. of the C.-W.

I SHALL never forget H. K. R., of Mawnan, near Falmouth, because he writes to me with a gimlet or a triple-split goosequill, at an angle of about 30 degrees, counted anti-clockwise. Only my devotion to my job and my correspondents gave me the nerve to plough through his very interesting letter. Well, my friend of the acute caligraphy is an inveterate Knight of the C.-W., and expects to put the valve-makers out of a job. He has brought reception by crystal to a fine art and the Continental stations come in when he whistles. What this man could do with one valve does not bear thinking about.

SHORT WAVES.

A super loud-speaker which can turn the sound from a crystal set into a volume louder than that of the Albert Hall organ has been brought to this country from the Continent. All we can say is—why?—"Daily Herald."

* * *

LOGICAL.

"Wireless has come to stay," we read in a daily newspaper. We think this must be so, because we've heard several people remark that theirs simply won't go.

* * *

Customer: "Will you allow me something on my old valves?"

Salesman: "Well, we'll allow you to take them home, sir."

* * *

We read in the "Daily Express" that: "The house cat may be a source of wireless interference . . . there is a good deal of electricity generated in the cat's fur, as well as plenty of static when she parades on the backyard fence. . . . The cat thus becomes a potential source of radio interference."

It looks like a hard winter for the household cat.

* * *

COLLEGIATE WIT.

Radio Fan: "I picked up W G Y last night."

Auto Fan: "Huh, wouldn't she give you her full name?"—"Radio News."

* * *

The bust of Dante which adorns one of the Scottish B.B.C. stations was recently referred to during the Children's Hour. This troubled one small child very much, and the next day a letter was received asking what had happened to the "busted Auntie."

* * *

Dr. Sawbones: "Yes, I know a broken leg is mighty painful; but I'll give you some sort of anodyne."

Radio Fan: "Oh, I can't afford anything so expensive. Better give it just an ordinary set."

* * *

ADVANCEMENT.

My mother sang me lullabies
Before an open fire;
Though she had other work to do,
She never seemed to tire.

De Forest and the others have
Relieved maternity.
Now mothers leave their lullabies
To Station 5 G B.

Earl Haig and Radio.

THE lamentable loss of that great man, Earl Haig, reminds me how keenly he valued the services of wireless and wireless men. The Armistice was concluded on November 11th, 1918. You may imagine how busy the C.-in-C. was at such a time. Yet on December 1st he found time to write to the Marconi Company expressing his "very real appreciation of the good services performed by wireless telegraphists throughout the war."

An Historic Valve.

THE radio message sent by Marshal Foch acquainting the troops of the fact that they had to stop the "hate" at 11 a.m. on November 11th, 1918, was intercepted officially for the authorities in this country by a naval rating under my control. I bagged the valve he was using at the time. I had a clean conscience in so doing, because it was a "try-out" given to us by a Yankee naval officer. I have it still, though I feel that I ought to offer it to some society for preservation. But I cannot bear to part with it.

Loud-Speaker News.

ON February 28th, 5 G B will broadcast a programme called "The Open Road," which appears to deal with all the methods of getting to the seaside. If you have never heard the voice of that human dynamo, Lloyd George, you will be able to do so on March 1st, when a speech by him will be broadcast by 2 L O and 5 X X. On March 3rd, Belfast will present an animal programme in which birds, butterflies, and elephants will take a part. If the B.B.C. can stage an argument between a butterfly and an elephant, I will never mention Chamber Music again.

West-End Note.

LEARN that there has come into existence the Queen's Park and District Experimental and Technical Wireless Club. Hon. Sec., Mr. F. Batho, 37, Enbrook Street, Queen's Park, W.10. Well, a good name is half the battle—and this is a whale of a name. We wish it proportionate success.

Empire Broadcasting.

A. N. F. (N.S.W.), in the middle of listening to 5 S W via 2 F C, takes up his pen to address a few remarks to us on the subject of Empire broadcasts. He does not like the B.B.C. saying that they are not prepared to finance these broadcasts heavily, and suggests that it would be good business for the country if they did. The money paid to the B.B.C. is paid by listeners here, and ought to be spent in their service. But I heartily agree that Britain ought to broadcast to the Empire, and I consider it should be a separate service, subsidised by the Governments concerned.

That Electric Boy.

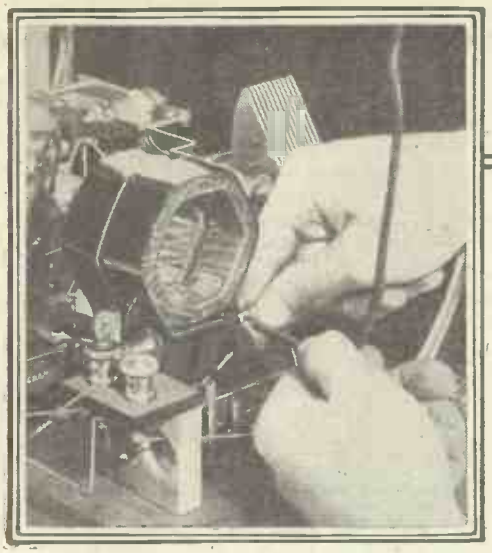
BESIDES making rain the radio waves are now credited with having electrified a boy. Well, if that boy grows up to be a waiter he will be "discharged." According to the report, candlesticks and iron bars exhibit uncontrollable agility in his presence, and I should like to have him around on the days our jobbing gardener comes. All these wonders have occurred since the boy's home got a wireless set. What will happen if they buy an electric-iron beggars the imagination.

Ask Me Another.

HERE is a variant of an old joke, which may, however, be new to some of you.

An unwary dealer promised his assistant to pay commission on sales at the following rate: For every set sold, a farthing for the first valve leg, a ha'penny for the second, a penny for the third, and so on, doubling it each time. The assistant promptly sold himself a seven-valve set for cash and demanded his commission. Would a ten-pound note cover it? Quick! Yes or no!

ARIEL.



Beware of the Mmfs.

You cannot be too careful when building a receiver, for even tiny traces of capacity have most startling results when they crop up in the wrong places.

By E. A. ANSON.

WHEN we deliberately connect capacity across a coil in the shape of a variable condenser, we have a tuned circuit. We can tune out one station and tune in another. For maximum efficiency we are told to keep the capacity small and make the coil as large as possible, for we always have the choice of a small coil and large capacity or large coil and small condenser.

Unfortunately, capacity is not such a definite thing as we assume. It is impossible to separate inductance coils from capacity. In fact, it is much more difficult than it would seem at first sight to keep this

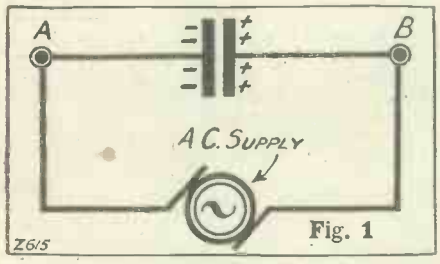


Fig. 1

capacity of ours from getting mixed up in parts of the circuit where we least want it.

Even tiny traces of capacity have most startling results when they crop up in the wrong places. It is for this very reason that the beginner who starts out quite gaily to build a 4 H.F. receiver will find himself enmeshed in an infinity of curious capacity effects. These effects generally make themselves felt and heard in a multitude of subtle sounds from a mighty rushing wind to the 8,000 p.p.s. whistle of a bat on the wing.

Worried "Wireless Wizards"!

But let no beginner be dismayed, for these very mmfds. have worried wireless wizards before him. When they gaily started out to make 4 H.F. receivers some six years ago, these very capacities made them stop to think.

Indeed, they thought for four or five years—hard. Then came the neutralised circuits. But even then the mmfds. were not beaten. They bobbed up again with parasitical oscillations very difficult to detect.

Before we measure the size of some of these unwanted capacities, let us get some idea of what they look like, for unwanted capacities do not build themselves into exquisite little condensers easy to behold.

Two conductors separated from each other by an insulator have capacity even if they are a mile apart. The closer they are together the larger becomes this capacity. The further apart, the smaller the capacity. When one conductor is charged with positive electricity the other prefers negative electricity.

If a machine that generates A.C. is connected across A B, in Fig 1, it will make first one side positive and then the other. The effect of this is to make it seem as if a current actually flowed through the condenser. Of course, in reality, the condenser is a good insulator and no D.C. can flow through it. But, by a sort of trick, the condenser can be made to pass current as if it were a conductor.

It can be calculated mathematically exactly how much current will flow for any given frequency. Roughly, the higher the frequency the more current flows. Thus, when we come to radio-frequencies, quite small capacities can pass quite appreciable currents. On the fairly short waves that the B.B.C. use, tiny capacities can pass large currents.

Some Condenser!

Incidentally, capacity is measured in farads. Nobody has ever used a condenser of 1 farad capacity, for it would be about as large at St. Paul's and quite unsuitable for one-hole fixing. So most of our condensers are measured in microfarads or micro-microfarads. You generally place a 1 mfd. condenser across your H.T. A microfarad is a millionth of a farad and a micro-microfarad is a millionth of a microfarad. The average tuning condenser has a capacity of ·0005 mfd., or 500 mmfd. The mmfd. system saves a multitude of ohms and is generally responsible for getting the wrong answer when you embark on mathematics.

Now it is these mmfds. that cause most of our wireless troubles. Like vitamins and disease germs, it is our little mmfds. that count. The lower the wavelength the more they count. Where do these mmfds. lurk in our receivers? How can we minimise them? Well, take an ordinary 1 H.F. detector (Fig. 2).

Why the mmfds. are everywhere!

In some places they don't matter, in others they will make you gnash your teeth. Look at the far end of the aerial. There is an egg insulator. One side connected to the aerial wire and the other to the mast. In wet weather this is almost the same as saying that the egg insulator is connected to earth on one side and to the aerial on the other. Thus we have a condenser. At this end of the aerial any condenser will leak away or by-pass away the H.F. voltage in the aerial.

An Aerial Insulator Tip.

If we connect our egg insulator in the normal way, we will introduce a capacity of 2 mmfd. But there is a better way. Connect each eye of the insulator without crossing the connecting wires. This way gives a capacity of only ·6 mmfd. At the receiver-end the mmfds. do not matter so much, for they all get lumped in with tuning capacity, but even then they all add up together and make it impossible to get down as low as possible on a given coil.

Thus, at the down-lead end, unwanted capacities decrease the minimum capacity of the condenser. So they are best avoided. Most good tuning condensers have a minimum capacity of about 20 mmfd. An average aerial has a capacity of about 250 mmfd. For this reason it is best to keep down-leads clear of all objects and leave them uninsulated, for insulation such as rubber has a greater capacity effect than bare wire spaced in air. In addition, when the insulation

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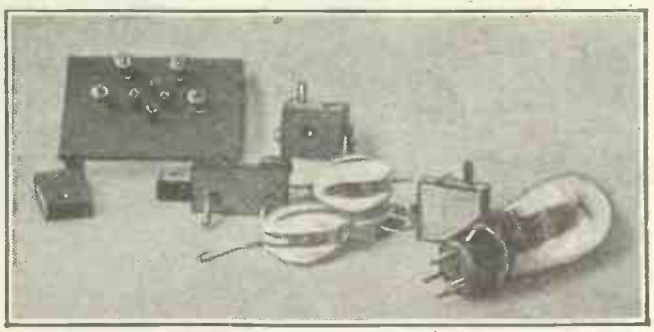


A few examples of the places where stray mmfds. may make a tremendous difference to reception. Aerial insulators, coil holders, and valve electrodes all have inherent self-capacity.

BEWARE OF THE MMFS.

(Continued from previous page.)

becomes wet, it will surely lead to inefficiency.

The tuning coil has self-capacity. Nobody has ever built a tuning coil without capacity, but the smaller the self-capacity the better.

Now we come to the valve itself. Between its electrodes there will be lurking mmfds. Small, but having baffling effects. The following table shows what may be expected here.

It may be interesting to explain how these small capacities were measured, in case others may like to rig up the fairly simple apparatus and make a few tests themselves.

How They Were Measured.

A wave-meter with a calibrated vernier was oscillated at 400 metres. Coupled to it inductively was a simple condenser and coil connected to a valve voltmeter. The valve voltmeter measured the exact voltage and resonance point.

Valve.	Grid to Fil. Mmfd.	Grid to Plate. Mmfd.	Fig. of Merit Grid to Flmnt.	Grid to Plate
D.E.H. 210	4·5	5·5	1·27/2	·85/2
D.E.L. 210	4·0	4·5	1·5/2	1·28/2
D.E.2 H.F.	3·5	4·0	1·3/2	1·7/2
Valve holder	2·0	1·0	1·8/2	1·8/2

The capacities to be measured were placed across the terminals of the wave-meter condenser. Then the wave-meter was turned to resonance by adjusting the vernier. The amount that the vernier had to be decreased in capacity gives the added capacity of the condenser being tested. The vernier condenser gave a capacity of 6 mmfd. for a 180° swing.

If the capacity under test were good electrically, the H.F. voltage before and after inserting the condenser to be measured was very nearly the same. The figure of merit in the table gives the ratio of H.F. voltage before and after. The bottom figure "2" is the voltage before adding the capacity. The top of the fraction gives the H.F. voltage after adding and retuning carefully. The nearer the new voltage is to two the better the dielectric of the capacity under test. Thus a capacity of certain two wires in air was 4 mmfd., and the fraction or figure of merit was 2—, showing that the added capacity was a perfect condenser.

Well, to get back to our H.F. valves. A dreadful thing happens due to the capacity of the electrodes. The 4 mmfd. or so couples the grid, and the plate and H.F. voltages are apt to be fed back and cause oscillation. Now we cure this by neutralising and our H.F. valves have come into their own.

Why We Neutralise.

What we actually do is to feed plus and minus electricity to the grid out of step with the plus and minus oscillations due to back coupling. If we feed the correct dose by making our neutralising condenser the right size, the oscillations cancel out and we get no oscillation.

In fact, we have been fighting the mmfds. with their own tools.

But there is still our tuned-anode circuit to consider. In it we have a tuning condenser of about 250 mmfd. Except for added capacity of the aerial our anode circuit is very similar to it. But there is an unwanted capacity when we start to tune. Whilst our hand is on the condenser knob we hear that distant station, but when we remove our hand the station goes with it. All caused by a few mmfds. in our hand.

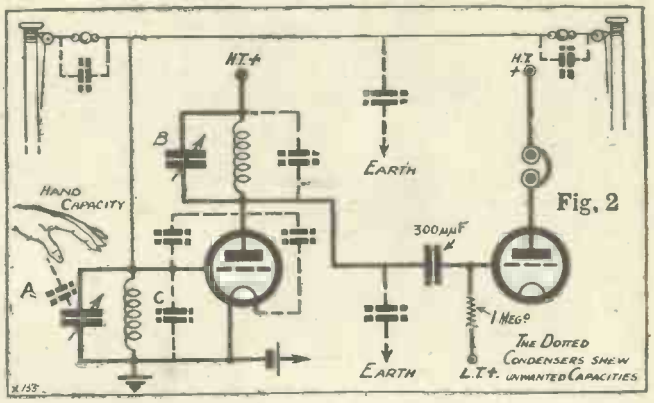


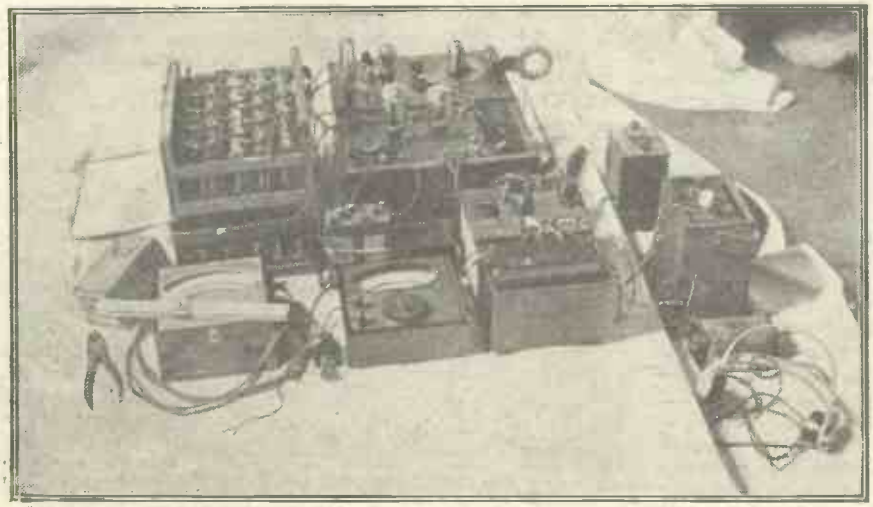
Fig. 2

The problem is easily cured by always taking care to connect the moving vanes to the zero H.F. side of the circuit. In this case to H.T. plus. This capacity trouble applies to almost all circuits, and is generally easily cured. Remember that, provided you shunt your H.T. with a 1 mfd. condenser, it may be considered as at zero H.F. volts. Of course, it may be at any voltage from a D.C. point of view.

Even terminals have capacity one to another. It is advisable to keep the aerial and earth terminals well apart. The table below shows what to expect as regards terminals. The capacity will vary according to the material in which the terminals are inserted.

Normally it is ebonite. Two Burndept 2 B.A. terminals 1¾ in. long were spaced 2⅛ in. apart centre to centre. This leaves a half-inch gap. The measurements were made just as for the valves, etc.:

Material.	mmfd.	Fig. of merit.	Remarks.
Ebonite ..	1·5	1·83/2	
Mahogany ..	1·4	1·8/2	
Pine	1·35	1·45/2	
Deal	1·35	1·35/2	
Damp paper	1·4	1·35/2	
Egg insulator	2·0	1·85/2	Normal way
" "	·6	1·9/2	Suggested way



The instruments used during the tests described. Among the many meters of various descriptions can be seen the valve voltmeter on the right of the photograph.

Watch Those Terminals.

Rows of terminals close together may look very pretty, but it is better to keep them apart if possible as these results show. Otherwise the mmfds. may play you a trick or so in the H.F. department of your receiver. It doesn't matter about terminals not carrying radio frequency such as L.T. or H.T. terminals of course.

We all know the saying, "take care of the pence and the pounds will take care of themselves." Well, in wireless it becomes "take care of the mmfds. and the mmfds. will take care of themselves.

Hence the cry of all set designers to space your wiring well apart and use bare wires. Above all, they always beseech you not to break out into a system of point-to-point connection entirely different to theirs. Painful tribulation with the mmfds. has shown them the best way to do it after much practical experience.

In a word, beware of the mmfds.!

You may not be able to erect an outdoor aerial, but it is possible an indoor variety will serve your purpose even better.

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

IT is the practice of quite a number of people to refer to indoor aerials disparagingly, as though they were definitely inefficient. But the fact is that a very good indoor aerial can be better than one of an outdoor type that may look as though it should be good. Take the adjoining houses of two listeners. One has a diminutive garden of which he is inordinately proud. Strung from an upper window across this garden and running to a small pole is his outdoor aerial, the envy of all his neighbours. The other house is quite a bit higher, but has no garden, and the occupant is therefore limited to an indoor aerial.

But making the best of a bad job, he has fixed up an aerial system in the roof space. Now it is quite possible that he is able to receive on his indoor aerial stations that his neighbour could not with a similar set.

The Importance of Height.

There are several reasons for this: in my first suppositious case, the aerial is, at the one end, very badly screened by a big tree, while at the other end the down lead runs parallel and close to a large metal drain pipe. Both these things will cause severe losses and detract greatly from the efficiency of the antenna.

The indoor aerial has a greater height, and height, it should be remembered, is one of the most important things in connection with the erection of an aerial. That it is surrounded with slates and bricks and mortar is of no great consequence, for wireless waves will penetrate through these just as easily as they do through air. That is, except when it rains, and the roof and walls are covered with a film of moisture. This will, to a certain extent, act as a screen, but not as such a damaging screen to radio reception as that large tree that overshadows the neighbouring outdoor aerial.

However, in these examples I have taken a very poor outdoor aerial and an extremely good indoor one, but the "pick-up" qualities of a medium outdoor aerial will be greater than those of a fairly good indoor one. But do you want a very good aerial? And I hope I shall not be accused of a radio heresy if I state that it is quite possible that your purposes will be better served with an inefficient aerial.

That "Background" of "Mush."

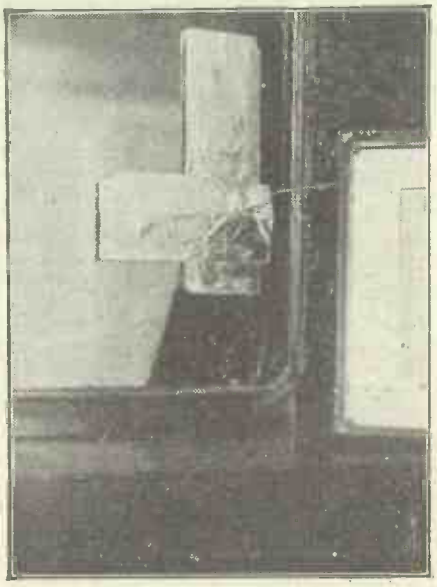
A great deal of "background" can be eliminated by deliberately making your aerial less efficient. You may lose ten or fifteen stations, but in so doing you will gain by clarifying the programmes of the half a dozen or so more powerful broadcasters, that you can use at any time for providing alternative programmes. Incidentally, you will also find that your receiver has become more selective.

A good indoor aerial may be all that you need. I am not including a frame aerial in this description, for this is a thing of quite another character. Truly, it is generally used indoors, but, generally speaking, it is so inefficient as an antenna that its use is confined to those who are able to employ a very sensitive multi-valve set.

There are many different ways of arranging an indoor aerial. If possible, it should be fixed up in one of the higher rooms in the house, or in a loft or attic. Height, as I have already pointed out, is the initial requirement, and it must not twist about down stairways and through passages. The best plan is to have the set in the upper room wherein is fixed the aerial, and then from the set run extension leads to the downstairs room for the loud-speaker or telephone receivers.

The Wire to Use.

If you happen to be very close to the local station, and this is the only one from which you desire to receive, then there is no reason why you should not sacrifice a certain degree of efficiency and fix up the aerial in a downstairs room if you so desire and it is more convenient to do so. Practically any kind of wire of the insulated kind can be used, although very excellent material specially manufactured for the purpose is obtainable from such firms as Ward & Goldstone, The London Electric Wire Co., Ltd., and others of our advertisers. Ordinary bell wire will serve quite well. No elaborate insulating need be carried out as the wire is to be indoors.



A novel indoor aerial which makes use of the "silvering" of a large mirror. There is a capacity connection to this via the sheets of tinfoil which can be seen.

First of all, however, a good earth connection is required. A lead must run directly from the earth terminal of the receiver to some point such as a main water pipe. A buried outdoor earth is a very excellent device, but it is an indisputable fact that for consistency and general efficiency a good waterpipe earth has many claims for general attention. Keeping the earth lead as short as possible, and of stout wire, take it if possible to a main waterpipe; one which does not go to a tank.

Make the Plumber Help.

And here is a tip worth remembering. When the plumber comes along to do a repair, get him to solder the earth lead to the water-pipe. Without a great deal of experience and a proper blow-lamp and tools, you will find it a difficult and even almost impossible task to do such a thing yourself. A good temporary joint can be made by scraping the pipe clean and then very tightly wrapping the cleaned wire round it. Proper earthing clips for making such earth lead joints can be purchased for a few pence each, but these cannot give you the permanence that a well-soldered connection can. Failing a waterpipe a gas-pipe can be used as an earth, but generally speaking this gives only poor results.

The wire can be strung across the room just below the ceiling between two opposite picture hooks, but, unless it is a very large room, the length will prove inadequate. Therefore, four or five separate lengths, widely separated, can be stretched across, the ends terminating in one down-lead at the side nearest the set. The other ends are left free and better reception will be obtained if these ends are pointing away from the station you most often desire to receive.

Helping an Outdoor Aerial.

If this scheme is considered an unsightly one, a wire can be run around the back of the picture rail. But the wire should not be taken the whole distance around the room. From the centre of one wall it can be run around the picture rail until it comes to the centre of the opposite wall, where it must terminate, or an extension be made through the door along a corridor. This extension must be kept in as straight a line as possible, and if it comes to such a point where it has to deviate greatly from a straight line here it should be terminated.

And, by the way, this reminds me that here is a tip worth noting on the part of those listeners having very small and poor outdoor aerials. If you have only a few feet of outdoor aerial, you can try an extension from the point of entry indoor, right across the room. In many cases this will definitely result in an increase of the pick-up qualities of your aerial system.

"GINGERING" THE R.S.G.B.

This interesting letter from the Chairman of the Association of British Radio Societies follows the Editor's recent plea for more life in British Amateur Radio representation.

DEAR SIR,—May I first thank you for your article in POPULAR WIRELESS, February 4th, *re* the Association of British Radio Societies.

The organisation of an amateur movement is always a difficult proposition, but with Radio Societies it is doubly so on account of the rot that seems to have set in; but I do not believe that this rot is due to lack of enthusiasm in the true sense of the word. I find the Radio Society member of to-day is just as anxious to discuss Radio matters as he ever was; but with the coming of broadcasting he has turned most of his attention to the entertainment side, and I feel that we must therefore find the interest in that branch.

Plenty of Interest.

There is certainly plenty of interest in this particular section, the only thing I am afraid of is the limitations of activities imposed by the authorities and the-head-in-the-clouds attitude of the B.B.C. I do not know if the authorities realise the amount of useful work that has been done by amateurs, but as far as I can see they only acknowledge one amateur and give him unlimited license. If it is a question of knowledge and they are quite sure of themselves, then nothing further need be said, and he should be on the G.P.O. staff. If, on the other hand, they are willing to concede equal knowledge to at least twenty other amateurs in the country, then equal facilities should be given for experiments to organised bodies containing those other amateurs.

I do not wish to rake up the amateur transmission controversy in which the G.P.O. showed up so badly.

I have only mentioned these points more clearly to show the need for members of Radio Societies to rouse up and get into this business with every ounce of energy they possess. To them I would say: "It is no use leaving it to your poor, hard-worked secretary, but get in and do something yourself. Talk at your meetings, and air your grievances as well as your knowledge. Take an interest in the experiments we are hoping to put forward in a week or two, and give your results to the secretary. Get into your mind that an association is now formed that will watch your interests and supply you with the basis for discussion and experiments, so that you will be certain of an interesting evening any time you go to a meeting."

"Join a Society."

To the man who is interested in radio and wants to know more, I would say: "Join a society, but not just to get particulars of the set you want to build—stay in, and when you have absorbed the knowledge, be ever ready to pass it on to other new members."

To secretaries I would say: "If you are in troublesome times, write to the Association Secretary, who is a kind-hearted man, with a wonderful experience. He knows all about Radio Society troubles and can help. Do not forget to send a postcard to L. A. Gill, Esq., Hope House, South Reddish, Stockport, near Manchester, and tell him the name of your society, your address, and the number of members on your register."

In conclusion, may I say to you, sir, as the Editor of a journal that has done much to foster the Radio Society movement, that if at any time the organised Radio Society movement can return all your good wishes and your help, I feel sure they will gladly and willingly do so.

50, Garswood Rd., Yours faithfully
Moss Side, Manchester. J. E. KEMP.

THE LOUD SPEAKER AND POLITICS.

What will be the effect of low-frequency amplifier technique upon the electorate? This amusing photograph of two prospective voters suggests that the loud speaker will be "viewed with suspicion."

SHORT-WAVE NOTES.

DAY by day the general "fade-out" on 20 metres or thereabouts is taking place a few minutes later, and accordingly 2 X A D's sphere of usefulness is becoming greater. At the time of writing he is being excellently received on the loud speaker at 8.15 p.m., and has been heard at excellent strength even later. This summer should be an excellent opportunity for transatlantic relays of broadcast programmes, and should also prove a boon to those who have not as yet experienced the undoubted thrill of receiving America direct.

Again, 2 X A D has been heard making cryptic announcements to the effect that "this is 2 X A D, Schenectady, exchanging programmes with the British Broadcasting Corporation." Still the British Broadcasting Corporation continues to put out its usual programmes and takes no notice whatever of 2 X A D! It certainly is a most peculiar state of affairs.

The writer has just made a single-valve set for the express purpose of receiving 2 X A D and 2 X A F with the minimum of interference, disregarding any loss in strength that may be occasioned by the use of special means of increasing selectivity. It is easy to convince oneself that this is the right track to follow; once a signal, *however weak*, has been received clear of all jamming, it may be amplified "up to taste," and if necessary put on the loud speaker without sounding as badly mangled as it would after being brought up to the limit of strength by the use of much reaction. This single-valver will be used in front of the same amplifier that is normally used for broadcast work, and the final output (it is hoped!) put on the loud speaker. There certainly is an unaccustomed thrill even for "old hands" on hearing really distant stations at "filling the house" volume!

That 20 metres is the wave-length of the future for reliable long-distance communication is being proved day after day. In spite of all that has been said about its unreliability, the writer has been in touch with United States amateurs on this wave-length every night since the tests began (twelve nights in all) at about 6 p.m.

W.L.S.

The "Handyman" Two

A really efficient two-valve set, on the making of which the Handyman can let himself go to his heart's content. Full details in this and the article which follows next week enable the set, coils and cabinet to be made quite easily at home.

By G. P. KENDALL, B.Sc.

The Completed Set wired up and ready for use.

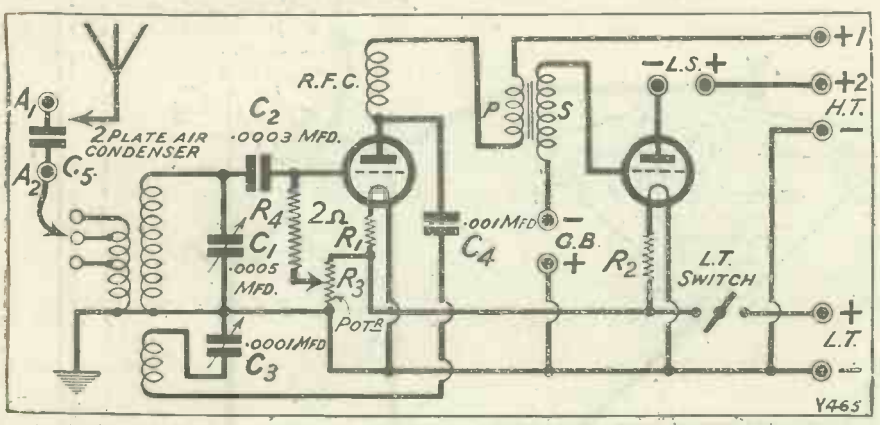
BUILDING a wireless set is becoming so easy with single-hole fixing components, detailed wiring diagrams to work from, and so on, that there is some risk of our becoming a race of "home assemblers" instead of home constructors. How many of us, I wonder, ever really construct any of the parts which are used in building sets?

Almost always all that we have to do is to assemble some ready-made components and wire them up, and this is getting so easy a business that there is very little skill required. Yet there was once a time, only a few years ago, when wireless enthusiasts used to perform such feats as building their own variable condensers (from the raw materials, not sets of parts!), winding their own L.F. transformers, and so on! True, the main reason for such works of skill and patience was that bought components were extremely dear, and often of no better quality than those made at home (sometimes they were worse!).

Lost Joys.

As prices came down and finish and efficiency went up, it was natural that almost everyone should start using the ready-made component, but there is no doubt that we miss a good deal of pleasure by so doing.

There was certainly more satisfaction in completing one of those earlier sets, with its numerous home-constructed parts, than one of the present-day type, which is so apt to be exactly like scores of others built by different people to the same design. One could at least feel that it was an individual job, and that there was no other like it. Obviously, no one really wants to go back to the days of transformer winding at home, simply because so many of the important parts of a set are now being turned out by the manufacturers to a standard of efficiency which in most cases we cannot equal ourselves. Nevertheless, it appears that quite a number of constructors are feeling that things are getting so easy that interest is being lost and that there is not sufficient scope for their skill and ingenuity.



The circuit employed is the popular Det. and L.F. arrangement, with reaction efficiently controlled by a variable condenser.

The "Handyman" Two is an effort to meet the difficulty by providing a design for a set in which there is some genuine home construction to be done, without loss of efficiency, but with a very considerable reduction in total cost.

The actual constructional work has been carefully limited to certain parts which rather gain than lose efficiency when made at home with due care and patience, so no one need fear that he is going to lose anything in results by embarking on this set. The main item is the making of the coils, and these when finished will be found distinctly above the average commercial type in efficiency.

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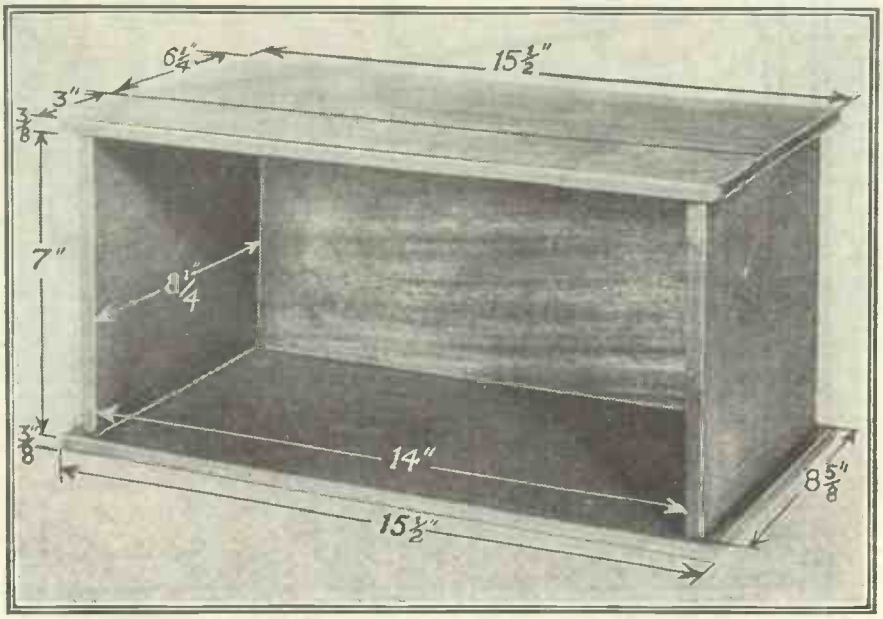

Any "Handyman" worthy of the title will be able to construct the cabinet from these details, and those embodied in the text.

THE "HANDYMAN" TWO.

(Continued from previous page.)

Details will be given for winding them for the ordinary bands of waves between 200 and 550 metres, and 1,000 and 2,000 metres, and also for the short waves down to about 20 metres, so that you will be able to try for K D K A (Pittsburg) on about 64 metres, 2 F C (Sydney) on 32, and several other interesting stations.

Another item indicated for home construction is the H.F. choke, and it is not intended that the reader should gain the impression that the object here is increased efficiency. Actually, the home-wound choke will be the equal of the average commercial specimen, but, of course, at a reduction in cost.

It can be made in a variety of ways, but a particularly simple one is to get an "Ebonart" special choke former, and wind this to the specification you will find on the box in which it is packed. The result is quite a good choke, at about half the price of a ready-made one. Of course, you will require a certain amount of patience to wind on the large number of turns of fine wire, and if it does not seem worth the trouble you can just as well use a bought choke of any good standard make. (The one in the original set, by the way, was

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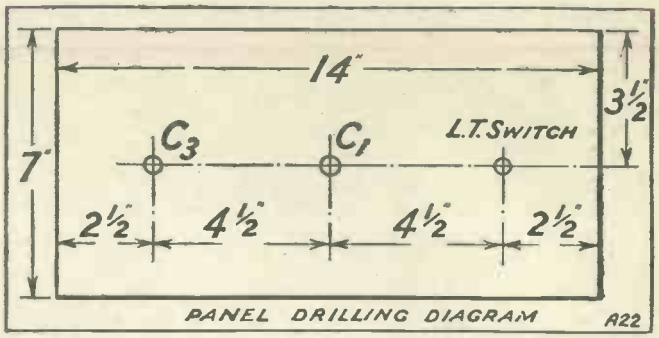

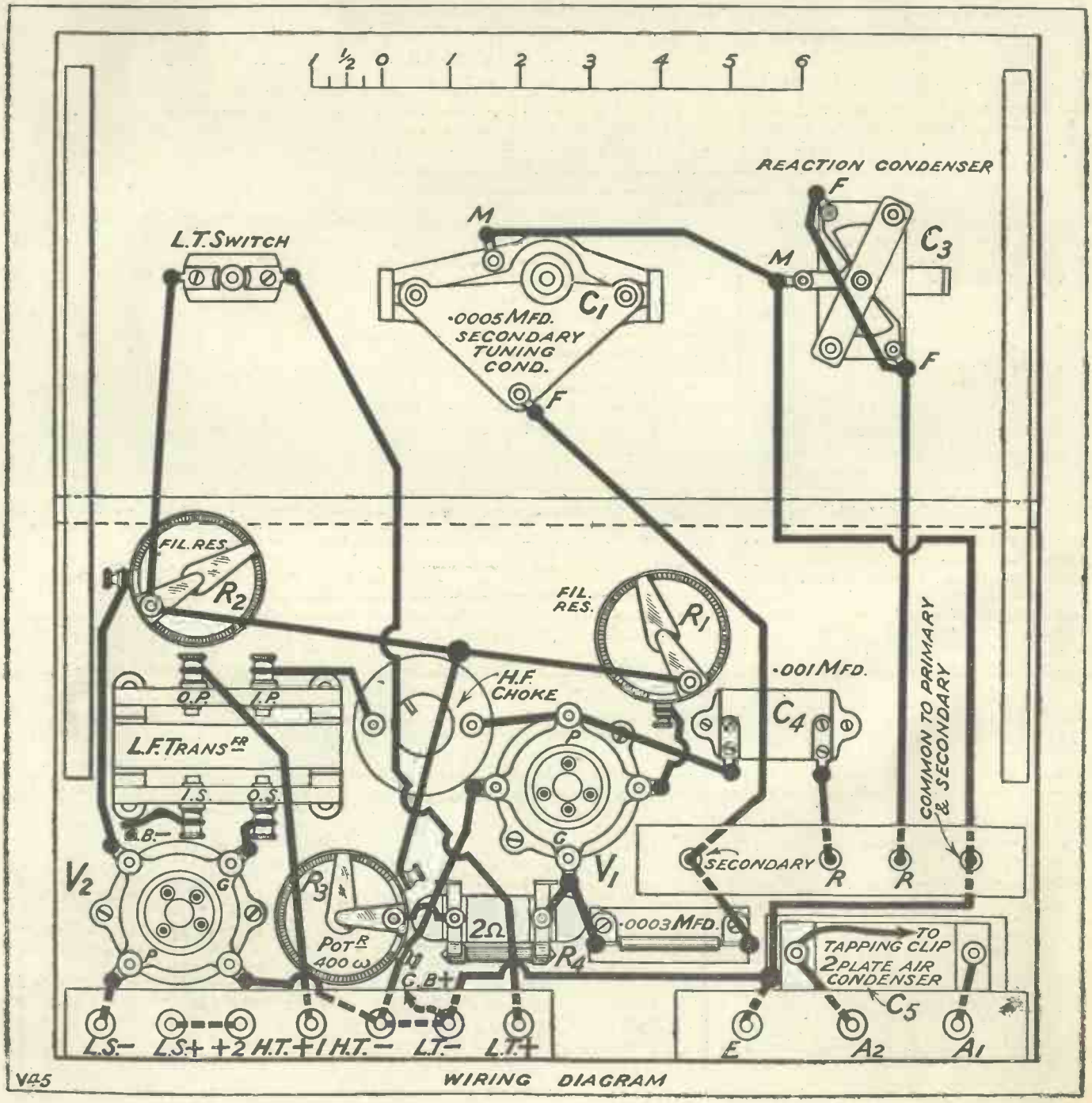

THE "HANDYMAN" TWO.

(Continued from previous page.)

actually wound on the "Ebonart" former mentioned.)

An item over which you can save quite a substantial sum is the cabinet, and anyone who is reasonably handy with simple tools can perfectly well build one of the simple nature needed for this set.

You can obtain a set of cabinet parts from Messrs. Hobbies, and put them together with the aid of the diagrams supplied therewith. This is quite a simple business, and no difficulty will be experienced if you first read through the notes at the end of this article, which have been contributed by the member of my staff who actually assembled the original cabinet.

The parts before the cabinet is completed.

COMPONENTS AND MATERIALS

1 Panel, 14 in. × 7 in. × ¼ or ⅜ in. (original was a "Red Seal" panel. Any good branded material).
1 Set of parts (Hobbies) or complete cabinet for above, about 8 in. deep, and baseboard.
1 ·0005 mfd. variable condenser, with slow-motion mechanism or vernier dial (original is a Utility. Any good make).
1 On-off switch (Benjamin, Igranic, L. & P., Lissen, Lotus, etc.).
1 ·0001 miniature type variable condenser (original is an Ormond. Any good make).
2 Sprung valve holders (Benjamin, Bowyer-Lowe, B.T.H., Burndept, Burne-Jones, Igranic, Lotus, Precision, W.B., etc.).
2 Baseboard filament resistors or rheostats to suit valves (Lissen in set. Any standard type).
1 L.F. transformer (any good make, according to the constructor's taste as to price, etc.).
1 H.F. choke of standard make, or one "Ebonart" choke former and 1 oz. No. 36 D.S.C. wire for home winding (Former obtainable from Messrs. Redfern).
1 ·0003 mfd. and one ·001 mfd. fixed condenser (Clarke, Dubilier, Igranic, Lissen, Mullard, T.C.C., W. & G. etc.).
1 2-meg. grid-leak and holder (Dubilier, Igranic, Lissen, Mullard, etc.).
1 3-terminal and one 7-terminal strip.
1 Insulating tube, 3 in. diameter and 3½ in. long, and one 3¼ diameter and 3½ in. long (originals were "Super Pirtoid)."
1 Ebonite strip, 5½ in. by 1 in., for coil socket, and two strips, 5 in. by 1 in., for coil bases.
Wire for coils, quantities roughly as follows: 4 oz. No. 24 D.C.C., 1 oz. No. 32 D.S.C. 4 oz. No. 34 D.S.C.
8 Plugs and 4 sockets for coil fittings (Eelex, Clix, etc.).
1 Potentiometer (Lissen).

The circuit chosen for use in the "Handyman" Two is a simple and straightforward one, consisting of a detector valve using a form of the Reinartz circuit followed by one transformer-coupled L.F. valve, which is probably about the best combination possible for a small set.

It enables you to work a loud speaker on your local station with adequate volume so long as the distance is not unduly great, and usually on 5 G B and 5 X X as well, except, of course, in the extreme south-west, west and north of the kingdom, where a bigger set is really needed unless a very unusually efficient aerial is used.

So far as distant working is concerned, the "Handyman" Two will hold its own against any "Det. and L.F." I have tested during the last twelve months, except the "Variactor" Two, which, of course, used a special circuit which was not suitable for short waves.

The detector portion of the set is closely similar to the "All Wave Reinartz One-Valver," a very successful little receiver described in "P.W." No 273, and the coils used are identical. The specification will be repeated next week.

Cabinet Work.

A description of a really home-made receiver, such as the "Handyman" Two, would hardly be complete without details of a cabinet which can also be constructed with a few tools.

The assembly was carried out entirely with ¾ in. countersunk brass screws, no glue being used anywhere. It was possible in consequence to put the cabinet together in a period less than three hours, without including, of course, the time taken to stain and polish it.

Should the prospective constructor of the "Handyman" Two consider the time involved worth it, he can purchase the complete set of wood parts from Messrs. Hobbies, Ltd., at any of their branches, or direct from their works at Dereham, Norfolk, price 7s. He will require, in addition to the above, two brass hinges, ¾ in. wide on each flange, three dozen ¾ in. countersunk brass screws, twelve brass screws ⅜ in. long for the hinges, and five or six screws about ½ or ⅝ in. long for screwing the ebonite panel to the baseboard, the whole costing approximately 9s. 3d. The cabinet parts are known as No. 9 at Messrs. Hobbies, so do not forget to mention this number when ordering.

Since a list of instructions, together with all necessary diagrams, are given with the wood parts for the cabinet, there is little need to give full details here. It is well to note, however, that the fitting of the

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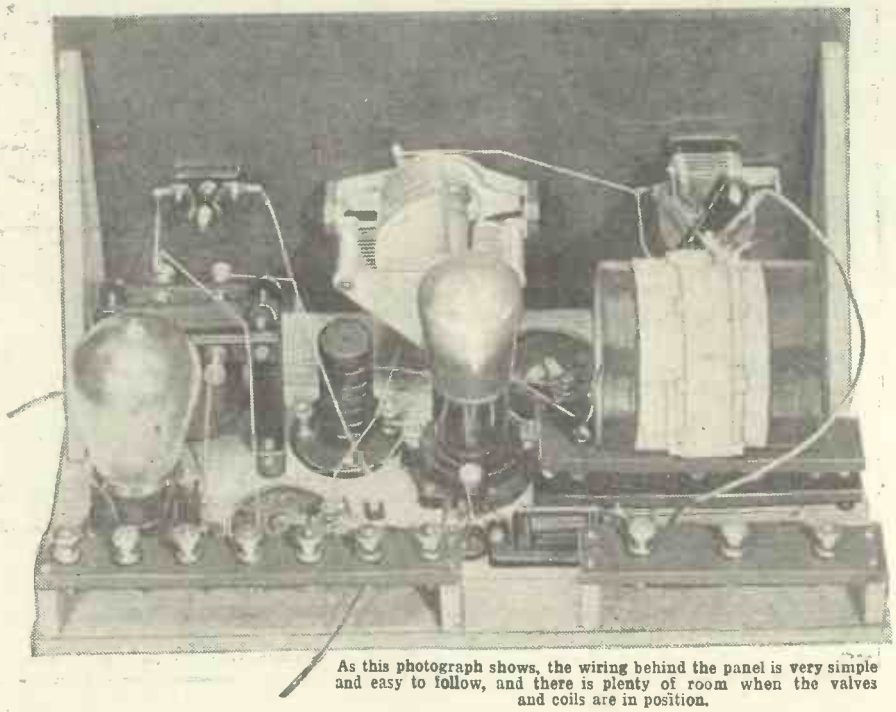

As this photograph shows, the wiring behind the panel is very simple and easy to follow, and there is plenty of room when the valves and coils are in position.

"SEEING" ACROSS THE ATLANTIC.

By THE EDITOR.

IT is perhaps natural that Mr. Baird's transatlantic television experiments should have created so much excitement in the newspapers. Wireless has always been a subject about which the newspapers have revelled. It provides good "copy" and an inexhaustible well for those who delight in dipping into the future. The late Jules Verne made a success by originating a new type of fiction—the type of fiction which forecasts future scientific wonders; and he was followed (much more cleverly and with greater scientific accuracy and detail) by Mr. H. G. Wells.

The Foolish Prophets.

To-day there is still just as much interest in the question of scientifically forecasting the future, and those clever gentlemen who write for the newspapers, airing their views as to what the world will be like in, say, a thousand years' time, are always certain of creating interest if they pick on one or other, or all three, of these subjects: Aviation, Atomic Energy, and Wireless Television.

It is not so many years ago that forecasting a flight across the Atlantic was regarded as extremely ridiculous; and since Sir Ernest Rutherford made known to the world some of his experiments in "exploding" atoms there have not been lacking people who, like Mr. Grindle Matthews, have dealt with the subject of death rays and the control of atomic energy with great effect.

Finally, in the realm of wireless television, the prophets have quite naturally taken up the attitude that it is foolish, in view of past scientific triumphs, not to assume that the crude television experiments of a year or two ago, and the equally crude ones of to-day, will in the very near future be developed just as rapidly and just as successfully as the motor car, the aeroplane, etc.

But television, curiously enough, is a very different proposition when looked at closely. Even in the old days, when the motor-car first made its appearance on the streets, there was definite evidence to justify the supposition that motor-car engineering would steadily develop. The same with the aeroplane.

Still Very Crude.

Both these inventions have more or less followed their original early principles and, by great good luck, although obstacles have been encountered in their development, the development has been more or less unimpeded by the limitations of nature or, if you prefer it, by the limitations of physical science.

When we come to television, it is a different case. Many people, remembering the example of the motor-car and the aeroplane, assume that because certain crude results have been obtained with television, its ultimate perfection is a certainty, and that it is merely a question of time and further experiment before television is, to use that hackneyed word, "perfected." Claims have even been made that it has been perfected already, but these can be discredited as absolutely unjustifiable.

Television experiments have so far led all those interested in them up a blind alley. Television workers, when beginning experiments, have a series of avenues of approach to their goal to choose from, and the avenues chosen have led to interesting and, in some cases, spectacular results. But so far those avenues of approach have terminated abruptly, due to the physical limitations imposed on the systems adopted. Distance for the televising of a crude image presents obstacles but not insuperable obstacles, and there is nothing very remarkable in the televising of a crude image across the Atlantic. Just as there was nothing very remarkable in telegraphing the Morse Code signals across the Atlantic on the occasion of the famous three dots message by Senatore Marconi. It certainly was spectacular and it indicated, quite rightly, that wireless telegraphy was capable of logical development and that it had commercial possibilities. But even in those days Senatore Marconi realised that if he could telegraph a hundred yards there was no reason why he could not telegraph a hundred miles and then a thousand miles, and then across the Atlantic. It was a question of power and the necessary facilities.

The same with television to-day. The present system can be used for televising a crude image across a room or across the Atlantic, but in both cases the great obstacle of detail is present. We will not weary our readers by recapitulating the scientific explanations of the difficulty with regard to televising in detail, except to state once more that to televise a picture in detail so that it can be really termed a moving picture by wireless is by known systems impossible.

"Impossible" is a big word, but we have yet to hear of a scientific man of repute who will definitely state that, for example, the Baird system, or the Belin system, or even the Alexanderson system of television is capable of being developed on its present lines in such a way as to make it possible for moving pictures in detail to be televised.

We repeat again that a million synchronised impulses per second is the minimum for successful television, and that is a radio frequency.

It must not be assumed that the articles which appear in this journal and in our contemporaries dealing with television are definitely pessimistic, but we do feel that it is due to our readers that the facts of the present position with regard to television should be put before them. Undue optimism is stupid, and to indulge in exaggerated and spectacular statements with regard to television would be an insult to our readers.

Why Not Be Candid?

Some people go so far as to say that true television is impossible. That is stupid, but it is not stupid to say that television systems as known at present are not capable of being developed to such an extent that true television will be possible.

A new system may be discovered any day, but so far the scientific brains in the country have been devoted to the subject on and off and have realised that, with present day limitations, both in physical development of apparatus and in knowledge of science, television is as far off as ever it was from the point of view of being a practical commercial proposition.

Undoubtedly the television experiments carried out by Mr. Baird are extremely meritorious, inasmuch as he has explored to the very utmost the avenues of approach open to him. No doubt he will go on and will succeed in giving perhaps larger pictures and even with less crudity, but of what use is it to talk about television unless it is a practical proposition and can fulfil the functions of a public utility service?

Let us be candid and face the facts with regard to television, and not jump to conclusions, because certain highly-ingenious and spectacular experiments have been carried out both by the G.E.C. of America, Mr. Baird, and others.

THE "HANDYMAN" TWO

(Continued from previous page.)

various portions together can commence with the sides and back, which can be screwed together and then screwed to the wood base.

The wood strip which goes on top of the cabinet in front of the lid can be then screwed in place by means of the two screws at each end, but not before the lid has been fitted alongside so as to get both in their correct positions. When arranging the hinges, squeeze the flanges together and countersink them level with the top of the back of the cabinet by chiselling pieces out of the wood. These can be fitted about 2 or 3 in. from each side.

(To be continued.)

The soul of the organ

60 VOLTS
(reads 66)
7/11
100 VOLTS
(reads 108)
12/11
9 VOLTS (GRID BIAS) 1/6
60 VOLTS
(reads 66)
SUPER POWER
13/6

This LISSEN Battery is obtainable at every radio dealer—ask firmly for "LISSEN New Process" and you will be rewarded by an improved tone in your loudspeaker which will be worth the trouble taken in refusing anything offered as a substitute.

POWERFUL, MOVING—WELLING AND SWELLING. You get the real tone of the organ when you use the **LISSEN** New Process Battery in your set. This is due to the pure d.c. current this battery provides.

And the reproduction of singer, speaker and instrumentalist alike is loud and clear *always* if you use this battery, for it yields its power noiselessly without a sign of ripple and without a trace of hum. The oxygen content of the cells—due to the new process—is so great that you get months and months of use from every LISSEN Battery and very delightful reproduction always.

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WON'T YOUR SET OSCILLATE?

If your set has lost its sensitivity for this reason this article will help you to put things right.

By D. GLOVER.

WHEN a receiver loses its power to oscillate it becomes "lifeless," and distant stations tend to vanish, but you can easily get it going properly if you bear in mind exactly what the word oscillate means. Of course, you should avoid making the set actually oscillate during broadcast hours, for to do so will cause interference with neighbouring listeners. But to make the optimum use of reaction when working on distant stations, it is necessary to work the set comparatively closely to the oscillating point.

I do not mean that you should be what is known as "right on the edge of oscillation," where the set is bordering on squeals and howls all the time, but, unless you have that power to oscillate at the end of your reaction control, you will be unable to obtain sensitive settings.

To get back to reaction itself, this is a "feeding-back" of energy from the plate circuit of the valve to the grid circuit. This operation generally takes place in the detector stage of a receiver. The feeding-back is sometimes accomplished merely by the coupling effect between two coils, one of which is in the anode circuit and the other in the grid circuit. The magnetic coupling between these two coils is varied by moving them nearer or further apart. This is known as the "swinging-coil" or magnetic method of reaction.

"Two Main Things."

In another system, that generally known as the Reinartz method, and the one which is more frequently incorporated in modern sets, the positions of the two coils are fixed (sometimes they are even wound on the same former) and the degree of feed-back is regulated by a variable condenser. The greater the capacity (or the higher the dial reading of the variable condenser), the more will be the feed-back and the closer you will come to the oscillating point.

Now you will see right away that there are two main things concerned in the obtaining of an efficient reaction control. First of all you have the valve. Secondly you have that coupling between the anode circuit and the grid circuit. If the valve is not operating efficiently it is not developing amplified impulses in its plate circuit which it can pass back. The valve must be of a type suitable for the position it occupies, although there are very few valves indeed which will not operate at all in a detector position, providing it has the L.T. and H.T. current it desires.

Where Voltage Is "Lost."

But obviously if the H.T. or L.T. values are widely wrong, that valve is going to refuse to rectify and amplify and bring itself on the right road to oscillation. Hitherto you might have been getting good results with only a 45 or so volt H.T. battery attached to the detector valve, but it is probable that there was not much of a margin, and a slight voltage-drop might cause the failure to oscillate.

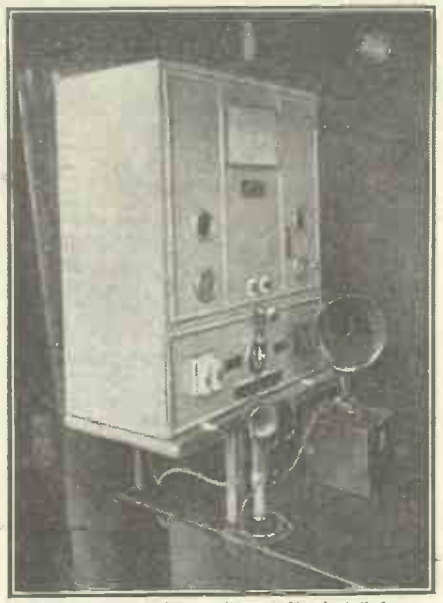
If this detector valve precedes a stage of resistance-capacity coupling, a fairly high H.T. voltage will be essential. You might have a 75-volt supply and think that 75 volts on the plate of a detector valve is quite ample. And so it probably would be if you had 75 volts on the plate of the detector valve, but you must remember that there is a very great voltage drop through the anode resistance used as an intervalve coupling. An initial 120 volts H.T. is quite a minimum sort of pressure to employ for a detector valve preceding a stage of resistance-capacity coupling.

If you are satisfied that your H.T. battery is large enough and is in good condition, make sure that the L.T. supply is "up to scratch." Even though the accumulator has only just come back from the charging station, this is no proof that it is in good condition. It may be tending to sulphate, in which case it will be unable to hold a useful charge for any length of time.

"Tired" Valves.

Finally, it may be that the valve itself has gone off colour. It is quite likely that a valve purchased a year ago or more is of what is known as the thoriated filament variety. These tend to lose their "pep" in the course of time, and have to be replaced. So much for the valve itself, and I would like to point out that the majority of the sets which have refused to oscillate, which I have come across, were found to be suffering from faults in the battery supply.

Now let us take the coupling between the anode and the grid circuit. In the swinging-coil system the closer the coils are together and, generally speaking, the larger the reaction or anode coil, the greater will be the feed-back. But it is necessary that both these coils should be wound in a certain direction, and that the current from the plate of the valve should pass through the anode coil in a certain direction also. It is an unfortunate fact that all makes of plug-in coils are not wound in the same way. It is for this reason that the injunction is made with the specification of so many sets that you should try changing over the leads to the reaction coil on the receiver if it refuses to oscillate. This proviso is not made because the designer is not quite sure that he has his connections correct.



This Marconi ½-kw. radio outfit, installed on the yacht "Crusader," is entirely self-contained. The handle in the centre of the bottom panel is used to change over from receiving to transmitting. Note the microphone and loud speaker.

Unsuitable Aerials.

So it may happen that the pair of coils you plug in to cover a certain band of wavelengths do not agree with each other. In this case the advice to try changing over the leads to the reaction coil is sound. If you can make the set oscillate only over the first portion of the tuning dial, then it is probable that your reaction coil is not quite large enough.

Providing the receiver and the coils it uses, in the case of a set embodying capacity-controlled reaction, are according to the designer's specifications, there should be few failures to oscillate. Here, apart from the valve and the batteries, the most common cause is an unsuitable aerial. Remember, a very long, double-wire type of aerial is not at all suitable for broadcast reception. A set will be more lively and more selective when it is attached to a single-wire aerial only some 75 feet or so in length, but the wire must be as high as possible, and kept well away from walls, trees, and other such objects.

Insurance Against Trouble.

There are very many other little things subsidiary to those mentioned above which will cause failure to oscillate. But it would take a whole book to enumerate them all, and I only trust that in your case the trouble will not be due to one of the more obscure little defects. As a sort of insurance against trouble, you can make a practice of periodically running over your receiver. See that all the grid leaks, anode resistances and other such devices are snugly tucked into their clips. Give each a twist or two. This will have the effect of cleaning their end contacts.

Examine all the screw connections, such as the terminals on L.F transformers and so forth, and see that these are tight, for screws have an uncanny habit of working loose. Make sure that all the valve-pins are making contact with their sockets. Lift each valve up and down in its holder, a cleaning action in itself which will frequently have a good effect.

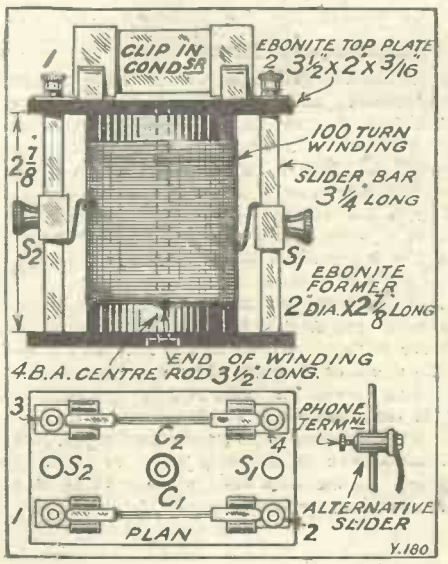
A NEW TUNER UNIT

By H. BRAMFORD.

THE tuner unit to be described in this article is designed upon entirely novel lines. It is intended for use in conjunction with a detector valve and any following stages of amplification. Variable condensers have been entirely dispensed with, slider adjustments taking their place. "Clip-in" fixed condensers are used for a purpose which will be explained later. The unit is remarkably compact, and used in conjunction with a valve holder and grid leak and condenser combined, in addition to filament rheostat and choke, would comprise a complete valve receiver. First, however, we will consider the material required in its construction, the whole device being home-made if desired.

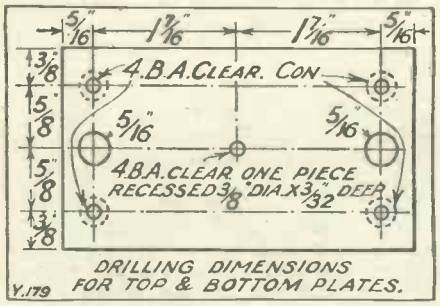
Material Required.

2 Clip-in condensers (as per photograph).
2 G. W. sliders (J. & J. Laker or any suitable type).
Wound ebonite former.
Ebonite, 2 pieces $3\frac{1}{2}$ in. × 2 in. × $\frac{3}{16}$ in.
Slider bar, $\frac{1}{4}$ in. square, 2 pieces $3\frac{1}{4}$ in. long.
2 B.A. rod, 1 piece $3\frac{1}{2}$ in. long.
4 B.A. nuts. Terminals, heads, and piece of flex wire.



This comprises all the material required, unless the coil is home-made, when a piece of ebonite former $2\frac{7}{8}$ in. long by 2 in. diameter and a $\frac{1}{4}$ lb. reel of No 24 enamelled wire will be required.

The general details, together with dimensions where necessary, are clearly shown in the accompanying diagrams. First drill the top and bottom ebonite plates, as shown. The four holes which have dotted lines around them are countersunk on the upper side of the bottom plate, and on the underside of the top plate. The centre hole of the bottom plate should be recessed on the underside. The two $\frac{5}{16}$ in. diameter holes make a forced fit for the $\frac{1}{4}$ in. square slider bars or to suit any other type of bar used.



Cut two pieces of slider bar each $3\frac{1}{4}$ in. long, and one piece of 4 B.A. rod $3\frac{1}{2}$ in. long. If the coil is to be home-made, cut off a piece of ebonite former $2\frac{7}{8}$ in. long, having an external diameter of 2 in. Wind upon the former 100 turns of No. 24 enamelled wire, close wound, securing the beginning of the winding and leaving a piece free for connection to terminal 1 of the top plate.

Few Connections Necessary.

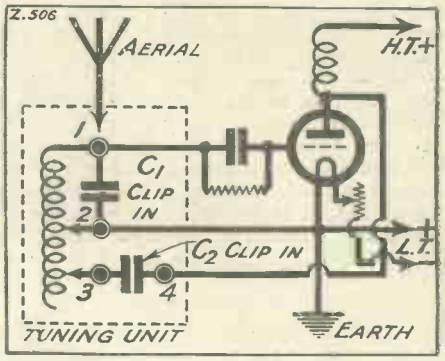
The end of the winding may either be finished off dead or taken to terminal 3 of the top plate. All that is now left to do is to assemble the pieces as shown. First place a slider over each of the bars. Force the bars into the holes in the bottom plate. To do this, slightly warm the ebonite and tap gently in.

The sliders should operate in different directions, one contact pointing up and the other down, as indicated. This is to give full play over the whole range of winding. Place the former in position and also the 4 B.A. centre rod, and firmly fix the top plate over all, securing with the centre terminal head.

Secure the four condenser clips to the top plate by means of four 4 B.A. countersunk screws, nuts, and terminal heads, and insert the fixed condensers.

The only connections necessary are as follow: Flex lead from S_1 to terminal 2, also from S_2 to terminal 3. Beginning of coil winding to terminal 1, and of coil winding (optional) to terminal 3. This latter is to eliminate any possible dead-end effect. If enamelled wire is used, remove the insulation along the paths taken by the sliders.

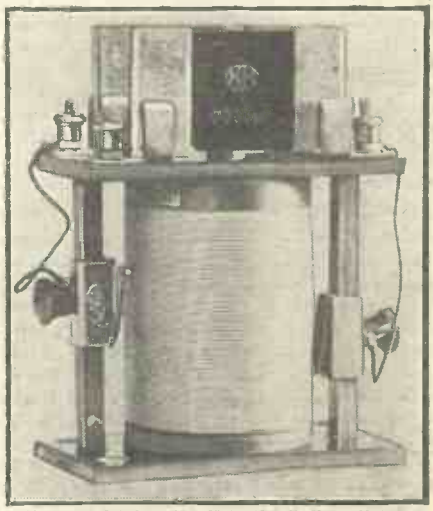
A circuit is given showing how the unit would be connected up as a Reinartz tuner. It will be seen that terminal 1 connects the aerial and grid leak and condenser. Terminal 2 goes to filament positive and earth. Terminal 3 is blank, but provides for an alternative aerial connection. Terminal 4 goes to the plate of the valve and one side of the R.F. choke.



A Compact Arrangement.

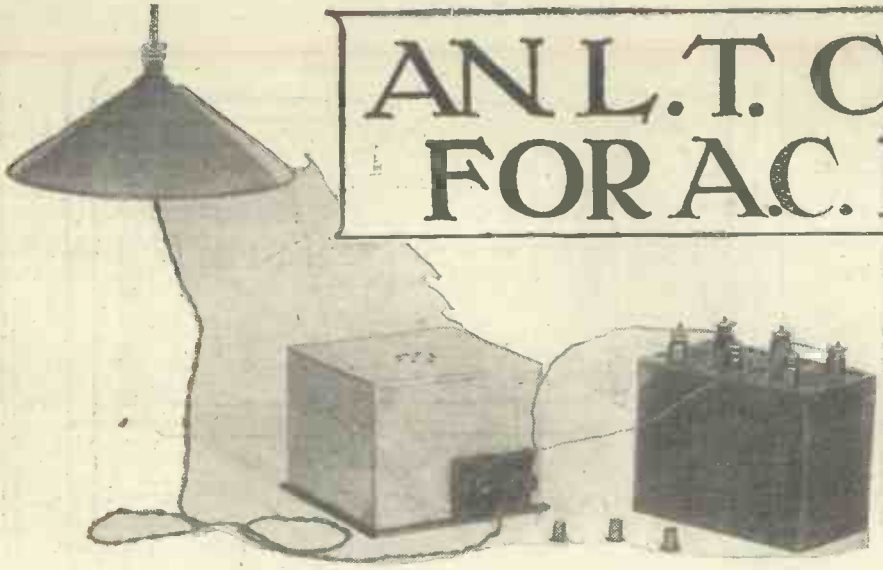
There are no variable condensers to manipulate, and much space is therefore saved. The unit is, in fact, ideal for use in portable or small receivers. First move S_1 and S_2 down the coil, the contacts of both being approximately opposite until signals are at their best. Then move S_2 down only, thus slowly increasing reaction. Make a final adjustment on S_1 when the best point of reaction has been found.

For local reception a ·0005 clip-in condenser for C_1 should be suitable, while a usual value for C_2 would be ·0003. Condenser C_1 has been incorporated to allow for a smaller amount of winding to be used, as the greater the capacity in parallel with an aerial tuning inductance, the less inductance or winding is required to cover a given wave-length range.



The completed unit. Note the "clip-in" type of fixed condensers used.

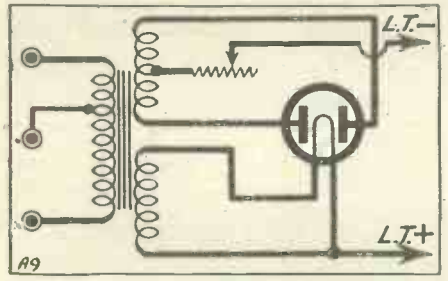
AN L.T. CHARGER FOR A.C. MAINS



This simple unit is both easy and cheap to make. It will save the owner of A.C. mains time, trouble and money.

By J. R. WHEATLEY.

EARLY in 1925 a rectifying valve of a type similar to that employed in the charger about to be described was obtained, and with the aid of a suitable transformer was put into service for charging three 6-volt accumulators in use on three different sets. After several weeks in use it was decided to check the life of the valve, and the following is the result:



In just over two years the valve has been rectifying for 621 days for 16 hours a day, or in all 9,936 hours. This is, of course, an abnormal life for such a valve, but goes to prove that rectifiers of this type form a practical proposition in every way. The amount of time and expense on maintenance, repairs and replacements has been nil.

Total Cost—About 32/-!

These few figures preceding a constructional article will, I trust, be understood, when one remembers the adverse criticism which such rectifier units have had to withstand during the past few months. The cost of the various parts for the construction of this charger is extremely low, and need not exceed thirty-two shillings, assuming that the constructor has to buy everything even down to the last screw.

The three main components, i.e. the transformer, valve, and rheostat, may be obtained for thirty-two shillings, which for most constructors will be the only expense, for a valve holder is usually to be found in every constructor's scrap-box. Although not absolutely essential, but as a safeguard, the whole unit has been totally enclosed in a sheet-iron container, further details of which will be given later.

The construction of the charger is extremely simple; in fact, one could construct the unit from the photographs alone, but perhaps a few additional details are advisable.

The Rheostat to Use.

To the bottom of the baseboard, which is 6½ in. by 6½ in. by ½ in., a thin piece of three-ply, 6¼ in. by 6¼ in., is tacked, forming a ledge at the bottom of the baseboard. This ledge will prevent the cover from slipping down over the charger should the latter be moved, for it is hardly necessary to screw down the cover to the baseboard.

The rheostat, which will have to carry approximately 1·5 amps., should preferably be calibrated in ohms.

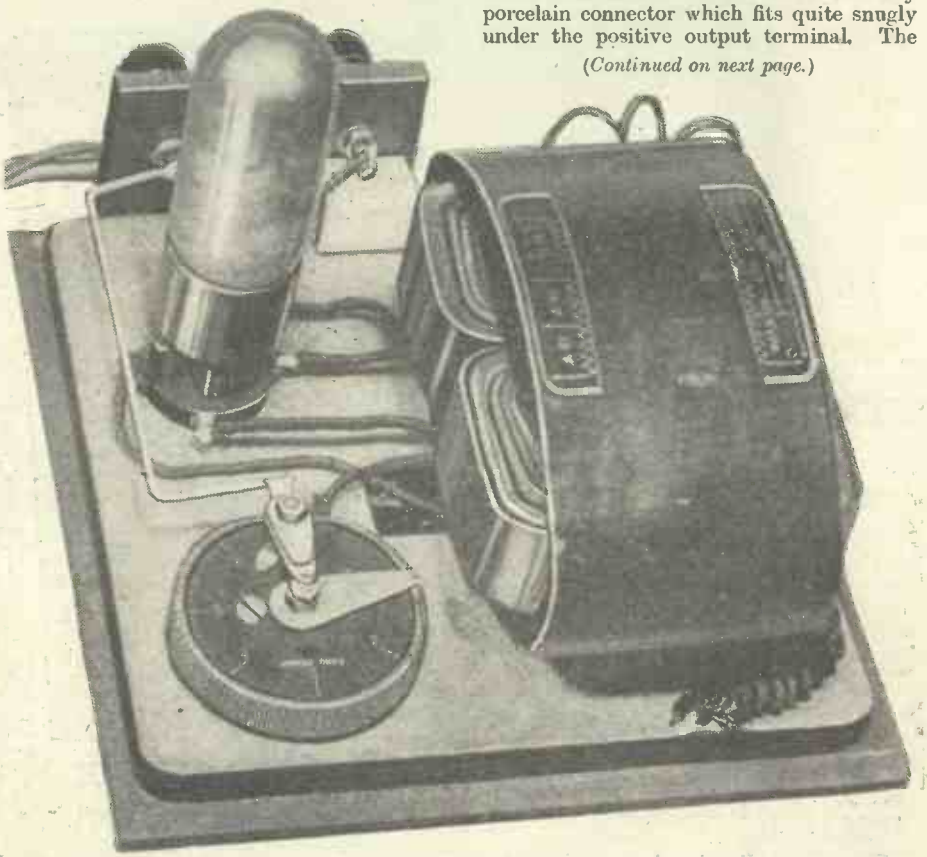
Simple to Construct.

Although a 6-ohm rheostat has been employed, 3 ohms would be quite O.K. for ordinary purposes, The mounting of the valve holder completes the construction, and all that remains is to mount the small terminal strip, which is 3 in. by 2 in., and wire up.

The leads from the secondaries of the transformer are so arranged that it is extremely simple to take these direct to the correct points without any extra wire, The connections to the mains call for some explanation. The primary side of the transformer, i.e. the winding connected to the mains, has three wires leading from it.

It will depend on the voltage of the mains in use as to the particular two leads which are connected to the small two-way porcelain connector which fits quite snugly under the positive output terminal. The

(*Continued on next page.*)



When you have connected up the leads from the transformer there remain very few other connections to make.

AN L.T. CHARGER FOR A.C. MAINS.

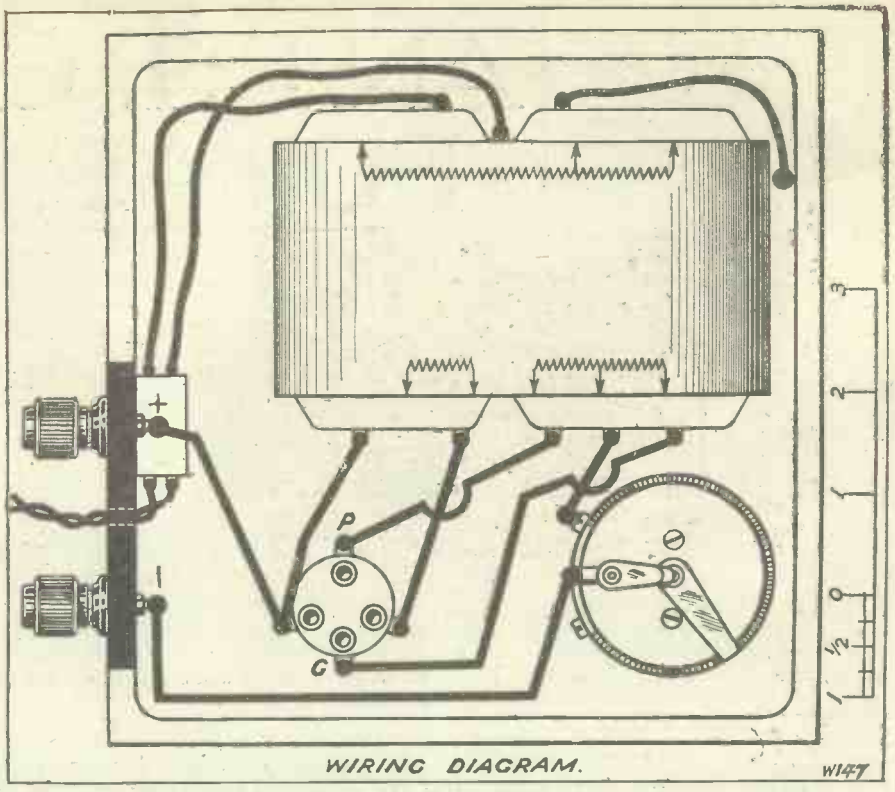
(*Continued from previous page.*)

tapping not in use should not be cut, but wound round in a spiral, bound with insulating tape, and the end stuck firmly down to the baseboard with the aid of a little "Chatterton's."

Before connecting the adaptor to the mains, insert the rectifying valve in the holder and examine instructions on the accumulator to be charged. Read the makers' instructions carefully, and you will find that a certain charging rate is specified. We will assume that a 2-volt 20-amp. hour accumulator requiring a rate of 1 amp. is to be charged.

COMPONENTS REQUIRED.

- 1 Baseboard, 6½ in. × 6½ in. × ½ in.
- 1 Mains transformer. Type A2. (F. C. Heayberd & Co.)
- 1 Rectifying valve. No. 451. (F. C. Heayberd & Co.)
- 1 Valve holder.
- 1 6-ohm rheostat.
- 2 insulated terminals.
- 1 Two-way porcelain wire junction connector.
- 1 Ebonite strip, 2 in. × 3 in.

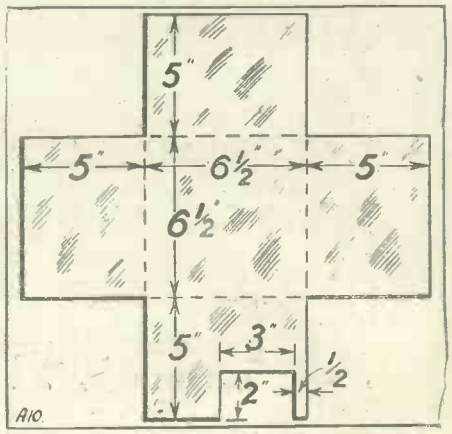


WIRING DIAGRAM. W147

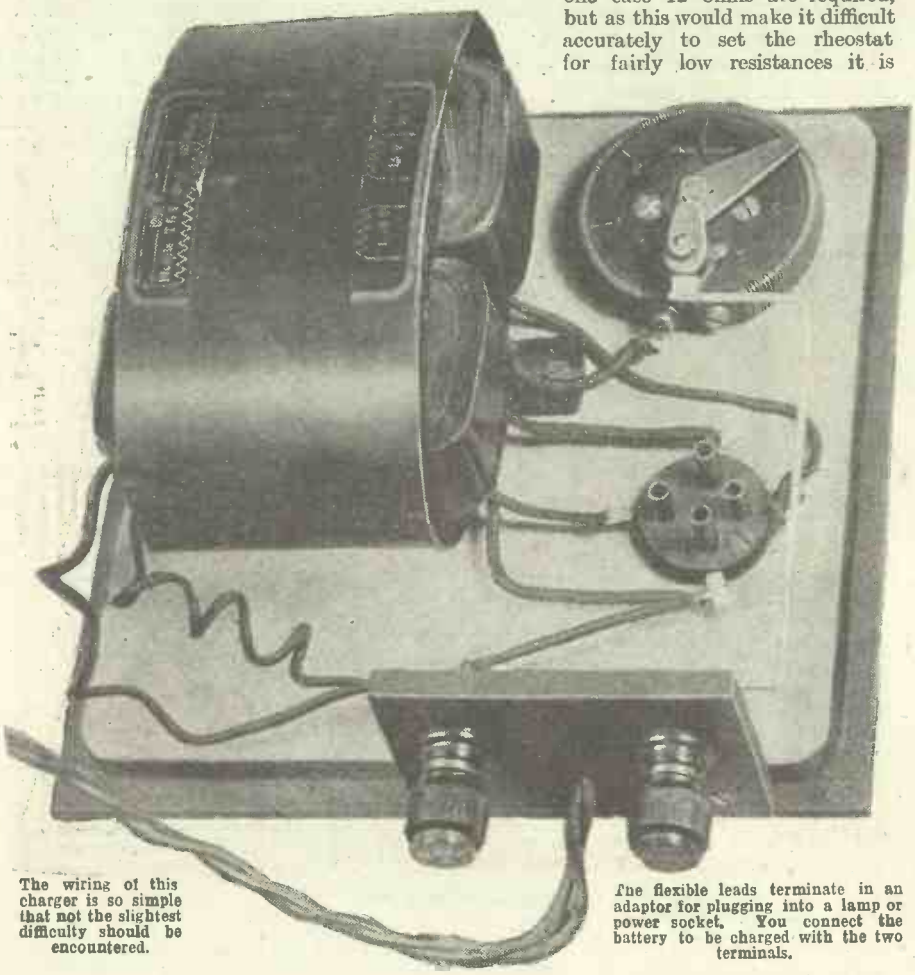
From the data obtained from the valve manufacturer the table in this page has been evolved. It will be seen that in one case 12 ohms are required, but as this would make it difficult accurately to set the rheostat for fairly low resistances it is advisable, in cases where above 6 ohms are required, to join the extra resistance in series outside the unit.

From the table it is then seen that 6 ohms are required, so the rheostat is set at maximum, the accumulator connected up, and the adaptor plugged in to a convenient mains socket. On closing the switch controlling the mains socket in use, a faint blue glow will be seen to appear in the valve which will steadily grow in intensity until a maximum is reached, after which it will remain quite steady until the mains are switched off.

With the particular accumulator taken it will take approximately 16 to 20 hours to charge the accumulator fully. The metal cover is easily constructed from sheet-iron from the dimensions given above.



Charging Rate.	Accumulator Voltage. 2 V.	4 V.	6 V.
·5	12 ohms	6 ohms	3 ohms
1·0	6 „	3 „	1·50 „
1·5	3 „	1·5 „	Nil



The wiring of this charger is so simple that not the slightest difficulty should be encountered.

The flexible leads terminate in an adaptor for plugging into a lamp or power socket. You connect the battery to be charged with the two terminals.

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

SHORT-WAVE BROADCASTING

A SOLDERING HINT—WIRED WIRELESS.

Short-Wave Broadcasting.

WHILE the use of short-waves of below 200 metres for broadcast transmission and reception has for some time been a much debated subject (with the negative side rather stressed), there is a good deal of indication that several of the broadcasting stations in the United States are anxious to adopt regular short-wave broadcasting. Some of the stations controlled by the National Broadcasting Company and the Westinghouse Company have been conducting experiments in transmission, quite apart from those which have been made public.

Some of the peculiarities of short-wave transmission are, of course, well known. We find in some instances that reception is good at a point of 2,000 miles from the transmitter, whilst it may be very poor at a point 200 miles away. We are able to cover extraordinary ranges with quite low power short-wave transmission, but often unable to communicate over comparatively short distances.

Extra Channels.

The importance of short waves in providing a solution to the congestion of ether is not commonly realised. Apart from highly-selective methods of reception as already adopted, one of the greatest hopes of solving the problem of interference, or the jumble of transmission between signals from different stations, lies in the further exploration of the short-wave region. When we consider that almost all the long-wave transoceanic telegraph stations of the world are crowded into a frequency band about 15,000 cycles wide, whereas the available short-wave field below 100 metres includes approximately 30,000,000 cycles, we have some indication what the future may perhaps bring in the way of additional facilities for radio communication.

A Soldering Hint.

When soldering very small objects it is generally most convenient to hold them by means of a pair of pliers as, if they are very small and light, they are apt to stick to the soldering iron the moment the solder touches them. When you are holding the work in the pliers, of course, one hand is entirely occupied, and you have only one hand to work with.

It is often very useful, therefore, to have the work held automatically in the pliers (in the absence of a small hand-vice), and this can very easily be accomplished by taking a strong elastic band and slipping it over the handles, doubling the elastic band if necessary to get sufficient force. The handles of the pliers are forced *apart* against the tension of the elastic band, and the work is inserted in the jaws of the pliers. The action of the elastic band then makes the pliers grip the work, and it is much easier to do the soldering.

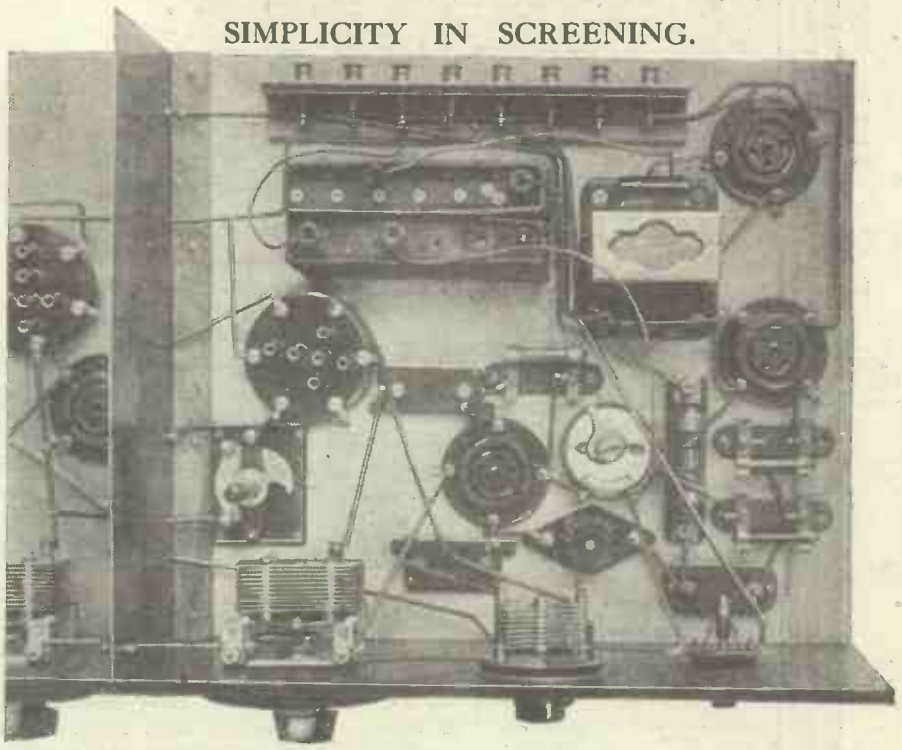
Wired Wireless.

Wired wireless, which was for a long time regarded as of very limited use, and then perhaps only applicable for government service or commercial purposes, seems to be finding increasing popularity in the United States and on the Continent. It is now being used as a means for distributing programmes over the telephone line or the electric-light wires, instead of by broadcasting through the ether in the ordinary way.

The term "wired wireless" is as paradoxical as the term "limited broadcast," which is also used in connection with the same system. The fact is that in wired wireless the signals are really distributed by means of wireless waves generated by a wireless transmitter in more or less the ordinary way, but they are caused to "adhere," as it were, to definite conductors and, therefore, they arrive at the various points to which those conductors lead, which explains the term "limited broadcast."

(*Continued on page* 1292.)

SIMPLICITY IN SCREENING.



To prevent inter-action between two stages of high-frequency amplification, it is now usual to insert a metal screen between them. An easy and efficient method of doing this is illustrated above. The set is the "Economy Five," a constructional blue print of which was recently presented free to every reader of "Popular Wireless."

NEWS FROM SAVOY HILL. FROM OUR OWN CORRESPONDENTS.

NEW RELIGIOUS FEATURES

VISCOUNT ASTOR'S PLYMOUTH APPEAL—AN ELLEN TERRY BIRTHDAY PARTY.

New Religious Features.

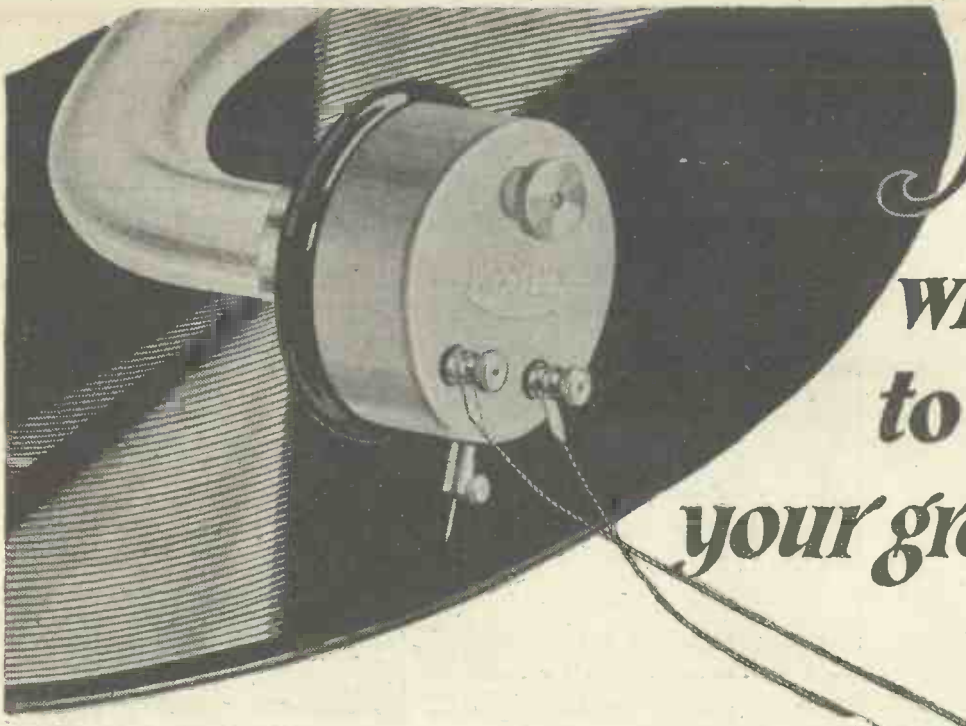
TWO new religious features are being introduced during Lent into the programme from London and 5 G B. That from London consists of a series of addresses by the Rev. W. H. Elliott, Vicar of Holy Trinity Church, Folkestone, entitled "The Seamy Side of Life," which are to be given between 3.30 and 3.45 p.m. on Thursdays, immediately following the service from Westminster Abbey.

The 5 G B transmissions are the Thursday Dinner Hour Service at the Parish Church of Birmingham. St. Martin's Bull-Ring, when the speakers, and the dates of their appearances will be as follows: March 1st, Rev. Pat McCormick; March 8th, Sir Harry Verney; March 15th, Dr. Herbert Gray; March 22nd, Dr. Peake; March 29th, The Rector of Birmingham; April 5th, Canon Rust.

Viscount Astor's Plymouth Appeal.

Viscount Astor is visiting the Plymouth Studio on Sunday evening, February 26th,

(*Continued on page* 1291)



How to use your wireless set to amplify your gramophone

AN ordinary gramophone with an ordinary horn and an ordinary sound box will not reproduce notes below middle C of the musical scale. Now with the new LISSEN Electrical Pick-up your gramophone will not only reproduce the low notes on your records as you never heard them on your gramophone before, but will amplify your gramophone music to any degree of loudness to fill a large room or a large hall for dancing —you can make one gramophone supply every room in the house with music—you can use your old records, long discarded, because needle-scratch is now largely eliminated. Your new records, too, will play better because needle noise is largely subdued.

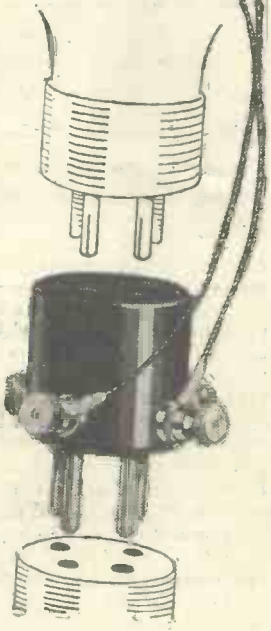
TO ELECTRIFY YOUR GRAMOPHONE the Lissen Pick-up not only largely eliminates needle scratch, but brings out the low notes on a record which no ordinary sound box is capable of reproducing.

INSTRUCTIONS.

Slip on the new Lissen Electrical Pick-up in place of the sound box on the tone-arm of your gramophone—take one connection from the Pick-up to the grid terminal of the Lissen Pick-up Adaptor (sold separately and having plugs and sockets corresponding to those of an ordinary valve-holder) and take another connection from the Pick-up to the negative filament terminal on the Adaptor (a trial on each of the filament terminals in turn will clearly show which is negative). When the Adaptor is used in the way just explained, care should be taken that NO connection is made to the plate terminal on the Adaptor, otherwise the H.T. battery will be short-circuited.

Alternatively, a connection from the Lissen Pick-up, instead of going direct to the negative filament terminal on the Adaptor, can be made to the negative terminal of a grid-bias battery. A connection should then be made from the positive terminal of the grid-bias battery to the negative filament terminal on the Adaptor.

The connected Adaptor, with a valve fitted into it, should be plugged into the detector valve socket of a two- or three-valve set. Volume can be controlled by the round milled nut on the Lissen Pick-up.



Lissen Electrical Pick-up 15/-
Adaptor for same 1/6

Obtainable at most dealers, but if any difficulty send direct to factory, no postage charge. Or can be sent C.O.D.

LISSEN LIMITED, 8-16, FRIARS LANE, RICHMOND, SURREY.

(Managing Director : THOS. N. COLE.)

PLUG-IN CENTRE-TAPPED COILS.

By O. J. RANKIN.

CENTRE-TAPPED coils have many uses in modern radio receivers. For instance, they figure in H.F. neutralising circuits. The one end of the coil is joined to the plate of the H.F. valve and the other end to the neutralising condenser. The central tap from the coil is taken to H.T. plus.

The component can also be used as an aerial coil, the aerial lead being connected with the centre tap. This enables a fairly high degree of selectivity to be obtained.

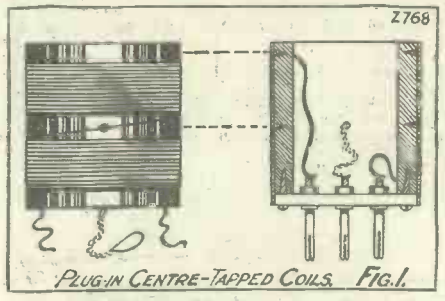
Simple Construction.

The accompanying sketch and photograph show the simplest possible method of arranging single-layer centre-tapped coils on the interchangeable principle. Each coil is wound on a 3-in. diameter cardboard former in the manner already described in an article entitled "More About Centre-Tapped Coils"; i.e. the centre tapping loop is passed through a hole in the former, which is then plugged with a piece of match-stick, or filled with a sealing compound, and taken down inside the former together with the beginning and end of the winding, as shown on the left of Fig. 1.

A Rigid Support.

Two pieces of wood, each about ¾ in. by ¾ in., and equal in length to the length of the coil, less the thickness of the ebonite used for mounting the pins, are screwed to the inside of the former with their top edges flush with the top of same. (See sectional sketch.)

The screws should be inserted in the positions shown by the dotted lines between the two sketches in Fig. 1, so that their heads do not foul the winding. The



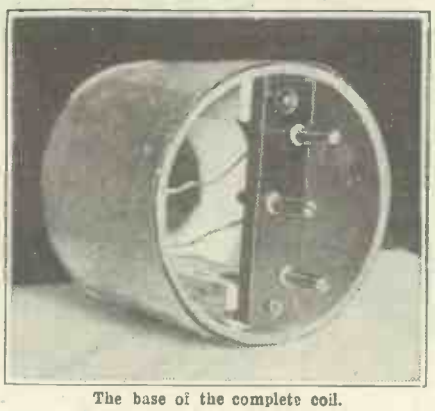
PLUG-IN CENTRE-TAPPED COILS. FIG. 1.

ebonite strip is fitted with the three pins and drilled at each end so that it may be screwed to the lower ends of the wooden supports. Thus, in effect, we have a rigid frame-like support to which the coil is attached.

The three wires are soldered to their respective pin shanks before fitting the ebonite, and the top of the coil is provided with a cardboard cap containing a small celluloid or mica window which obviates the usual groping with the pins when blank discs are fitted. The window is 1½ in. in diameter and, providing the ebonite strip is not more than ¾ in. wide, one has a good view of the sockets on the holder when inserting a coil, even when the holder is placed inside a fairly deep cabinet.

Cardboard bands, equal in thickness to the diameter of the wire on the coil, are glued round the extreme upper and lower ends of the former, so that a length of American cloth may be attached to same in order to protect the winding.

The general arrangement of the coil is clearly shown in the photograph. It should not be necessary to add that the pin setting on all coils should be identical,


The base of the complete coil.

and that a template will be required for marking off the ebonite strips, and also for marking the positions of the sockets on the holders.

"UNIVERSAL" COIL MOUNTING.

CYLINDRICAL coils are easy to wind, but not so easy to fix in the set. When you have taken a lot of trouble in putting a bare wire-spaced winding on an ebonite former, you do not want to spoil a good job by mounting the coil so that the wire touches the baseboard of the set. Fitting brackets on the former involves rather tricky work with a drill, and a risk of splitting a thin-walled former.

Easily Made Holder.

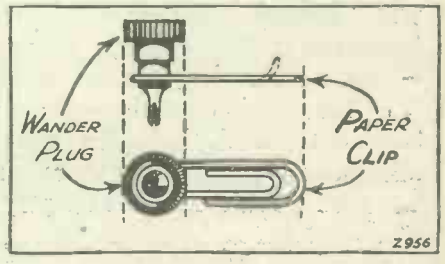
If you make up the fitting shown in Fig. 1, you can mount your coil in any position. A and B are two strips of wood or ebonite, ½ in. wide, slightly longer than the diameter of the former, and of any convenient thickness. Clamp the former between the strips by means of a 4 B.A. rod down the centre. Mount horizontally by attaching two brackets as shown. Mount vertically by screwing one strip to the baseboard (with a recess cut in the latter for the nut). Put on the coil and clamp with the top strip and nut. Any oblique angle of mounting may be obtained by fixing a wedge-shaped piece of wood under one end of the bottom strip.

A PAPER CLIP DODGE.

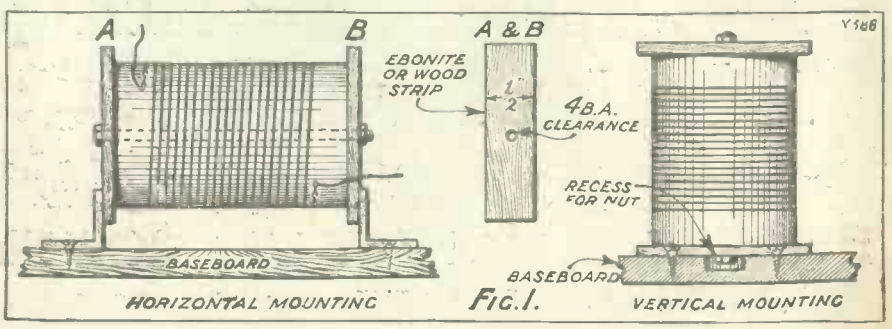
THERE are times when it is desired to try out two or three different high-tension batteries on a wireless receiver, the set itself being already connected up to either a multi-way battery lead or separate leads terminating in the usual form of H.T. wander plugs. While a large proportion of high-tension batteries are provided with tapping sockets, it occurs frequently that they are not, and it is a nuisance to have constantly to remove and replace the plugs from the leads according as to whether junctions have to be made to sockets, terminals, connecting links, pocket battery strips, etc. When occasions like this arise in my own case I find it saves a lot of time to adapt the plugs for all contingencies simply by the addition of wire paper clips.

Great Saving of Time.

The sketch will show all that is necessary. Just remove the insulated head of the plug and slip one end of the paper clip over the screwed portion. Replace the head and screw home tightly. Now, with the aid of



the clip either kept out straight or bent at right angles half way along its length (shown dotted in sketch), efficient electrical connections can be made to terminals or the clip sprung over connecting links or metal strips as desired. Of course, the use of the plugs in the normal manner for inserting into H.T. sockets is in no way affected. Simple dodges such as this are responsible for a large saving of time to the constructor and experimenter and are thus worth noting.



CORRESPONDENCE.

ELIMINATING PLUG-IN COILS

NATURAL REPRODUCTION—A VOICE FROM INDIA.

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.

ELIMINATING PLUG-IN COILS.

The Editor, POPULAR WIRELESS.

Dear Sir,—Can I claim to have done well—speaking wirelessly? I decided yesterday that I was tired of plugging and unplugging coils when I wanted to receive on different wave-lengths, and thought I would try and arrange for switches instead. Normally, there is nothing out of the way in this, but I wanted to include the short waves; anyway, I did it. I am at the moment listening to 2 X A D relaying 5 X X, Chelmsford, with very little fading considering that W G Y had got to pick it up first. It was the peculiarity of listening to 5 X X via 2 X A D which decided me to write. The set works perfectly in every way.

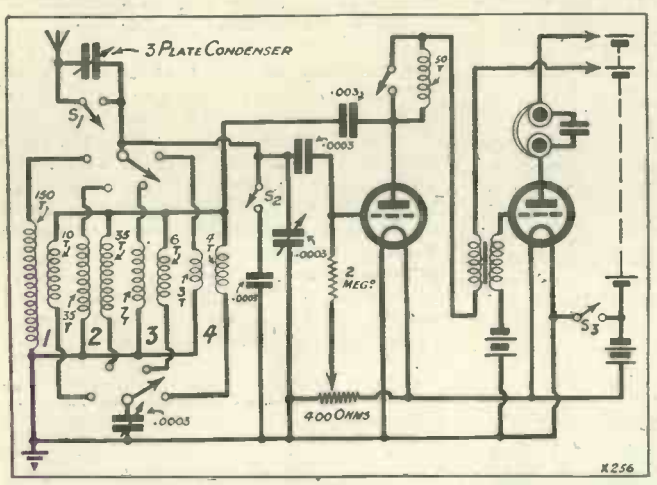
Since drawing the accompanying diagram I have switched over to the No. 3 coupling (2 X A D came on No. 4), and almost immediately tuned in K D K A, but the reception is very distorted except for speech. Practically all this winter the distortion on K D K A has been unbearable. I have had just the ordinary reception on Nos. 2 and 1.

I do not claim anything original in being able to receive these American stations, but hitherto I have only been able to by taking out one coil and putting in another, disconnecting the aerial and placing it elsewhere, whereas now I simply use switches. Actually, I was very much surprised to get any oscillation on the short waves with so much capacity around. The family can now tune in America.

Yours faithfully,

J. G.

Charlton, S.E.7.



NATURAL REPRODUCTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—I should like to make a few remarks on the subject of wireless reproduction as viewed from the highest possible standard. I have frequently read and heard it said that it is now possible to reproduce the studio performance with such realism that no difference can be discerned. Now as one who has made a thirty-years' intensive study of tone in all its classifications I may possibly be fastidiously critical about what I hear, but I can assure you that the day of exact reproduction has yet to arrive. I make this statement after the most careful study of every known type of receiving apparatus from detector to telephone. Assuming that the design of the transmitting station is really excellent and that no distortion is occurring in the successive links between studio and receiver, I think that there is much still to be done in perfecting the latter. My quarrel is not against the modern valve or modern components, but against the *design* and *adjustment* commonly practised by radio engineers who are not expert in tonal and musical science.

Unless a man knows more than a little about "harmonic proportion," and is moreover capable of analysing the hundred and one varieties of *timbre* which distinguish one musical instrument from another, he is literally groping in the dark when designing a low-frequency amplifier and speaker. Before he can say with conviction that a loud speaker is capable of reproducing the studio performance with absolute fidelity (or, if you like, with apparent fidelity), he ought to know within a little what the real thing is. We all remember Sir Thomas Beecham's famous indictment, and some of us are now saying that had he heard a properly-designed receiver and a coil-driven free-edged cone speaker he would have been compelled to retract his words. I gravely question whether the great conductor would have done anything of the kind. The difference is still palpable to a musician of refined discrimination.

I gladly acknowledge the amazing advance in acoustic reproduction made possible by the introduction of the moving-coil cone speaker, but while the *principle* is sound, the design and artistic adjustment of this type of speaker leave much to be desired. I will mention but two features which at the present moment are ruining its prospects of success as a faithful reproducer. The first is the moving coil itself. This is invariably wound to the wrong number of turns and in the wrong manner. The result is *harmonic distortion*, a term which denotes lack of proportion between the various harmonics of each musical note produced. The second point relates to the suspension of the periphery of the cone. This is far more important than the "stiffness over mass ratio" of the diaphragm, because the latter admits of very little variation for optimum results, whereas the method of suspending the edge is subject to wide variations in design. The tendency is to curtail the freedom of the cone to such an extent that a large percentage of the superiority of the Rice-Kellogg principle over other types is lost. There are many other features which are making present-day coil-driven speakers entirely unsuccessful as natural reproducers, and this is all the more tantalising to the musician who realises the capabilities of the type.

With regard to present-day receiving apparatus, design and artistic finish is strangely lacking if the desideratum is a faithful reproduction of music. The very best that engineers have to offer apparently is some form of anode-bend detection followed by two or three L.F. stages, with super-power valves in parallel in the last stage fed by umpteen volts and passing umpteen milliamps, with suitable values of grid bias. The alternative is a stage of push-pull amplification. Given a steady milliammeter needle and a suitable output filter, the set is said to be as near perfection as can at present be attained. There has been much discussion in these columns as to the relative merits of the various known types of L.F. coupling, in which I myself took part. I then spoke very highly of battery coupling. But there are great disadvantages with this, and none of the systems at present in use are capable of delivering the goods. *A new method of coupling is necessary.* This does not mean the scrapping of transformers, chokes and resistances, but the introduction of a new combination in which these components will take their proper places. The time is coming when the demand for transformers will be greater than ever, but their connections will be entirely different.

In conclusion, I believe it is quite possible to arrange the design of both receiver and speaker so as to secure real fidelity of reproduction. This cannot be accomplished without a complete understanding between engineer and musician. I have at my house an experimental receiver and speaker which is an indication of what can be done, though I should not wish to claim that it is the last word. The most difficult things to reproduce in wireless—the organ and the orchestra—are certainly reproduced with more realism than is usually associated with radio, and I need hardly say that interested visitors are always welcome.

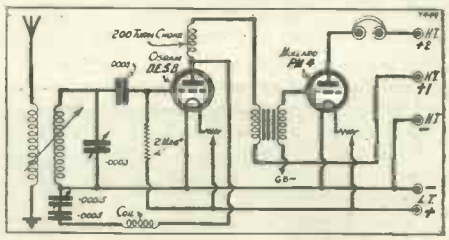
(Rev.) NOEL BONAVIA-HUNT.
(Organ Consultant.)
96, Broadhurst Gdns., West Hampstead, N.W.6.

A VOICE FROM INDIA.

The Editor, POPULAR WIRELESS.

Dear Sir.—Being a regular reader of your valued paper I take the liberty to write you a few notes on wireless as received here by me in S. India. Firstly, short-wave reception. I have read with interest your notes from time to time regarding short-wave work, and how the B.B.C. have lagged behind in this matter, despite successes of P.C.J.J. and other short-wave stations. Anyhow, I'm glad the B.B.C. have moved at last, and it may be of interest to you to say that their transmissions relayed from the Albert Hall on Armistice Night were most successfully received here between the hours of 1.30 and 3.30 a.m. Indian time on Saturday. I picked up the carrier wave at 1.40 a.m., and was soon able to tune in the speech of H.R.H. the Prince of Wales, and also the community singing which followed, which included the old favourites of the war, also hymns, fife and drums, bagpipes. The reception on the whole was very good indeed, not quite as much volume as P C J J and the Australian stars, but still it was very good. One point of the transmission was that it had a very marked pulsating or surging effect, which came in regular waves about every half-minute, this effect is noticeable from all short-wave stations on telephony, but the B.B.C. was much more pronounced. I have reported to them direct.

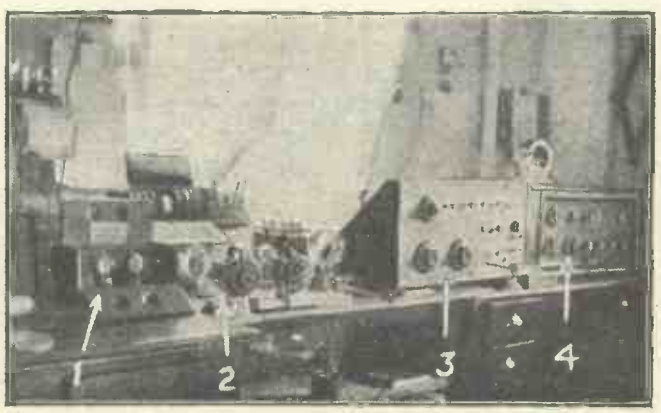
I get excellent results here on my short-wave set, which is a two-valve (Det. and L.F.) Reinartz circuit, a diagram of which I attach. I receive 2 N M, Mr. G. Marcuse's station, also P C J J, Sydney, Perth, American stations, and of course Morse stations by the score, and most can be got without an aerial or earth. I normally use an outdoor single aerial of 90 ft. length and 30 ft. high. A photo of my set is enclosed, it may be of interest to you. It shows from left to right (1) A double-power amplifier. (2) Short-wave



set. (3 & 4) Five-valve sets for longer waves. I use five-valve set, straight circuits, 2 H.F. (transformer coupled), detector, 2 L.F., last being a power valve. The results on longer waves have also been good. I can get any night Moscow (on loud speaker), also Turkish station (Stamboul), Paris, Langenberg, but Daventry I've only got once, but hope to get it again this cold weather season. There are several other Continental stations coming through, but have not identified them as yet. The two Indian and Colombo stations of course come through fine on loud speaker, and Bombay is about 600 miles, Calcutta 1,000, Colombo 600, and it's no trouble to get them. All my sets are built up by myself. Trusting this will be of interest.

I am yours truly,

J. P. WILLIAMS (Capt.)
17, Cambridge Road, Bangalore, S. India.



Captain Williams' outfit—(1) A double-power amplifier ; (2) short-wave set ; (3 and 4) long-wave five-valve sets.

APPARATUS TESTED

AN ELECTRIC SOLDERING IRON—AN EXCELLENT MILLIAMMETER—A WET H.T. BATTERY—CHEAP GRID LEAKS

* *

Traders and manufacturers are invited to submit wireless sets and components to the "P.W." Technical Department for test. All tests are carried out with strict impartiality in the "P.W." testing-room, under the supervision of the Technical Editor, and the general reader is asked to note that this weekly article is also intended to provide a reliable and unbiased guide as to what to buy and what to avoid.—EDITOR.

AN ELECTRIC SOLDERING IRON.

THE golden rules for successful soldering are that the iron should be kept clean and at a correct and constant temperature. No more easily are these rules carried out than with an electric soldering iron. With such the work is greatly facilitated. Although soldering is never essential in the construction of a radio receiver, it is always advisable and in any case amateurs should cultivate the art, inasmuch as it is capable of useful applications in the house for other purposes. An electric soldering iron need not be an expensive item; for instance, we have recently received from Messrs. Knowles & Son, of 87, Wardour Street, London, W.1, one known as the "K.N.," which retails at 12s. 6d.

We have found it quite suitable for light work, such as that which is met with in the assembly of radio sets. It is supplied complete with two bits which are interchangeable in a simple manner, and 5 ft. of twin flex fitted with a specially moulded patent lamp-socket adapter. Its consumption is very low, being approximately 75 watts, and it is supplied suitable for operating on 100 to 110 volts, or alternatively on 220 to 250-volt mains. It is also guaranteed for the period of one year, which is certain to recommend it to the discriminating amateur who has had experience of badly designed electric equipment.

As mentioned, it is supplied with interchangeable bits, the one straight and the other of right-angle form, so that it can be used in the most awkward places.

AN EXCELLENT MILLIAMMETER.

We have frequently advised constructors to cultivate the use of meters. With such you can keep your receiver in perfect running order and track down distortion to its source, and before it becomes appreciably audible. But if a milliammeter, for instance, is to give good service in the anode circuit of one of your valves, it must be properly designed for its task. It should have a fairly large scale and a moderately dead beat and accurate movement.

The Ferranti meters appear adequately to fulfil all these requirements. We have recently had one reading from zero to 15 milliamperes on test. We particularly like the design of the needle and this alone stamps it as a high-class job. This needle is of skeleton construction, is light, has practically no inertia, and its point is knife-edged and permits extremely close readings to be taken. Incidentally, if it swings hard over on the passage of high

(*Continued on page* 1290.)

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FIXED CONDENSERS

FOR BATTERY ELIMINATORS

and

H.T. BATTERIES

SALIENT POINTS

1. Dielectric losses negligible.
2. Capacity is effective at high frequency.
3. Wound with pure foil and not with metallised paper.
4. All sealed in and completely non-hygroscopic.
5. C1 tested at 1000 v. D.C. and quite safe for use on 500 v. continuously.
6. C2 tested at 500 v. D.C. and quite safe for use on 250 v. continuously.

Type C1.
C1T (soldering terminals).
C1S (screwed terminals).
Capacity: 2 mfd.
Price 7/-

Type C2.
Capacity: 2 mfd.
Price 4/-

FERRANTI LTD. HOLLINWOOD LANCASHIRE

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The Editor will be pleased to consider articles and photographs, dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts 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.

THE "PROGRESSIVE" ONE.

H. H. P. (Penge, London, S.E.20).—"I have had a crystal set for some time (and, as you know, 2 L O shows get rather boring at times), so to get a change of programme at times, I decided, as a first attempt, to try the 'Progressive' One. Now comes the trouble.

"I can't understand what is wrong with it. London comes in almost too strong (good tone); 5 G B strong, but always a pinch of 2 L O with it; Stuttgart, just comfortable to listen to, but again more 2 L O. That is my 'log' as far as ordinary hours go. To-night (Sunday) at 7.30 I tried to tune in to some foreign stations, and got Stuttgart, also Langenberg ('Merry Widow' on at time), then Leipzig. This I held till Big Ben chimed 8, when of course 2 L O overpowered it, as did 5 G B to Langenberg. (These three stations at fair strength.)

"My parts are as follows: ·0005 variable S.L.F. (wave-master), ·0003 variable S.L.F. (Ormond), ·0003 fixed, grid leak, H.T. choke, resistor (all Lissen), valve holder (Lotus). The set is wired and coil wound exactly as Mr. Dowding explained it. Aerial 20 ft. high both ends, 50 ft. span, 20 ft. lead-in.

"Now I have one confession to make (this may be the whole point). Several of above parts were given me as Christmas presents. One of the non-radio members of the family presenting me with a valve, this being a Triotron (Austrian) 2-volt ·05 G.P.

"Three friends have given me advice. One says 'Buy a valve!' Well, perhaps I ought. But does a valve make a set selective? No. 2 says 'Put your aerial up 10 ft. and cut it 10 ft. shorter. (Here we are screened, and I think it would need a 50 ft. mast to get into the open.) No. 3 says 'Get a slow-motion dial.' As a novice, I should put the whole trouble to the aerial. Would an indoor aerial be efficient? If so, what size?

"In conclusion, I should like to say I built the Lo-Cost crystal set on Thursday night in under half an hour, and was getting Charlot's Revue at real good strength. Thanks for it. It is a topping stand-by set."

It does not, by any means, always follow that a valve of the exact type recommended will increase selectivity to a really marked extent. Your friend No. 2 comes very near the truth in recommending a

(*Continued on page* 1286.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 1284.)

higher and shorter aerial. It would in all probability make a marked difference.

A slow-motion dial is a great help towards fine tuning, but the absence of such a dial is not the cause of 2 L O "trespassing." As you have already proved—from the fact that your one-valve "Progressive" pulls in the programmes from 5 G B, Stuttgart, Langenberg, and Leipzig—the set is a wonderfully sensitive one. And consequently, when 2 L O—which is "only just across the river" from Penge—starts up on full power, your sensitive set seems almost "too strong." But you must remember that to get long distance it is essential for the sensitivity to be there; and, furthermore, that good as the "Progressive One" is, it will only become a real "reacher-out" when the H.F. stage (described by Mr. Dowding in his second "Progressive" article) is added.

Scores of readers have remarked upon the great increase in selectivity as soon as the H.F. amplifying valve is added to the one-valve set; and of course its programme-range is enormously increased by the addition of the high-frequency amplifier.

If, however, you are not able to add the second valve at the moment, we should seriously consider the question of a wave-trap. The "P.W." Standard Wave-trap, for instance, is easily made up, and it was designed for just such a purpose. Particulars of its construction are given in "P.W." No. 297, February 11th issue.

THE GRID CONDENSER.

L. S. D. (Whitechapel.)—"I am mounting the new set in the old cabinet and upon the panel I have already got fixed a ·0003 mfd. variable condenser. It used to be the tuned-anode condenser, but now I shall not want it and I wondered if I could use it for a grid condenser. Would it be all right and, if so, what would be the effect of "tuning" or varying it?"

It will be quite O.K. for you to use the variable instead of a fixed condenser as a grid condenser. For ordinary reception you will probably find that a variation of this condenser from "all in" to about "half way in" makes very little difference, although when turned all out or nearly all out results become unsatisfactory owing to grid choking, which leads to distortion. If, however, you intend to use the set for long distance it is quite likely that you will find that variation of the grid condenser will be of material assistance in strengthening up a weak station.

2-VOLT VALVES FOR THE "TOURIST" TWO.

T. Barker (London).—"Only the R.C. and the H.F. valve in the 6-volt class were given in the description of the 'Tourist' Two which appeared in Popular Wireless, No. 278. Can the same class of valves be used from the 2-volt series? If so, what variable resistance for the 2-volters is required?"

It will be quite all right to use a 2-volt H.F. valve for the first position and a 2-volt detector for the second position. Corresponding to those in the 6-volt class which have been named, you could use in the Mullard range a P.M.1A or a P.M.1H.F. for the first valve, and for the second valve a P.M.1L.F. Similarly, the 2-volt Cossors would be 210R.C. (blue band) for the first stage, and a 210 Detector (black band) for the second stage. If you decide on the Marconi or Osram valve the first one should be a D.E.H.210, and the second one should be a D.E.L.210.

Speaking generally, any good "H.F." valve in the 2-volt range will give good results in the first position and any good 2-volt "detector" in the second.

Regarding the variable resistance to be employed for these valves, it is becoming quite common with valve manufacturers to place such reliance in their filaments that *variable* resistances are unnecessary. When the filaments of valves were very delicate it was essential that they should be run at exactly the right temperature or there was grave risk of destroying them. This objection does not now apply and most valve makers claim that their valves will run as well from a newly-charged accumulator as from a partially discharged one, the slight variations in voltage between these two states making very little difference to the efficiency of the valve. If, however, the manufacturer you have in mind specifically recommends the use of a filament rheostat we should use one of quite low resistance say, having a maximum of 5 or 6 ohms.

THE VOLTS ON THE VALVE

T. H. (West Ham, London, E.15).—"I have built up a three-valve set, Detector and two L.F., from the Blue Print No. 20. It is working quite satisfactorily. In the last stage I am using a Cossor power valve with 100 volts on the plate, but what I cannot make out is this. When I measure this last valve and test the voltage with a high-resistance voltmeter it registers only 60 or 70 volts. If I disconnect the loud speaker and short circuit the two terminals then it registers 100 volts. So this means that the loud speaker absorbs 30 to 40 of my volts. Is this quite O.K.? There is just the same drop of voltage when I use a pair of headphones."

Yes, it is quite O.K., T. H., and it happens in every case that the full voltage of the H.T. battery is not applied to the plate of the detector valve. This is not generally realised, but your test with a voltmeter shows it up clearly. In order to get the 100 volts effective upon the plate you would have to use a battery of more than 100 volts, in order to overcome the effect of the resistance which is in series with the valve.

It is because there is a voltage drop in the circuit that it is generally possible to increase the maximum voltage from a battery above that which the makers recommend for the particular valve in order to get best results. According to Ohms law, the voltage across the valve itself can never be the full voltage of the H.T. battery while there is any resistance in series in the same circuit, and, of course, the loud-speaker or the telephone winding represents a pretty high resistance, so that it is inevitable that there should be an apparent large decrease of the voltage actually applied to the valve itself. Consequently a valve rated at an anode voltage of 80 may work best when the battery plug is at a much higher figure.

THE NOVEL ONE-VALVER.

R. J. W. (Market Harboro', Leics.).—"Whilst I was staying with a friend in London we called at another friend's house and listened to his wireless set. It was only a one-valve set, but in the short time that we were there it tuned in both English and Continental broadcasting, and it seemed easy to handle and more efficient than my own set, which is a two-valver. I was so struck with its performance that I would like to build it for myself. On enquiry I find that the circuit used was the "Novel" One-Valver that was described in Popular Wireless

(*Continued on page* 1288.)

LORDS OF THE LONG-BOW

For lying on the grand scale the palm must be awarded to Dr. Frederick Cook, the American explorer, who, in the year 1909, became the temporary centre of attraction for the whole civilised world as "discoverer" of the North Pole.

Stories of men who have tried to hoax the world are many and varied. Some of the most noteworthy are being related in a short series beginning in the current issue of "The Weekly Telegraph." They make capital reading. Pride of place is given to Dr. Cook.

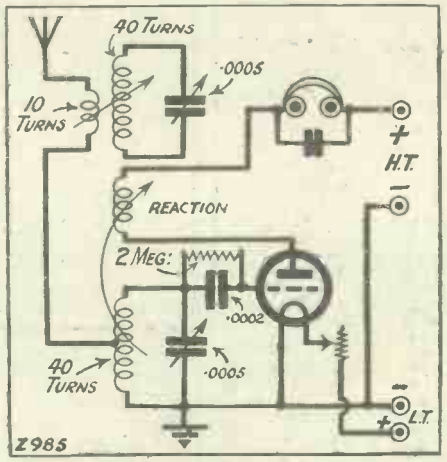
RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 1286.)

some time ago. As I do not understand diagrams, would you mind telling me the connections of this set in words? And also if any parts besides the following are required? Coil holder, ·0005 variable condenser, grid condenser and leak, valve holder and valve, rheostat, telephones, and the usual batteries."

All the components necessary to build the set are named in your list, and the point-to-point connections are as follows:—Aerial to one side of the single coil holder, to the plate circuit of the valve holder, and to one telephone terminal. Remaining telephone terminal to H.T. positive. H.T. negative to L.T. positive and to rheostat. Other side of rheostat to one filament of the valve holder. Other filament leg of the valve holder to L.T. negative to one side of the variable grid leak, to earth, and to one side of the variable tuning condenser (·0005 mfd.). The remaining side of the tuning condenser (·0005 mfd.) to the remaining side of the single-coil holder and to the grid condenser (·0002 or ·0003 mfd.). The final connection is from the grid socket of the valve holder to the remaining side of the variable grid leak and the grid condenser.

A SELECTIVE ONE-VALVE SET.
(With Wave-trap.)



The correct connections of a selective one-valve set are shown above.

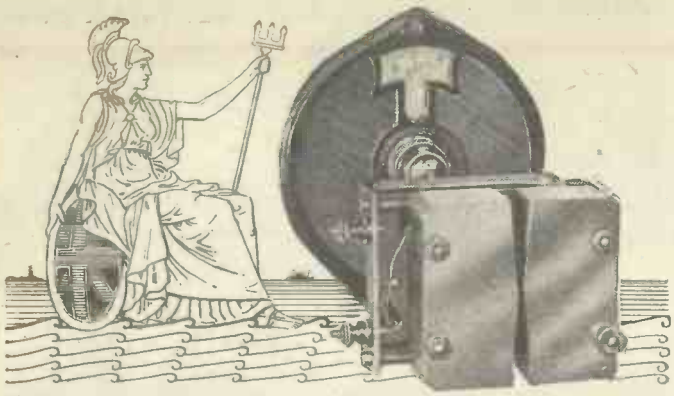
In the "What is Wrong?" diagram last week the aerial lead was earthed instead of being connected to the grid coil. The grid leak, the grid condenser, and H.T. negative were omitted, and the absence of a by-pass condenser might have given rise to a failure to oscillate.

(Note.—The next "What is Wrong?" diagram will appear next week.)

THREE FAMOUS SETS.

P. J. W (Lowestoft).—"I find one of the biggest troubles in wireless is to know *which set to build.* The recent article on the 'Master Three" was a great help in this respect, but the trouble with some of these sets is to find out what circuits they employ, as some of the makers don't say on their literature."

If you have the "Cossor Melody Maker" or the "R.C. Threesome" in mind, as well as the "Master Three," you will find full circuit details of all these popular designs and a free pictorial Blue Print of them in the March number of "Modern Wireless" (on sale March 1st, usual price, 1s.). Mr. Dowding, our popular Technical Editor, has written a long article on these receivers, and he includes operating and constructional hints as well. You should make sure that you obtain this March issue of "Modern Wireless," for it will prove of peculiar interest to you in the circumstances.



"RULER OF THE WAVES"

RIPAULTS LATERAL ACTION CONDENSERS

These are the Condensers specified for

THE "ECONOMY FIVE"

Fully described in "Popular Wireless" of Feb. 11th, 1928.

Note the big differences in the construction of this condenser over all others. The usual swinging plates, needing so much space on the panel, are eliminated by a cam moving the plates with a lateral action, thus saving a great deal of space. Space occupied at back of panel is only 3¾" by 2¼".

The Slow-Motion Dial scale reads to 360 degrees, which gives exceptionally wide spacing on the lower wave-lengths. Ripaults' Lateral Action Condensers allow a very minute variation of capacity for a single degree on the dial, and permit of an assembly that eliminates loss and self capacity.

In up-to-date Sets Lateral Action is the secret of the skilful tuning that brings in Stations "all round the Dial." Witness the fact that many Sets designed by the Technical experts of the Wireless Journals are specifying Ripaults Lateral Action Condensers where great selectivity is required.

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Good News for Set Builders!

In response to the urgent demand for a first-class 4-valve set for family use, Mr. PERCY W. HARRIS, M.I.R.E., has now prepared

The WIRELESS CONSTRUCTOR ENVELOPE No. 2

In this envelope—obtainable at all bookstalls, price 1/6—will be found full constructional details of a magnificent and inexpensive receiver, called

"THE CONCERT FOUR"

Made of standard parts, all easily obtainable, it is a *highly-sensitive long-distance set*, giving *powerful reproduction of wonderful quality*. Covering both long and short wave-lengths, with a switch for 3 or 4 valves, it is essentially *a set to enjoy*, both in building and operation.

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By post, 1/9, from the Amalgamated Press, Ltd., Bear Alley, Farringdon Street, London, E.C.4.

APPARATUS TESTED.

(*Continued from page 1282.*)

current it does not bend. It is very easy to over-run a milliammeter. You take out one of the grid-bias plugs and over swings the needle.

In many cases this has the effect of bending the needle, and after this a meter is, if not totally useless, quite unreliable. The Ferranti milliammeter is in every way a sound design. It might be slightly more expensive than many on the market, but it should be remembered that it is a precision instrument. And, additionally, it is a precision instrument capable of retaining its accuracy under adverse conditions.

A WET H.T. BATTERY.

The Wet H.T. Battery Co., of Brownlow Street, London, W.C.1, recently sent us one of their larger types of wet H.T. batteries. It consists of 60 of their No. 3 Standard Cells and gives 90 volts. This battery was tried out under normal radio reception conditions. It was employed in conjunction with accumulator H.T. to operate a powerful five-valve set employing a super-power valve.

The H.T. current required by this set when working properly is 25 milliamps. For a few days after placing the battery in operation there was a certain amount of fluctuation, current dropping from 25 milliamps after a period of about one hour to 23 milliamps, and then rising to about 24. But after about a week the outfit settled down to its work and delivered a steady 25 milliamps for the periods of three and four hours that the set was in use. Since then there have been no appreciable variations, and the battery has continued silently and steadily to function. A wet battery of this nature appears to be an ideal solution to the H.T. problem where large sets are in use, and where there are no electric-supply mains or charging facilities.

CHEAP GRID LEAKS.

It is not so very long ago, comparatively speaking, that grid leaks cost as much as 9s. 6d. each, and many amateurs were compelled to make their own with pencil lines and paper, seldom with satisfactory results. As a commentary on present prices we have the new Pye grid leak, due to the well-known Cambridge firm of this name, which retails at 1s. A range of seven values from ·25 megohms to 3 megohms is available at this price.

The component is of the conventional tubular type with metal end-caps, but, additionally, at each end is a short length of soft copper wire. These wires can be soldered directly on to terminals or other leads or can be twisted with the fingers into loops so that they can be slipped under terminals. A very ingenious scheme, and one which will commend itself to amateur constructors.

These very cheap grid leaks also appear to be perfectly efficient and the ones submitted to us for test were found to have values substantially as stated. If every one issued is similarly reliable and accurate Messrs. Pye should do a roaring trade in these "bob" grid leaks.

NEWS FROM SAVOY HILL.

(*Continued from page* 1278.)

to broadcast an appeal on behalf of Virginia House Holiday Camp, which is held annually during August at Maker for some 200 children living in the poorer districts of Plymouth.

Szigeti at Sir Henry Wood's Concert.

Though he has lived and played extensively in this country for a good many years, Szigeti, the famous violinist, to whom Sir Hamilton Harty dedicated his one and only violin concerto, has never appeared before the microphone. That he will do so on Friday, March 9th, will make the National Symphony Concert, which Sir Henry Wood is conducting at the Queen's Hall, all the more interesting, and indeed important, particularly as the piece chosen for him is Beethoven's Concerto.

The novelty of the evening will be a new suite of four impressions, inspired by scenes depicted in stained glass windows, to which its composer, Ottorino Respighi, has given the title "Vetrate di Chiesa." Another work of outstanding interest in the programme is Frank Bridge's Symphonic Suite "The Sea," which was first produced in 1912 at the Queen's Hall "Proms.," and is published in the Carnegie Collection of British Music.

An Ellen Terry Birthday Party.

To commemorate the 80th birthday of Ellen Terry, a special programme, consisting of Shakespearean scenes in which the great actress excelled during her stage career, is being arranged by the Dramatic Department of the B.B.C. on Monday evening, February 27th, when it is hoped several members of the Terry family will take part. A musical programme will also be broadcast under the direction of John Ansell, this being a repetition of that given at a Festival Dinner in Honour of Miss Terry at the Hotel Cecil on June 17th, 1906, when Mr. Ansell was the conductor.

Herman Scherchen for March 4th.

A Symphony Concert, under the direction of Herman Scherchen, who, it will be remembered, conducted one of the Albert Hall National Concerts last season, which was incidentally his first British appearance, has been arranged for London listeners on Sunday afternoon, March 4th. The outbreak of the War found Scherchen occupying the post of conductor of the Symphony Orchestra at Riga, with the result that he was imprisoned in Russia.

On regaining his freedom in 1918, he founded the New Musical Society in Berlin, and four years later was appointed conductor of the Frankfort Museum Concerts. To-day he is regarded as one of the leading German musicians. The programme on March 4th will include a novelty in England, the Hindemith Concerto for Orchestra and Delius' Cello Concerto played by Beatrice Harrison.

Curios in 2040 !

Mr. Richard Hughes, the radio dramatist, will talk on Friday evening, March 9th, on antiques and curios in the year 2040. This talk will, of course, be somewhat of a fanciful nature, and one which even the youngest of our listeners can hardly expect to test as to the accuracy of Mr. Hughes as a prophet.

TECHNICAL NOTES.

(*Continued from page* 1278.)

Choice of Programmes.

The system of wired wireless seems to offer quite a practical scheme for ensuring a choice of programmes in large towns, where selectivity with an ordinary wireless receiver is rendered difficult by the presence of a local broadcast transmitter.

With wired wireless, several programmes may be fed simultaneously into the same conductor and separated out at the receiving end by means of filter circuits.

A rather important incidental point in connection with wired wireless is that the signals received may easily be made enormously stronger than those picked up from an outside aerial by means of ordinary broadcasting.

Gramophone and Wireless.

A wireless receiving set and a gramophone have this in common, that they are both adapted for the reproduction of sound, and that each has a specific sound reproducing horn or equivalent. Evidently then if you possess both a gramophone and a loud speaker you are duplicating parts which are common to both; for this reason devices were introduced, even in the very early days of broadcasting, for reproducing the sound from a gramophone record via the wireless loud speaker.

Apart altogether from the great convenience of combining the two instruments together, it is possible by means of the amplifying system of the receiver to amplify the sound from the gramophone record to any desired reasonable extent. This is a great advantage from many points of view. For one thing the amplification is obtained without throwing any further destructive effort on the record itself.

Everyone knows that you can produce a much louder reproduction from a gramophone by using a shorter or stouter needle, but the extra loudness obtained in this way is at the expense of the record itself, which is much more rapidly worn out. With valve amplification, as obtained through the amplifier of the receiving set, the life of a record may, in fact, actually be prolonged, because it is possible to use a "soft" needle, which treats the record very gently, and then to make up for it by a little extra valve amplification.

Electrical Pick-ups.

Personally, I am very greatly in favour of these electrical pick-ups, as they are called, as they seem to me to be quite the proper scientific way of doing the job. As the sound is amplified, so also is the "surface noise" or "scratch" of the record, but the pitch of the latter being usually very different from that of the desired sound, it is feasible to exclude a great deal of the amplified scratch by means of a simple filter circuit.

There are all kinds of gramophone electrical pick-ups on the market now. In most cases the pick-up is an electro-magnetic device similar in principle, though not in actual construction, to a telephone receiver.

Incidentally, I would like to call my readers' attention to the special monthly Radio-Gramophone section commencing in the March issue of "Modern Wireless."

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