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MORE ABOUT THE 7/6 THREE-VALVER (See Page 970)

Popular Wireless

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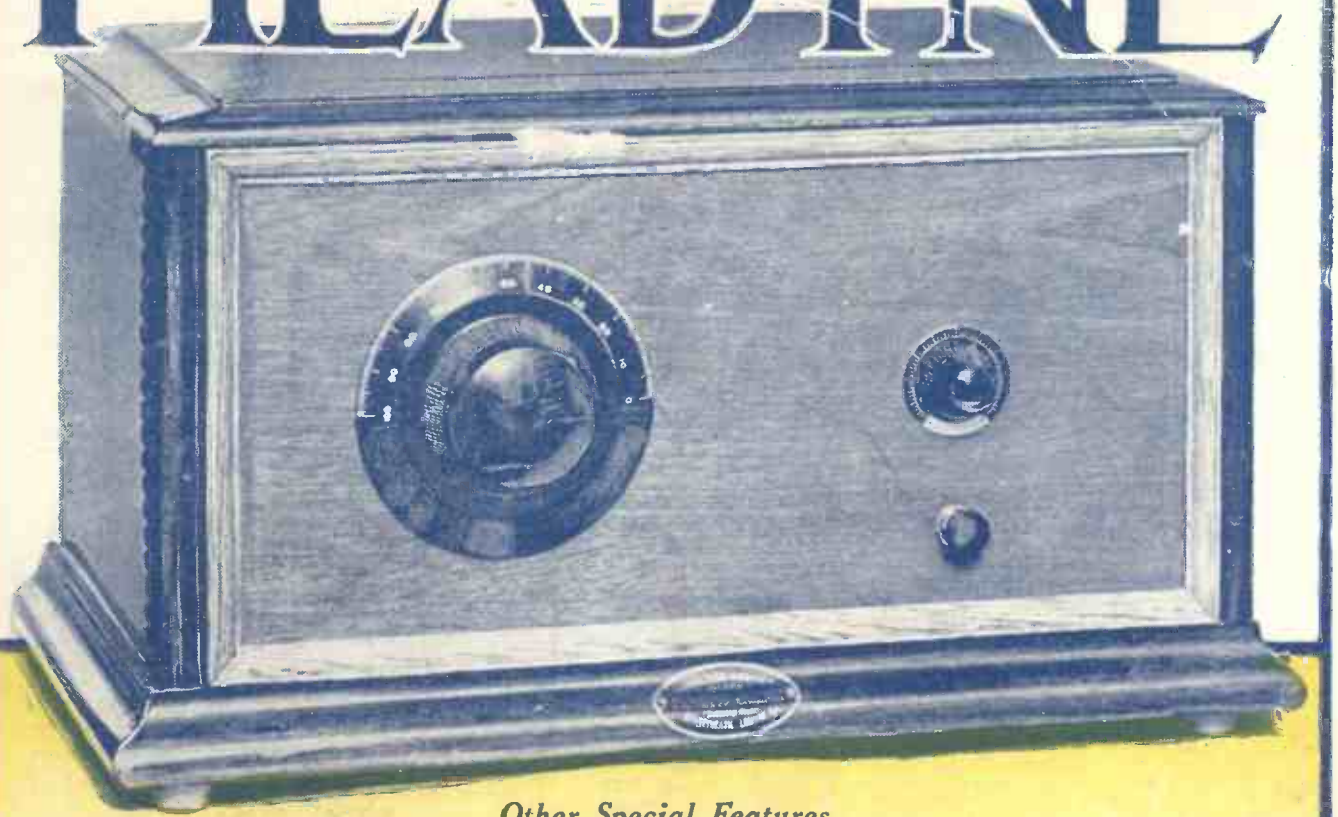
No. 345. Vol. XIV. INCORPORATING "WIRELESS" January 12th, 1929.

The 1929 "FILADYNE"

FULL DETAILS INSIDE



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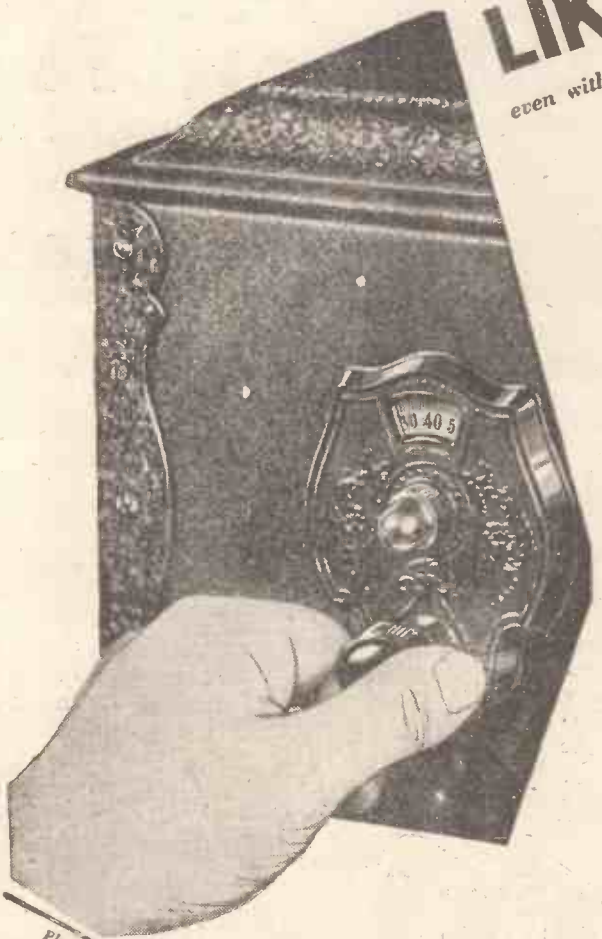

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RADIO NOTES AND NEWS.

Society Note—B.B.C. Wavelength Changes—The Latest from Mars—Radio from the Mains—More Nature Study—DX Hounds Leap—Radio as Fire Fighter.

S. O. S.

WILL the gentleman, apparently of Greenock, who so kindly sent me the curious implement as a New Year's gift, be good enough to telegraph, at his own expense, stating the purpose for which it is intended, thus saving the technical gang from a nervous breakdown? The voting at present is, 1st, Haggis-cutter; 2nd: Automatic-machine opener; 3rd: Parritch tester.

Idea for Song-Writers.

WHEN one considers how certain nonsensical songs seize the public's fancy and run like wildfire through the Empire, one wonders when a popular radio song will make a hit. Think of "A Bicycle Made for Two," "Oh, Mister Porter," "After the Ball Was Over," and the recent "Why is the Bacon So Tough?" And then imagine: "Give Me My Little Fat Valve," or "Where is 2 L O To-night?" Gentlemen of Boosey's, I look to you.

Wireless Telephony Spreads.

A PUBLIC wireless telephone service has been opened between Holland and the Dutch East Indies. Calls may be made between The Hague, Amsterdam, Rotterdam and Utrecht, to the four leading towns of the East Indies. The fee is £2 10s. per minute, and two days' notice of the call are required. This is the third long-distance radio-telephone service to be opened in two years.

Society Note.

THE Croydon Wireless and Physical Society is the first to open the ball in these Notes this year. Its officers have been elected, and its Hon. Sec., Mr. H. T. P. Gee, of Staple House, 51-52, Chancery Lane, W.C.2, will be pleased to hear from those desirous of joining the society. It is a serious and successful body, and we wish it another good year.

B.B.C. Wave-length Changes.

AS from January 13th the B.B.C. stations' wave-lengths will be: 5 X X, 1562·5; 5 G B, 482·3; Glasgow, 401·1; Manchester, 378·3; London, 353; Cardiff, 323·2; Aberdeen, 311·2; Belfast, 302·7; relays and Bournemouth, 288·5; Newcastle, 243·9. By the way, the B.B.C. calls "kilocycles" "*kilohertz*." This is a new piece of B.B.City. What's the great idea? We know what a cycle is; why call it a hertz? It hurts! And if a cycle is a Hertz, why not call a metre a Marconi?

Important New Invention.

E. R. R., writing in "The Field," brings before the public notice what is apparently a new product of the inventor's brain; if it is not that, it is the fruit of E. R. R.'s imagination. He introduces "radio meters." Students of philology, and others, will know that this means "measurers of radio," but these radio meters are exceptional, for, says "E. R. R.," "They will measure, *that is to say*, low tension *current* up to about 150 *volts*." (My italics.) Well, clever radiometers which can measure current in volts ought to be able to act as petrol-gauges!

Odds and Ends.

BERLIN has relayed a Wagner concert from Java. A bit of its "own" back, slightly "faded."

Marconi House is for sale. Senatore Marconi is not included as a "fixture." Men I know say they hope the building will regain its former glory as the Gaiety Bar and Restaurant.

£1 10s. 6d. was collected by the sale of wireless pictures in a Glasgow club. Thirty shillings was paid by the guest of honour, an Englishman, for a photo of Sir Harry Lauder. The odd sixpence was given by an Aberdonian who thought it was the price of the dinner, including wine, cigars, wine and cigars and wine—(and cigars)!

G.B.S. AND B.B.C.

This picture shows Mr. Bernard Shaw broadcasting in happy vein upon Dramatic Art. Note the type of microphone recently used to link up the lecturer to B.B.C. listeners.

Latest from Mars.

DR. MANSFIELD ROBINSON still makes love to Mars. It is now reported that he has hopes of getting through to that planet from Brazil, on 22,000 metres. I am pretty well acquainted with the business capabilities of the chief of the Rio de Janeiro station, and should not be surprised to hear that he has fixed up a contract with Dr. Robinson, providing for one call per week per annum, and, for an extra fee, a guaranteed reply, with the Mars postmark on it. After all, the doctor's money is as good as anybody else's!

Thoughts on Infinity.

HORRID solemn, isn't it? But the principle back of Dr. Robinson's experiments is not so fantastic as might at first be thought. I have doubts about Mars, but why should we confine speculation and experiment to the insignificant scattering of dust which we call *our*

(*Continued on next page*).

NOTES AND NEWS.

(*Continued from previous page.*)

solar system ? If the astronomers are to be believed, there are millions more suns, each with its system of satellites. Is it so incredible that in an infinite universe peopled by countless millions of worlds, there should be only one world on which intelligent life exists ? I think not ! But I am not at all sure that 22,000 metres is the right wave-length to get at it.

Radio from the Mains.

THE idea of distributing radio broadcasting by means of domestic light and power wires has "caught on" in the U.S.A. as a sound proposition. So much so that already one company for its exploitation has been formed, the "Wired Radio Incorporated." This corporation has been granted by the Kolster Radio Corporation exclusive licences for putting radio "on the mains." There can be no doubt that the present generation will see the day when broadcast programmes are "laid on" just as gas, water and electric light are nowadays.

Secrets of the "Beam."

MARCONI'S have sent me numbers 1 and 2 of their new advertising venture, "The Marconi Review." It is very high-brow, commercial and mathematical, but withal of great interest. I suppose that commercial radio engineering is about as far removed from the amateur's gadgets as is the "Flying Scotsman" or the "Golden Arrow" from the toy trains we buy at Christmas. Yet the "Marconi Review" so far has given a most interesting account of the development of the Beam System, showing what an important part was therein played by the famous yacht "Elettra."

The Wireless League.

THIS League deserves to be better known. First, its address is 19, Berkeley Street, W.1, where its secretary sits in his lair waiting to give inquirers full particulars. Membership includes the insurance of wireless sets and accessories, free technical help, and legal advice on all wireless matters. Members are invited to express their opinions of broadcast programmes, which after consideration may be the subject of recommendations to the B.B.C. The League also does useful work in presenting hospitals with free sets, helping the blind, etc. It also has a scheme for the registration of approved wireless traders.

More Nature Study.

THE pup that panicked when the military band was tuned in is no more one of the family; he had to be swopped because his habits were more suited to a prairie than to a house. His successor is a rough-haired terrier, with the sweetest whiskers and beard; only six months old, but the image of an ancient Wesleyan padre I knew years ago. This chap will take anything from the radio except the flute, and if a flautist flaunts his flute during the tyke's waking moments the little blighter barks himself into a fury, and has to bite the sofa cushions to save himself from apoplexy.

Altogether, Boys !

IT is reported from Russia that a man cursed with the name Zlotnikov has been granted a patent for a master wireless clock, by means of which, 'tis claimed, any number of clocks or watches, which are adapted for the purpose, can be kept going and synchronised. It was Charles the Second's grief that he couldn't make two watches keep similar time, and he used to tell people how foolish it was, therefore, to expect all men to think alike. If he could only have had this radio clock—he would have lost his head.

Radio As Fire Fighter.

SOMEWHERE about 1919 I was present at a demonstration given by the Marconi Company to the London Fire Brigade, in order to show how an engine "on the job" could keep in touch with headquarters. The demonstration was successful, and telephonic communication was established in a few minutes. I shall never forget the astonishment of a good lady who, from the window of a little house in a by-street, saw a burly fireman shinning up a lamp-post with the aerial. Nine years have elapsed and now Rochdale has equipped all its fire-engines with radio. Slow but sure ! But what of London ?

SHORT WAVES.

One old lady writes to say that she can hear much better by using a loud speaker than by headphones, but she simply can't make it balance on her head.

She evidently hadn't seen our issue of December 29th, wherein we published an article entitled : "How to make the 'P.W.' *Better Balance* Cone" !

* * *

NO OLD STOCK.

Mrs. Fan (who is doing a bit of shopping for hubby) : "I want to buy a radio battery."

Clerk : "Storage ?"

Mrs. Fan (indignantly) : "No, of course not ! I want a good fresh one."

"Radio News."

* * *

A tramp, walking into a pawnbrokers' the other day, enquired how much he would get for a wireless set. When he laid it on the counter the pawnbroker said he would think he'd get quite six months—he'd sold that set to a customer the day before.

* * *

Jack : "Was your wedding reception a big success ?"

Jill : "You bet ! Why, we got Hollywood on the loud speaker."

* * *

"Finnish, thank goodness !"—as the DX fan said at the end of the National programme broadcast.

* * *

The B.B.C. announce that they would like to find a silent kind of paper which could be used by lecturers, etc., when they read their speeches.

A silent kind of lecturer might be a good idea !

* * *

Answer to Correspondent. If your loud speaker continues to croak, remove the horn—you may find a frog has fallen down there.

* * *

A TRAGEDY OF 1929 ?

First Office Boy : "How'd you lose your job, Jimmy ?"

Second Office Boy : "Aw, I told the boss I wanted the afternoon off to go to my grandmother's funeral, and he saw me at the football game over the television."

* * *

This Power Unit we have here
I must confess, is very dear.
It's guaranteed to give *no noise*
To spoil the radio listener's joys.

And now it's hooked up all around.
But, darn it all ! there's not a sound !
Somehow it's just a little bit
TOO NOISELESS now, I must admit.

"Radio News."

God Save the King.

ALL "P.W."-ites must surely be following the progress of His Majesty's illness with anxiety mixed with admiration for the fight he is "putting up." As a man who has consistently carried out his duty in what must be a most exacting job, he has won the esteem of his people and radio men will recall with a throb of fellow-feeling how he expressed his delight in sitting down to his set for a little ether-combing. One touch of radio—and our King becomes one of *us*, just as he is one of the philatelists.

The DX Hounds Leap.

MY query about the reception of 6 A G (W. Australia) has proved that the DX hounds, if they were sleeping, had each one eye open. Our champion, R. W. S. (Little Wakering), galloped up at the whistle, with a confirmation card from 6 A Gin his teeth, and got a lump of sugar. A. G. M. (Stoke-on-Trent) and others also claim 6 A G as their bone. J. E. B. (Luton) got him, but modestly described it as "the usual roar of atmospherics, bursts of music, intermittent fading and half-heard announcements that we call Australia !" His query about Nairobi is answered by R. W. S.

Text-Book Wanted.

IN "P.W." for December 22nd, page 836, a gentleman who pleads for good English yet signs his letter in Latin, deplores the lack of lucid text-books about wireless. Dr. J. A. Fleming is a worthy successor of those Victorian giants Huxley, Tyndall and Faraday, and his book entitled "Waves and Ripples in Water, Air and Aether" is a fascinating and simple exposition which will prepare the student's mind for details of radio methods. Then, if our correspondent will let me have his name and address, I will send him a book on elementary physics for wireless amateurs.

Physics the Master Key.

THE difficulty of writing about wireless for non-scientific people lies in the fact that wireless is an art of the electrician, and a proper understanding of it presupposes an understanding of an enormous number of physical constants and conceptions, electrical, magnetic, electromagnetic, acoustic, chemical and mathematical. If one mentions an ampere one involves the volt and the ohm, which, in turn, involve other physical quantities, and so on, well-nigh *ad infinitum*. There are, however, a number of admirable books for beginners—Mr. P. W. Harris has one or two to his credit—which should be found at any large bookshop.

An Idea for 1929.

I DON'T know why the island of Tristan da Cunha suddenly occurred to my mind, but it was no doubt telepathy—"I don't think." However, what a boon it would be to the inhabitants of that island, where a steamer calls but once or twice a year, if they could only have a small short-wave telephone transmitter and receiver, and get into touch with civilisation through the world's amateurs. I wonder whether the amateurs could and would "put it over." It would be a noble gesture.

ARIEL.

THE 1929 "FILADYNE"

One of the most popular circuits ever placed before "P.W." readers is the Filadyne, a circuit originated by the Technical Editor. It is of an entirely novel character and can give astonishing results. Here is an entirely new two-valve version. Designed and described by J. ENGLISH.

THAT unique circuit, the Filadyne, is of particular interest to listeners who want big results for a small outlay. Within reasonable distance of the local station this detector scheme gives quite a fair loud-speaker output with no L.F. amplification at all. Another pleasing aspect is that high voltage batteries are not required, and in every way the Filadyne valve makes the utmost of the power supplied to it.

COMPONENTS AND MATERIALS.

- 2 Sprung valve holders (Benjamin, W.B., Igranic, Lotus, Pye, Ashley, B.T.H., Bowyer-Lowe, Marconiphone, Redfern, Burndept, Formo, Burne-Jones, Wearite, etc.).
- 1 L.F. transformer, ratio about 6 to 1 (Igranic type J in set. Any good make in which the correct ratio is available).
- 2 Baseboard rheostats, 30 ohms (Igranic, Lissen, etc.).
- 1 ·0001 mfd. fixed condenser, one ·001 mfd., and one ·005 mfd. (Lissen, T.C.C., Dubilier, Igranic, Mullard, Clarke, Goltone, Magnum, etc.).
- 1 ·0005 mfd. variable condenser (Dubilier, Lotus, Lissen, Cyldon, Burton, J.B., Igranic, Ormond, Colvern, Bowyer-Lowe, Pye, G.E.C., Peto-Scott, Raymond, Formo, etc.).
- 1 Panel-mounting potentiometer, 400 ohms (Lissen, Igranic, etc.).
- 1 On-off switch (Lotus, Benjamin, Lissen, Burne-Jones, Igranic, etc.).
- 9 Terminals (Eelex, Belling & Lee, Igranic, etc.).
- 1 Tapping clip.
- Materials for coils, wood for panel (see text), cabinet if desired, wire, screws, etc.

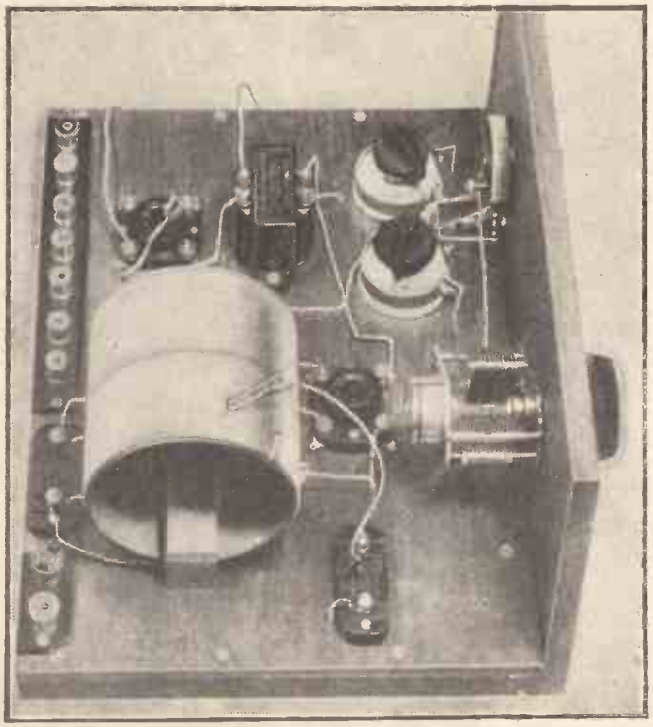
Results Above the Average.

Recent developments led me to design the two-valve receiver illustrated on this page. This little set incorporates several new features and comprises the latest version of the Filadyne detector followed by a simple L.F. stage. I have purposely limited the design to two valves because this particular combination is sufficiently powerful to give excellent loud-speaker reproduction from the local station, results being well above the average for a normal two-valve set. The Filadyne is certainly a detector of great purity, and the quality of the output of this two-valve combination is most pleasing, particularly if it is reproduced on a good loud speaker. Moreover, the set can put up a very good DX performance for its size, in fact, such is its response to the controls that it gives you the impression you are almost handling a three-valve receiver.

The New Circuit.

A two-valve receiver does not eat into a lot of money either for building or for upkeep, and when designing this set I have had in mind the man who wants reasonable selectivity and good volume and quality without much expense. Hence this receiver can be reproduced for some fifty shillings and a little common-sense construction.

Interested experimenters will certainly want to know how the circuit functions and to have some description of the new features mentioned above, so let us begin with the theoretical diagram of Fig. 1. We have the usual tuned double-filament coil L_1 L_2 and potentiometer reaction-control, but you will notice at once that the reaction coil L_3 is not in its usual position. By shifting it to the anode circuit we obtain certain definite advantages, such as a smoother control of reaction and an easier elimination of H.F. energy from the L.F. output grid circuit. You will find further details of the anode reaction scheme in a recent article of mine in POPULAR WIRELESS. When tuning in a strong station I have noticed a perceptible increase in volume when the reaction coil is in the anode circuit as compared with it in the grid circuit. This would appear to be due to the fact that a stronger regenerative effect can be obtained with the valve biased nearer to the upper bend on the grid current-anode volts curve, which naturally ensures a bigger L.F. output for a given H.F. input on the filament.



Mr. English invented the tuned Filadyne-choke system and this is incorporated in his latest set. As you will see, the set is quite a simple, inexpensive affair.

Selectivity.

The remainder of the detector section is quite normal, the aerial lead being tapped on to one of the filament coils, the degree of selectivity increasing and the volume decreasing as this aerial tap is lowered towards the battery end of the coil. There

(*Continued on next page*).

THE 1929 "FILADYNE."

(Continued from previous page.)

is a small fixed condenser C, in series with the aerial lead, as this improves selectivity when the set is used on a normal aerial. If you change over to a small aerial, it is easy enough to short this condenser with a piece of wire, thus saving the cost of a second aerial terminal. Reaction is controlled by means of the potentiometer, which is shunted across the filament supply,

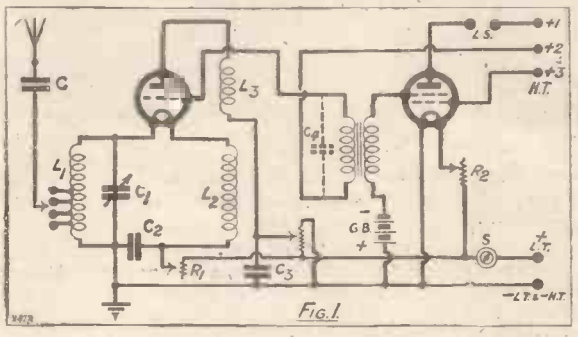


FIG. 1.

the condenser C_3 being necessary to bypass the H.F. component in the anode circuit. The great advantage of this form of reaction control is that it has no effect on tuning, which is then much easier, especially on weak signals.

You will notice that a tetrode valve is shown in the L.F. position. While ordinary valves may be used with every success without any alteration in the design, I have made provision for the tetrode in the interests of economy. The Filadyne detector rarely requires an H.T. voltage more than 40, while the tetrode power valve will comfortably handle the full output of the detector on 40 to 50 volts only. So there is no need for an H.T. supply of umpteen volts: a modest battery of 60 volts will do excellently, while the necessary valves are not expensive.

Fixed Condensers.

After an inspection of the theoretical circuit you may think that I have put in too many fixed condensers. With the exception of C_2 they are all necessary, but the capacities are not critical. The set will work almost as well without C_2 and any fixed condensers from ·001 mfd. to 2 mfd. capacity will do for C_2 and C_3. Some types of transformer have the shunt condenser C_3 sealed up inside them, so that this condenser is not necessary if you use one of these transformers. The transformer used in the original set has such a built-in condenser, and in spite of its small size it works quite as well as a more expensive model of larger dimensions. The low A.C. resistance of the Filadyne valve makes it possible to couple it to the L.F. valve with a high-ratio transformer such as the 6 to 1 component used here without loss of quality. There is no reason, however, why you should not use a lower ratio component if you have one.

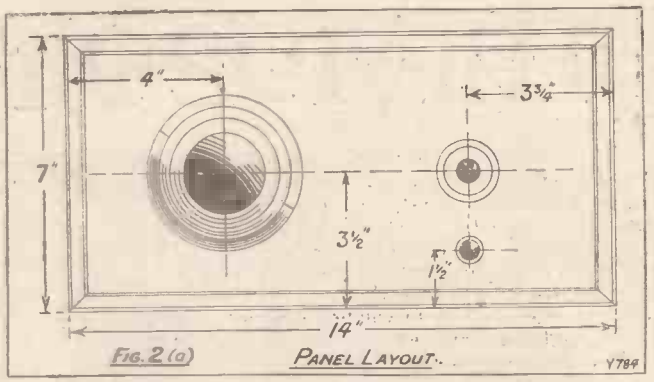


FIG. 2 (a) PANEL LAYOUT. Y784

The Valves To Use.

There is just one other point in connection with components which I must deal with before getting down to practical details, and that is filament current control. To make the set really adaptable you should be able to use two valves of different filament rating. There are valves specially good as Filadyne detectors in the 2-, 4- and 6-volt ranges, so that you can use any one of these with the 4-volt tetrode or a 4-volt Filadyne valve with a 2-volt L.F. valve, and so on. This is easily arranged by providing a 30-ohm rheostat in series with each valve filament. These rheostats are of the baseboard-mounting type, and when once adjusted to suit the valves you are using they require no further alteration. A filament rheostat is essential for the first valve, because adjustment of the filament current of the Filadyne detector has to be made rather carefully for the best results. However, once you have chosen your Filadyne valve and set the rheostat, it can be left at that adjustment for good.

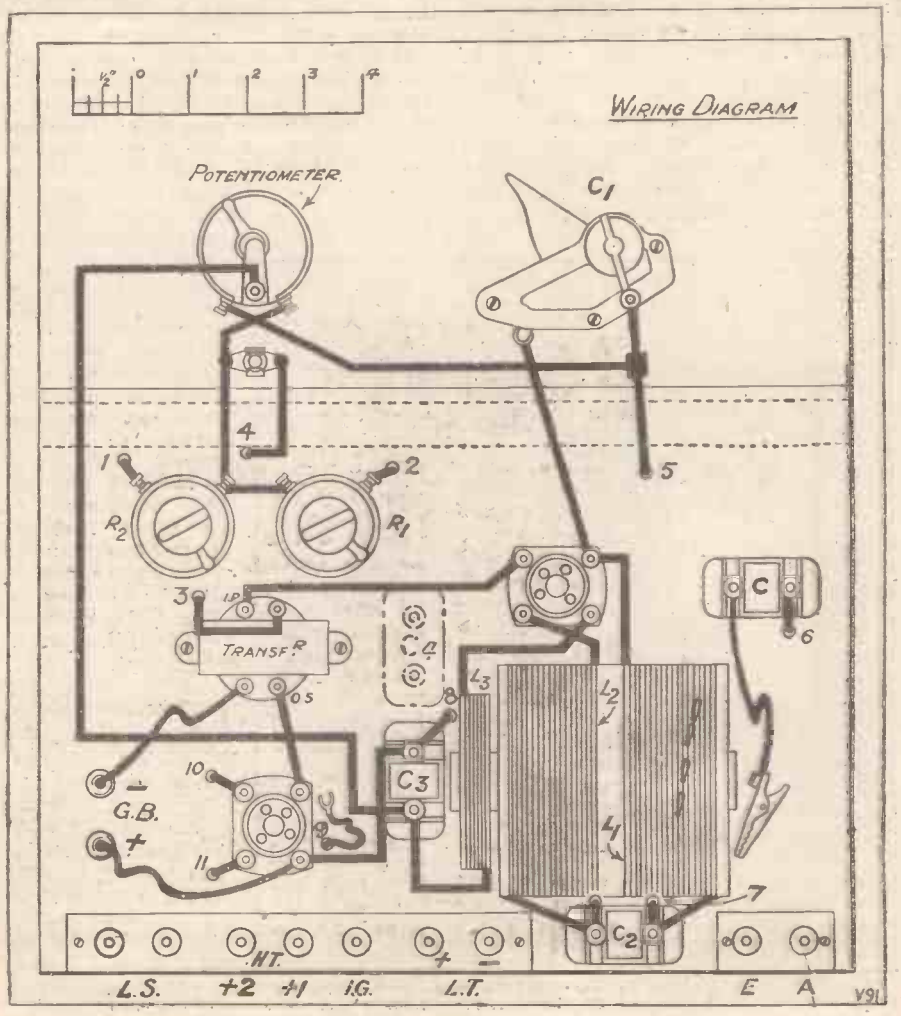
VALVE DETAILS.

VALVE.	Filament Volts.	RHEOSTAT SETTING. 2v. Accu.	4v. Accu.	H.T. Volts.
Dario Super H.F. Bi-volt.	·7	⅝	½ to ⅝	24/30
do. 4 volt.	1·6	⅜	Just on	18/24
D.E.2 L.F.	1·4	nearly full	½	30/36
D.E. 3	2·5	—	⅛	30/40

The Reaction Control.

When choosing the potentiometer the features to look for are a smooth movement of the contact arm and a wire-wound resistance of not more than 400 ohms. An easy running contact arm is essential for a silent and smooth control of reaction.

(Continued on next page).



THE 1929 "FILADYNE."

(Continued from previous page.)

The construction of the receiver is quite simple and straightforward, but there are one or two features calling for special mention. This is not a set where construction consists merely of assembling a collection of components and then wiring them up. The keen constructor likes something more exciting than this, and here he will find just that extra constructional work which is neither tedious nor superfluous.

Novel Construction.

The unorthodox Filadyne scheme surely deserves something new in the way of constructional ideas Accordingly I have avoided conventional construction wherever possible.

First of all we have the panel-baseboard assembly. Instead of the stereotyped ebonite panel screwed to a wooden baseboard, I have made up a panel of ¼-in. thick wood and framed it in a narrow moulding in the same way that glass is set in a picture frame. The photographs you see here cannot do justice to the novel and pleasing appearance of this type of panel, which is so easy and cheap to construct. It looks particularly well in a cabinet as the moulding avoids the monotony of the perfectly flat ebonite panel. You need not fear loss of efficiency because the panel is a wooden one. All the components mounted on it are at earth potential, so that there can be no H.F. losses or leakage. Of course, a standard ebonite panel can be used, if you prefer it, and it looks quite well if "picture framed" like the wooden panel. The moulding is secured to the wooden panel with small panel pins, and the help of a little glue or Seccotine. After a good sand-papering, it can be stained and polished.

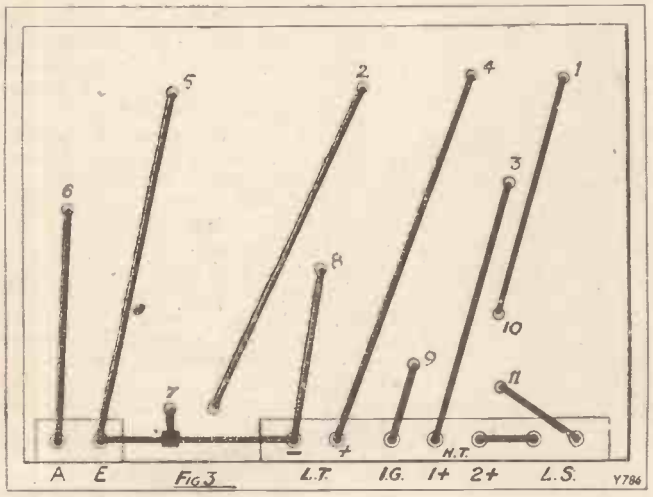


FIG. 3

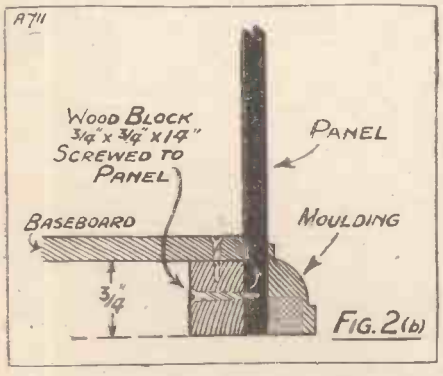


FIG. 2(b)

The wood panel is attached in a simple manner to the baseboard after drilling, as shown in Fig. 2b, the baseboard being another of ¼-in. thick wood supported at each end on battens. This allows for under-baseboard wiring which is convenient in any type of set. The panel drilling points are shown in Fig. 2a. The ebonite terminal strips are screwed down to the baseboard after cutting out pieces of wood slightly smaller than the strips.

You will not require much advice on mounting components and wiring up the set, but I would recommend you to leave out the coils until everything else has been done, so the necessary details of winding, etc., will be left for the moment.

If you follow closely the under-baseboard wiring diagram of Fig. 3, you can use bare wire, as none of the leads crosses another. The wires are brought up through ⅛-in. diameter holes drilled through the baseboard, which can be done either before or after mounting components.

In the wiring diagram I have shown in dotted lines the position of the shunt condenser C_3, should you use a different transformer where this condenser is not sealed up inside it.

The final step in construction comprises the making and mounting of the coils which, from the photographs, may appear to be complicated Actually this part of the work is quite simple and straightforward.

First of all we have a 4 in. by 4 in. former of Paxolin, Pirtoid, etc., on which you will wind two sections, each of 50 turns of No. 24 D.C.C., both sections being wound in opposite directions with a space of ½ in. between them. One of these sections, the one wound in an anti-clockwise direction as seen from the end, is tapped at 5, 10, 15 and 20 turns, counting from the edge of the former. An easy way of making tappings is to tightly twist a loop about ½ in. long, and after winding, cut the loops, remove the insulation, twist up tightly and lightly solder. Now obtain a piece of 3-in. diameter cardboard or Paxolin tubing, ¾ in. long, and wind on 25 turns of No. 36 D.C.C. wire.

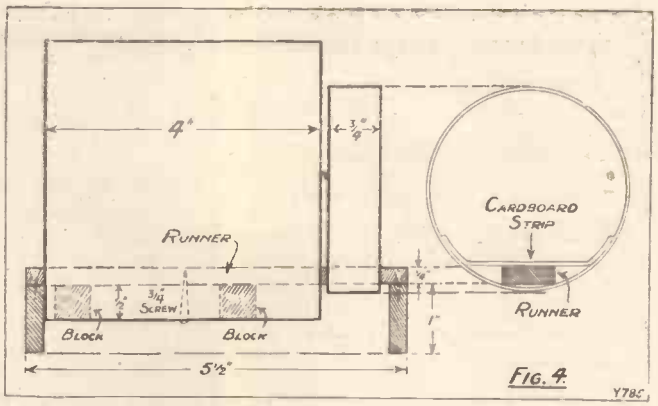
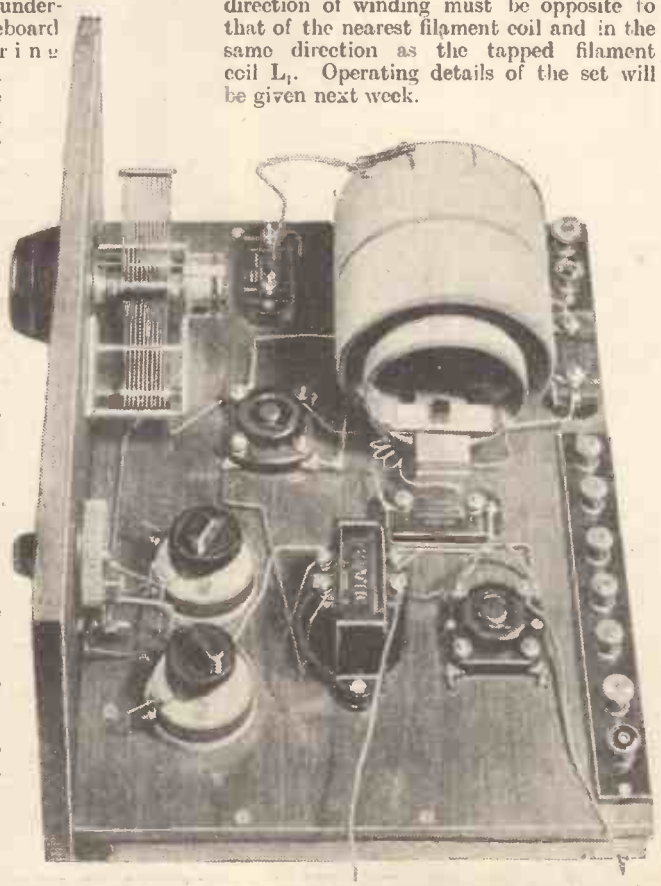


FIG. 4.

Mounting the Reaction.

We have now to mount the reaction coil so that its coupling with the filament coil can be varied. The necessary constructional details are shown in the diagram of Fig. 4. A ¾-in. screw secures the 4-in. former to a 5½-in. length of ¼-in. wood 1-in. wide, which forms a runner for the moving reaction coil. A piece of thin cardboard is glued inside the reaction coil former. When placing the reaction coil on the runner the direction of winding must be opposite to that of the nearest filament coil and in the same direction as the tapped filament coil L_1. Operating details of the set will be given next week.



Note the novel choke-tuner, with its simple and efficient reaction coupling adjustment. The reaction control is by a potentiometer and is unusually smooth.

LATEST BROADCASTING NEWS.

SAVOY HILL MOBILISES

GALE WARNINGS IN 1929—ANSERMET AGAIN—JIMMY WILDE AND BENNY'S BAND—SCOTTISH STUDENTS' BROADCAST—A WORTHY APPEAL.

Savoy Hill Mobilises.

THE passing of the old year witnessed a great revival of activity at Savoy Hill. This came as a considerable surprise in those circles which had encouraged the view that the B.B.C. had lost its accustomed resiliency in defence which pulled it through so many critical times up to twelve months ago.

As the rumours of attack developed into probabilities, circumspection increased, and the holidays saw no dulling of the edge of alertness. A storm is likely to burst; but it will do more good than harm to the B.B.C. Therefore, if it does good to the newspapers concerned, it will belong to that necessarily limited category which benefit the victors as well as the vanquished.

Gale Warnings in 1929.

By arrangement with the Admiralty the broadcasting of Gale Warnings in 1929 will take place at fixed hours, namely, 1 p.m., 4.45 and 6.15 p.m. on weekdays, and 3.30 p.m. on Sundays. The object is that mariners shall tune in at these hours which it is considered are most convenient for the purpose.

The arrangement has necessitated an adjustment in the broadcasting of the Greenwich Time Signal, which in future will be given at 1 p.m. from 5 X X (in place of Big Ben at that hour) and a new one at 4.45 p.m. which will precede the present 4 p.m. Time Signal. On Sundays the Time Signal will be broadcast at 3.30 instead of Big Ben being given as hitherto at 4 p.m.

Ansermet Again.

Ernest Ansermet, the distinguished Swiss conductor whose work is already known to British listeners, is to direct the first of the second half of this season's Symphony Concerts at Queen's Hall on Friday, January 18th.

The programme will include items by Linda Seymour, Kate Winter, Theresa Ambrose, Rispah Goodacre, and a section of the National Chorus. On the previous evening the Royal Philharmonic Society's Concert, conducted by Barbirolli, will be broadcast from the Queen's Hall.

Jimmy Wilde and Benny's Band.

Jimmy Wilde, who since his retirement from the ring has taken an interest in many other forms of entertainment—his name has been associated with three cinemas in South Wales—has recently taken over the Cardiff Palais de Danse at the Celtic Rooms.

Jimmy knows from experience something of the value of publicity, and when he installed Benny's Band as his musicians he realised that their reputation as one of the finest dance bands in the Principality could be calculated to attract the business. Cardiff Station is relaying its programme between 10.20 and 11 p.m. on Friday, January 18th, with an interval at 10.30 for items by the Welsh Miners' Quartet.

Scottish Students' Broadcast.

For an hour and a half on Monday evening, January 21st, Scottish stations will be under the (what some people might be inclined to consider) risky control of University students. There seems to be no special reason why the B.B.C. should hand over their studios to young men whose reputation, when let loose, is certainly on the lively side, but no doubt adequate assurances were forthcoming which eliminates any fear of overstepping the mark.

That being so, listeners can look forward with pleasure, rather than with trepidation, to a good entertainment, because it is fairly certain that the students of Glasgow, who are to have the first turn, will put up a show that will take a lot of coaching.

Edinburgh and Aberdeen students follow, and their spasms are not likely to fail in effort to put the first fellows in the shade. However, it will be for listeners to judge which of the three entertainments they like the best, and the three programmes will be broadcast from all stations in the Scottish group.

A CHAT ABOUT CUPS?

Sir Thomas Lipton, the famous sportsman and tea merchant, broadcasting from W J J D, the Chicago Station, during his recent visit to the States.

A Worthy Appeal.

It is difficult to recall among all the many hundreds of appeals for funds on behalf of charity which listeners have been asked to support during the last four years, one that possesses a story so brimful of British pluck and self-sacrifice as those will hear who listen to the Newcastle Station to-morrow (Sunday), January 13th.

It is another of those stirring stories of the gallant deeds of Bob Smith, coxswain of the lifeboat "Harry Vernon." "Bob" died last year with a record that must be outstanding, even in the annals of that distinguished but reticent class to which he belonged.

No doubt East Coast listeners will show their appreciation of the services of one of the most intrepid lifeboatmen who ever lived.

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

RECORD SPEED

REVOLUTIONS PER MINUTE—EARLY EXPERIMENTS—LENGTH OF RECORD, ETC., ETC.

Record Speed.

I AM often asked by readers why it is that a gramophone record runs at a speed of about 75 to 80 revolutions per minute, and why this particular speed was chosen.

You will realise that once any arbitrary speed has been standardised by record manufacturers, it becomes a very difficult matter to get away from that practice, since a gramophone must be made to play any type of record. Therefore, there is little likelihood of the speed at present adopted being seriously departed from.

Early Experiments.

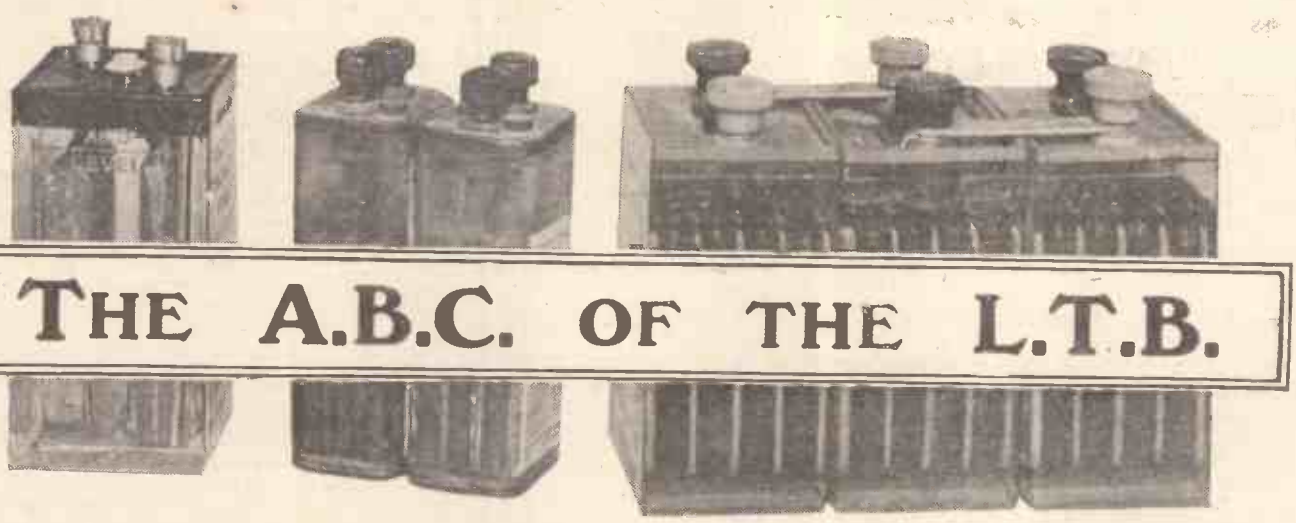
As to the reasons why this speed was adopted, it would take a long time to discuss the various considerations which enter into the question; indeed, it has been asserted by some experts that there is really no particular reason at all for a speed of about 80 revolutions per minute and that the speed was arrived at more or less by accident.

I can tell you that this speed was *not* arrived at by accident, but was the result of many experiments undertaken in the early days of the gramophone, although that is not to say that, with new conditions and with the many improvements which have been made in the recording and duplication of gramophone records, some different speed might not give just as good, if not better, results.

Length of Record.

That the actual linear speed (that is, the speed with which the record moves under the needle point) may be varied within wide limits is shown by the fact that the actual linear speed at the edge of the record is roughly two to three times as great

(*Continued on page* 986.)



THE A.B.C. OF THE L.T.B.

Every listener knows that it is advisable to keep on good terms with the accumulator—for if you "upset" it the carpet suffers. This article tells of the many little practical points that it pays to watch if you desire to get maximum service from your Low-Tension Battery.

By P. R. BIRD.

THE first accumulator or storage battery was produced by a Frenchman named Plante about seventy years ago, Like the modern accumulator, it consisted of sheets of lead, separated from one another but submerged in acid.

Plante used sulphuric acid, and he found that if the cell were connected to a source of electrical pressure and charged, certain chemical changes took place inside it. Plante found also that when disconnected and stood aside. the cell's new chemical composition was retained for days, or even weeks, yet when the cell was connected to a suitable circuit the chemical changes began to reverse again, and go back to the normal state, and in doing so gave rise to an electric current like the one that was required in the first place to create those changes.

Input and Output.

Plante's cell, therefore, was the means by which electricity could be "accumulated" and stood aside conveniently until wanted. It was a practical and reasonably cheap method of storing electricity, and although the accumulator has been improved greatly during the seventy years of its existence, it remains in essentials very much the same.

A smear of "Vaseline" or other petroleum jelly will protect the terminals.

One of the great advantages of an L.T. accumulator is that it is a reasonably low-loss component. That is to say, the amount of electricity which it will give off after having been stood aside is nearly equal to the amount which was put into it. The convenience of being able to store electricity by means of an accumulator is so great that even if it gave back only a half or three-quarters of the energy put into it, it would be an extremely useful piece of apparatus. As a matter of fact a good accumulator will do far more than this, and generally about ninety per cent of the input is returnable as output.

When an accumulator has been newly charged, tests with a voltmeter will show that the electrical pressure (or difference of potential, or voltage) between its negative and positive plates appears to be about 2·5. After a time the electrolyte tends to settle down, and the voltage of the cell becomes about 2·1.

As the accumulator is discharged, the voltage across any pair of plates slowly falls, and the lower limit is reached when the voltmeter shows only a difference of only 1·8 volts across each cell. Fortunately, no matter what the *size* of a battery is, whether it be a large 80-actual-ampere hour, used for starting a motor-car, or a small 20-actual-ampere-hour cell for running a wireless set, the voltage for any given pair of plates behaves in the way stated above.

Voltage Variations.

Thus a 2-volt battery (one pair of positive and negative groups) will usually show a voltage between 2·1 and 1·8, according to whether it wants charging or not. A 4-volt battery (two groups of plates) will show double these figures (newly-charged 4·2, and 3·6 when run down), whilst a 6-volt battery, consisting of three groups of positive and of negative plates, will show treble these figures, i.e. a voltage of 6·3 down to about 5·4.

The voltage or difference of pressure between the plates is not the only method of knowing the condition of a battery. Equally good is the indication to be obtained from the liquid in the cell.

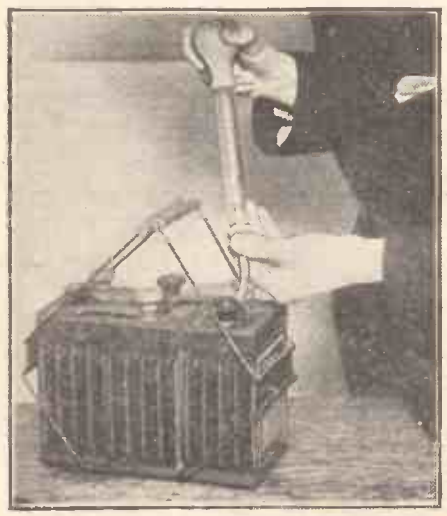
Cases are sometimes met with in which an obviously dud battery, quite useless for wireless work, will show a reasonably good voltage after discharge. At service stations and other places where the condition of the accumulator is a matter of the utmost importance, the voltmeter readings are always supported by hydrometer readings. (Hydrometers can be obtained quite cheaply from any electrical shop and every amateur who aims at keeping his L.T. battery in good condition should procure one.)

A Useful Check.

Instructions are given with the instrument, which will be found to consist of a kind of fountain-pen filler, which can be dipped into the liquid of each cell in turn, and which will draw up some of this liquid into a glass tube. Arranged in the tube are floats, generally of different colours, and the position of these indicates the condition of the battery.

There are generally three of these floats

(*Continued on next page*).



This illustration shows how the electrolyte is drawn up into the tube of the hydrometer, in which are floats that show the condition of the cell.

THE A.B.C. OF THE L.T.B.

(Continued from previous page.)

in the tube, one heavy, one medium, and one light. When the accumulator has been properly charged and is in good condition all three of these will float to the top of the liquid. About half-way through the discharge of the accumulator it will be

Testing the voltage of a battery by means of a voltmeter connected across its terminals. The most accurate reading is obtained after the set has been in use for an hour or so, and whilst the battery is still supplying current to the set.

found that the heavy float has sunk to the bottom of the liquid and the medium-weighted float is preparing to do so.

When the battery is run down even the light float will refuse to keep to the top of the liquid sucked up into the tube, thus showing that the battery is in need of re-charging. The hydrometer test is not an electrical one at all, but is a test of the "specific gravity" of the liquid. In other words, the hydrometer checks the chemical changes which are going on inside the cell.

The Two-fold Test.

The actual specific gravity of your accumulator will be found to vary a little with different makes, but as a rule a fully-charged battery will have a specific gravity of about 1·275. Such a battery is fully discharged when the gravity is about 1·150. An important point to notice about the specific gravity is that it is conveniently proportional to the condition of the battery so that when the battery is half charged the specific gravity will be half-way between the two figures mentioned above. (i.e. 1·210).

By using both the voltmeter and the hydrometer to check the condition of your accumulator you can be quite certain of keeping it in good condition. An old battery in which the active material has become very poor is quite capable of giving a misleading *voltmeter* reading, and an accumulator from which acid has been withdrawn or spilt is quite capable of giving a misleading *hydrometer* reading. But there is no accumulator fault which can mislead both the voltmeter and the hydrometer when they are used in conjunction, so that the use of both instruments (and they are both perfectly easy and simple to use) is a complete safeguard for the accumulator owner.

The maker's instructions regarding the charging and discharging of an accumulator should always be adhered to, for although a robust instrument, an accumulator will repay its owner for all the care that is taken with it. Remember that cleanliness is essential and the battery should not be allowed to become dirty or splashed, but should frequently be wiped over with a clean cloth.

Acid and Accidents.

The acid is harmful to all clothes, sore hands, etc., and nowadays everyone knows that it must be treated with the utmost circumspection and under no circumstances must it be allowed to come into contact with clothing, carpets, or anything of the kind, which it will quickly attack and in time destroy.

To prevent it attacking the terminals of the accumulator, these should be cleaned thoroughly with sandpaper or wiped over with a cloth dipped in strong soda water, and then they should be coated with petroleum jelly, a smear of which will afford complete and continual protection.

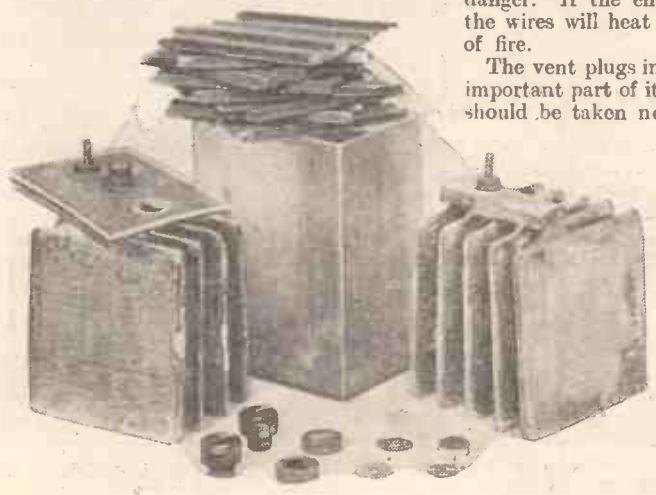
As an accumulator is sometimes handled by quite inexperienced people it should be noted that there is a right and a wrong way to unfasten its leads. You should *never undo the L.T. leads at the ends joined to the set.*

The proper, and indeed the only safe way to disconnect them is first to take them off the L.T. battery itself.

Disconnected L.T. leads which are joined at one end to the set are comparatively harmless. But leads disconnected from the set at one end and joined to the L.T. battery at the other end, are a source of danger. If the ends of such wires touch the wires will heat up, and there is danger of fire.

The vent plugs in an accumulator are an important part of its construction, and care should be taken not to lose these.

"ALL PRESENT AND CORRECT!"



Here are shown the various parts of an accumulator — containing case, lid, positive plates, negative plates, separators, lugs, etc. (Note that there are 5 negative (right) and 4 positive plates so that when assembled both sides of each positive faces a negative plate.)

The holes in the vent plugs should be kept open, and as gas escapes from these when the accumulator is being charged and when it is in use, it is dangerous to place a naked light near to them. The greatest enemy of the accumulator is sulphation, which is a form of chemical action that attacks the plates if they are not properly looked after.

Sulphation is sure to be troublesome if the accumulator is allowed to run down and then stand aside without being recharged. Consequently, always make a habit of returning the accumulator promptly to the charging station as soon as the voltmeter or hydrometer tells you that recharge is necessary.

Don't Shake It!

Remember, also, that an accumulator should not be shaken about more than is necessary. Constant charging and discharging is apt to loosen some of the active material on the positive plates of the cell, and if the cell is shaken this may come in contact with some of the negative plates. If so, it immediately sets up a little "battery" on its own and a form of local action commences which may in time completely ruin the accumulator.

Local action is one of the causes of over-sulphation, and in addition to the accumulator standing idle, which is another common cause, other sources of sulphation are under-charging, "running the cells

In time the acid level falls, owing to evaporation, gassing, etc. Fresh acid must not be added, but the loss should be made good by adding a little distilled water.

down too far," an internal short-circuit such as is caused by metallic impurities finding their way through the vent-plug holes, underfilling of the accumulator, or filling it with acid of the wrong specific gravity.

Level and Loss.

Finally, remember that the level of the acid in an accumulator should never be allowed to fall below the top of the plates, in fact, it always should be slightly above this, say half an inch or so. In time a certain amount of the electrolyte will be lost owing to evaporation, etc., and it will be necessary to add *distilled* water occasionally to make up for the loss. (The sulphuric acid does not evaporate, so, on no account should more acid be put into the cell, only distilled water, or otherwise the specific gravity will rise owing to the fresh acid added.)

The problem of communication between aircraft and aerodromes and other stations is being investigated very carefully. This article describes some of the steps that have already been taken to make air transport safe.

By EDWARD B. CRAFT.

THE present development of air transport is bringing out its need for adequate communication in much the same manner as the earlier development of railway operations disclosed for that industry the necessity of special communication services if speed and density of traffic were to be attained with safety. The electric telegraph, by a most fortunate coincidence, was available just at the time the railways required it; and as the demand for speed became pressing the telephone was perfected.

By another fortunate coincidence, radio appears to be available just at the time it is needed for communication with aircraft in flight. During the war, radio equipment of relatively crude design was installed in aircraft and proved of great utility. Since the war radio telegraphy for aircraft has been further developed by the naval and military services of most countries, but radio telephony has received less attention, probably because of the inherent difficulties and lack of a pressing demand.

Increasing Safety.

When surprises due to bad weather can be eliminated, the safety of air transport should compare favourably with that of other forms of transportation. By means of a suitable communication system weather reports from observers located along and near an airway can be collected; and it should be possible, therefore, to reduce materially the weather hazard of air transport.

On some airways communication between terminal landing fields or airports is now made by means of radio telegraph and on others by trunk telephone calls. Neither system is ideal for the purpose. An ideal system which is instantaneous and reliable repeats messages at all airports, is free from interference, takes up no radio routes, and furnishes a permanent record of all messages at all airports, is the telephone-typewriter service.

This makes possible the instantaneous transmission of communications between distant offices, and simultaneously provides each office and any desired intermediate stations with typewritten copies. This service has been used for a good many years by the principal Press associations in America and is now being extended rapidly to serve the needs of larger business organisations.

When an aviator leaves an airport he should be given information of the weather along the route ahead of him, and a forecast of the nature of probable changes during the time of his flight. If general weather conditions are settled, or if his flight is a short one, a forecast is entirely adequate. However, for long flights and at times of uncertain and threatening weather, it is important that the pilot be continuously advised by radio of the weather conditions he may encounter during his flight.

A special aeroplane equipped with radio-telephonic and other types of wireless apparatus. It is a veritable wireless laboratory.

In particular, storm warnings and reports of the visibility and landing conditions at the airport where he expects to land should be sent him. Weather and landing advice can be broadcast from each airport along the airway. Provision of radio transmitters at airports and receiving sets in the planes will make possible a simple one-way system of communication, and permit any number of planes in the air to be advised without confusion.

Experiments in America.

The perfection of facilities for communicating weather and landing information to planes in flight, which will enable them to operate with safety under relatively unfavourable meteorological conditions, will greatly stimulate the demand for improved aids to navigation. It seems to be established that under conditions of poor visibility, when landmarks are totally obscured and beacon lights are useless, flying requires some form of radio goniometry if the pilot is to find his way through.

A number of systems have been proposed for this purpose; evolution of the system which is most satisfactory will be a matter of time and will require close co-operation on the part of all factors in the industry.

In America the Bell Telephone Laboratories, at their radio station at Whippany, New Jersey have erected an experimental two-way radio-telephone system and radio beacon. In connection with this apparatus it utilises a Fairchild Cabin Monoplane with Pratt and Whitney "Wasp" engine. The plane has been carefully bonded and shielded and is equipped with radio field-measuring apparatus of the laboratories' design.

(Continued on next page.)

TESTING DRY BATTERIES.

What happens when an H.T. battery "runs down"? Some interesting and important facts are given in this article.

From A CORRESPONDENT.

THE factor which causes the voltage of a dry battery to fall, though this is not perhaps generally known, is rising internal resistance. In a new battery of good design and construction the internal resistance of the cells is very low indeed, being but a small fraction of an ohm apiece. As soon, however, as the battery is put into service two causes of deterioration set in.

In the first place polarisation to a greater or less extent occurs, owing to the formation of hydrogen bubbles about the positive carbon rod. These are dealt with by the depolariser of manganese dioxide, which gives up part of its oxygen to combine with hydrogen and form water.

A Second Cause.

This process brings us to the second cause of deterioration. The manganese dioxide within the sac or "dolly" which surrounds the carbon rod becomes gradually used up, and as it does so the resistance of the sac itself increases. There is no longer a perfectly free path through the cell, and the voltage falls in consequence.

It has been dinned into us for years now that the only proper instrument for taking H.T. voltages is a high-resistance moving-coil voltmeter. This advice is all very well up to a point. The higher the resistance of the meter, the truer will be the reading obtained of the E.M.F. of the battery, taking no account of its internal resistance.

But as the internal resistance rises, this type of voltmeter may give a rather false indication of the battery's condition so far as doing *work* is concerned. Remember that voltage merely corresponds with pressure in a steam boiler. A pressure of, say, forty pounds to the square inch can be generated in a tiny boiler, but the amount of steam that the boiler can deliver is too small to do any useful work. The battery has to deliver current, and if the internal resistance is high, it may be unable to give as much as we require from it.

Finding True Condition.

It is sound practice always to test a high-tension battery when it is under load, for then we obtain a reading which shows what we may call the true working E.M.F. Better still, if you have a high-resistance instrument, take a voltage reading first of all on open circuit, and then upon closed circuit. Should the resistance of the battery be high, there will be a big difference between the two.

A very convenient way of obtaining a rough idea of the battery's resistance is to arrange across the terminals of the voltmeter a resistance with a value of about 3,000 ohms capable of carrying a current up to 50 milliamperes, and so disposed that there is a switch enabling it to be thrown into circuit (that is, in parrallel with the voltmeter's coil) or out of circuit.

Take the reading first of all with the switch open, so that the resistance is out of circuit. Then close the switch and take the readings again, but do not leave the switch closed for more than just enough time to note the reading. The greater the difference between the two readings, the higher the internal resistance of the battery under test.

A good-quality battery in new condition should show a drop of not more than 2 to 3 per cent when the switch is closed; with a bad one, even when new, the drop may be quite considerable.

When the battery has been in use for some time the difference between the two readings will naturally increase. When it reaches from 10 to 15 per cent the battery may be regarded as having reached the limit of its useful life.

"Air and Ether."—Inspecting the radio transmitter and receiver installed in the aeroplane.

Another way of obtaining an approximate idea of the internal resistance of high-tension batteries is to make use not of a voltmeter, but of an ammeter.

The negative terminal of the ammeter is connected to the negative contact of the battery, and a lead with a bared end is fixed to the positive terminal of the instrument. One touches this bared end for an instant on the extreme positive contact of the battery, watching the meter pointer the while. The lower the resistance of the battery, the greater the number of amperes which will pass.

Extreme Care Required.

Generally speaking, a high-tension battery has developed too high an internal resistance by the time that it fails to pass about ·5 ampere. In the hands of an expert, the flash test is an exceedingly useful one, but it is not recommended to the beginner.

AIR AND ETHER.

(*Continued from previous page.*)

With this plane exact measurements can be made at various altitudes, under different weather conditions, of the efficiency of radio transmission from the Whippany transmitter. In addition, the plane carries radio transmitting and receiving sets of experimental design. It is, in fact, a flying radio laboratory in which the engineers may experiment under actual flying conditions.

The Jamming Problem.

A radio-telephone system with a sufficiently powerful transmitter and sufficiently sensitive receiver to give reliable communication for 100 miles will give fair communication for perhaps 200 miles, and its carrier-wave will interfere with reception for a much greater distance. To avoid interference due to the beating of carrier frequencies, airports within a few hundred miles of one another may be assigned to different frequency channels, but serious difficulty is at once apparent from a glance at the map of the National Airways.

Within 800 miles of Chicago, for example, there are over fifty terminal fields or airports. It would seem obviously impractical to assign the available telephone channels, of which the international agreement allows six, to cover the eastern and central United States without serious interference. By restricting power as much as possible and by other means yet to be devised, it may be found possible to assign the same wave-length to airports relatively nearer together. For the distribution of weather information only, however, the airways may well find insufficient the frequencies in the exclusive band, 315–350 kilocycles.

On certain main routes, air transport companies will eventually require two-way telephone despatching systems of their own to control plane movements. These systems will consist of radio stations situated at the various airports along the route and interconnected by suitable wire lines.

Short-Wave Tests.

The frequency channels required for such services cannot be found in the 315–350 kilocycles band which, as just indicated, is apparently inadequate for the public services of weather broadcasting from airports. Further channels in the short-wave region appear to be necessary.

In the short-wave region the Bell Telephone Laboratories have initiated an additional development project. In co-operation with the Boeing Air Transport Company, they have undertaken to make a survey of the airway between San Francisco and Chicago, and to develop a system of two-way telephony between planes in flight and terminal landing fields on this route.

The planes and landing fields will be equipped with experimental radio apparatus and a co-operative experiment will be conducted during the coming winter. From this work it is hoped to determine for an air transport company the requirements for a two-way radio-telephone service. The investigation should furnish invaluable data both for radio operation and aviation, and thus make available to commercial aviation the best possible communication service.

The FICTITIOUS FARAD

The Farad has long been regarded as a unit far too large for practical use. This article gives some startling facts concerning it which will be of interest to all amateurs.

By R. GOODE.

WHETHER it be true or otherwise that, according to a tale which has long gone the rounds, a certain radio tyro entered a wireless dealer's shop and calmly demanded a 2-farad condenser is, perhaps, beyond the present point. But it is certainly true that most of us have become so used to hearing the term "farad" that few individuals indeed take the trouble to realise exactly what a farad means.

The *farad* is, of course, the standard unit of electrical capacity. Its name originated as an expression of honour and appreciation of the mighty work done by Michael Faraday (1791–1867) in the development of electrical science, and especially the practical side of electro-technics. The term, in fact, serves to perpetuate the memory of the man more effectively than any material monument could do.

A ·001 mfd. variable condenser, of the old type, possessing 73 plates.

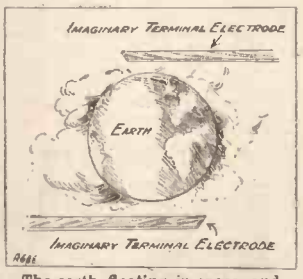
However, in many ways, the farad is quite a fictitious unit. It was originally defined as the capacity of a condenser which would hold a charge of one coulomb of electricity, and give rise to a difference of potential of one volt between the condenser terminals. But, one rather thinks, the idea of the farad was developed at a period at which electrical science was still in its earliest infancy, and during which time many theoretical considerations were imperfectly realised.

Consequently it is that the farad can now be shown to be a unit which is almost infinitely too big for all practical usage, no matter whether such usage be in radio technics, or in the older branches of electrical science.

Impossibly Large Apparatus.

Experimental considerations can be made to show that a 1-farad condenser would be an impossibly large piece of apparatus. Consequently, for practical usage, the farad has been divided up into millionths of a farad, each millionth being termed a *microfarad*. Thus, for instance, a condenser possessing a capacity of ·0005 microfarads has, in actual fact, a capacity of 1/2,000th of a microfarad.

Within more recent times still, however, it has been found that even the microfarad is apt to provo rather a large and unwieldy unit for fine electrical work. On this account, therefore, the *micro-microfarad* has come into use, one micro-microfarad being, of course, one millionth of a microfarad, or one million-millionth of a farad. However, for ordinary radio use, the microfarad alone seems to have retained its hold, the majority of such condensers being rated in decimals of a microfarad.



The earth floating in space, and acting as a spherical condenser of 720 mfd. capacity between two imaginary terminal electrodes.

But now let us deal with the farad itself in order that we may endeavour to obtain a true appreciation of its enormous magnitude as a unit of capacity.

Size is Relative.

Naturally, the size of anything depends to a great extent upon the way you regard it. So is it, if you really think of it, regarding the actual magnitude of the unit of capacity—the farad. If we think merely in microfarads, or in micro-microfarads, then naturally, the farad itself appears of an enormous size. On the other hand, if we got ourselves used to dealing in farads only, then the microfarad and micro-microfarad would appear almost indescribably small.

Contrasting the sizes of a 1-farad condenser and St. Paul's. The height of the condenser would be 790 feet.

Return, however, for a moment to the ·0005 microfarad condenser which we talked about a moment or two ago. This, as we saw, has a capacity of 1/2,000th of a microfarad. Therefore, it would take no less than 2,000 of these condensers to provide one microfarad of capacity. Still further, the astounding number of 2,000,000,000 of these ·0005 mfd. condensers would have to be combined to make up 1 farad of capacity.

Capacity of the Earth.

Every sphere or spheroid which can hold an electric charge possesses its own capacity. The capacity of even large spheres is only very small. But, taking the whole earth itself as a sphere of perfectly conducting material, it has been worked out that its capacity would be about 72/100,000ths of a farad, or approximately 720 microfarads; that is to say, the total capacity of about 360 commercial 2 mfd. condensers! Strange, but true enough, so enormously great is the farad itself.

Suppose, again, that some enthusiastic experimenter set out to build himself a 1 farad variable condenser, and that he was able to obtain the plates of an area approximately equal to the ground space of St. Paul's Cathedral. In such an instance, about 117,000 of these plates would be required, and if they were of ordinary condenser-plate thickness and were spaced about 1/25th of an inch apart, the total height of the condenser would work out at approximately 790 feet—without, of course, taking into consideration the enormously thick and strong end-plates, and the various other fittings which would be required for the erection of such an instrument.

Michael Faraday, the founder of present-day electrical science, in whose honour the unit of capacity has been named.

Now, the top of St. Paul's Cathedral is given as being 356 feet above the ground, so that the 1-farad condenser of our millionaire radio enthusiast would tower into the air more than double the height of St. Paul's! Such a condenser would hold a charge of 1 coulomb of electricity (1 coulomb being the quantity of electricity conveyed by a current of 1 ampere in 1 second), and it would possess a terminal difference of potential of 1 volt.

THE NEW WAVE-LENGTHS.

A review of the re-shuffle of stations which the B.B.C. is bringing into operation on Sunday, January 13th.

By THE EDITOR.

THE B.B.C.'s decision to alter the wave-lengths of their stations comes at an opportune moment, for undoubtedly interference, instead of improving, has been growing worse. The B.B.C. have, as they point out, a definite policy for combating the interference problem, and that may be shortly enumerated as follows:

1. To discover by every possible means a general agreement as to the allocation of wave-lengths between all broadcasting authorities responsible for working stations in Europe.
2. To organise the British broadcasting system in a way which will give satisfaction to the greatest number of listeners.
3. To make the maximum use of the present facilities available.

Work Badly Hampered.

As is well known, the work of the Unione Internationale de Radiophonie has been considerably hampered by the fact that certain careless radio authorities on the Continent have not adhered to the wave-length agreement worked out by the Unione, and although much has been done in clearing up the recalcitrant stations—some of the Spanish ones being the worst offenders—much still remains to be done in order to bring all the European stations into line, and to enforce a strict observance of wave-length regulations.

Until this is really accomplished, it will be impossible to guarantee the safe and sound working of the Unione's wave-length plan. It will be remembered that in March, 1926, a plan was submitted to the Council of the Unione, called the Plan de Genève. This plan was agreed to by over eighty per cent of the stations in Europe.

Although the Plan exists to-day, it must be remembered that a good many new stations have cropped up since 1926, and consequently the plan is not working as well as it might. In fact, it is a little out of date.

Consequently, a new plan, based on the old, has become necessary, especially when the Governments' Wireless Conference at Washington reduced the total number of wave-lengths for broadcasting, despite the fact that new stations were growing up, and that new broadcasting authorities demanded better service as regards wave-lengths than they had been given in the original Plan de Genève.

The New Scheme.

This new plan has at last been evolved, and has been given the title of the Plan de Bruxelles. This plan has been worked out as a means of obtaining an amicable adjustment of station wave-lengths for the benefit of all, but owing to the new stations existing to-day, the limitation of wave-lengths necessarily imply a sacrifice from all those broadcasting authorities which were unduly favoured in the old Plan de Genève.

This country, among others, has had to give up some wave-lengths. The B.B.C.'s sacrifice, in order to make the plan workable, has been to exchange a wave-length of 353 metres for one of 243·9. The full details have been already given in the "Radio Times," and it is unnecessary to recapitulate them here, except to point out that the new plan will be put into execution on January 13th, 1929.

Required Immediately.

The B.B.C. point out that longer notice of the change in wave-lengths could not be given, as the situation is so serious that it is imperative to get the alterations made as soon as possible. Captain Eckersley rightly states that the B.B.C., realising the possibilities of the international broadcasting

MILLIONS OF VOLTS!

This American engineer has succeeded in taking a record of a lightning flash in detail which can be analysed at leisure. It shows prodigious pressures!

situation, prepared proposals over three years ago to meet such difficulties in the future.

These proposals became known as the Regional Scheme, but delay and delay and delay was encountered, so much so, in fact, that interference got the upper hand and, as Captain Eckersley points out, is an evil now very aggravated. Had a start on the Regional Scheme been made earlier, and had there been less red tape and dilly-dallying at the Post Office, probably the seriousness of the situation to-day would not have been so accentuated.

Captain Eckersley also points out in his article that Germany is in a much better position than we, and thus gains the reward of foresight because of ability to act upon a situation much quicker than we do. In short, the Regional Scheme for this country is two years late.

However, we hope this Plan de Bruxelles will help clear up a situation which has become of late almost impossible, and we sincerely hope that the B.B.C.'s difficulties in connection with the Regional Scheme will quickly be swept away and that the whole plan will go forward to a triumphant conclusion.

We published the new revised wave-lengths in our issue for January 5th, but we are again reproducing them in this week's issue of POPULAR WIRELESS for the benefit of those readers who did not fully note them in our previous issue.

Will Not Affect Sets.

The changes in the British wave-lengths are not very great. In fact, in certain instances, the new wave-lengths show a difference of only a few metres from the old wave-length. For example, the London station, which has been working hitherto on a wave-length of 361·4 metres will, in future, work upon one of 358 metres, and the consequent adjustment to receivers will be very small.

This change, of course, will in no way render obsolete existing receiving sets.

As the "Times" points out in an editorial on the question of the new wave-length changes, the new plan seems to have practically no disadvantages. In fact, the listener who is in the habit of tuning-in foreign stations should, as a result, find it easier to separate foreign stations and, in fact, easier altogether to pick them up and tune them in. Further, the introduction of the exclusive wave-length scheme for the Relay Stations will bring relief to some four or five million listeners, chiefly owners of crystal sets in the thickly populated areas where hitherto the most frequent cases of interference from European stations have been noted.

Offenders Not Punished.

It is to be hoped that the B.B.C.'s statement, that steps will be taken to ensure that the wave-lengths adopted are strictly maintained by the various stations concerned in order to put an end to the interference nuisance, will be borne out in practice. But the Unione Internationale de Radiophonie, although a kind of wireless police-station, as the "Times" describes it, is not given any definite authority for punishing offenders.

The most the Unione seems to be able to do is to draw the attention of offenders to their misdemeanours, but it would be a great help if some method of punishment could be evolved, whereby careless foreign stations breaking the agreement could be brought to book, and made to realise the error of their ways. It is not much good having a policeman unless there is a magistrate before whom to haul the offender.

The New Wave-lengths.

Kilohertz.	*Metres.*	*Station.*
192	1,562·5	Daventry 5 X X.
622	482·3	„ 5 G B.
748	401·1	Glasgow.
793	378·3	Manchester.
838	358	London.
928	323·2	Cardiff.
964	311·2	Aberdeen.
991	302·7	Belfast.
1,040	288·5	Relays and Bournemouth.
1,230	243·9	Newcastle.

N.B.—These changes come into operation on Sunday, January 13th.

TRANSATLANTIC TELEPHONY—A WARNING.

The Editor, POPULAR WIRELESS.

Sir,—The Postmaster-General's attention has been called to your issue of the 22nd December, page 836 of which contains several letters from correspondents concerning their interception of Transatlantic telephony, and he directs me to point out that the deliberate interception of such messages is contrary to condition (1) of wireless receiving licences (and a corresponding condition in experimental licences) which reads as follows:

1. The Licensee shall not allow the station to be used for any purpose other than that of receiving in the premises occupied by the Licensee broadcast programmes and messages sent for general reception and messages sent from an experimental station in connection with experiments carried out by the Licensee.

If a licensee in the course of his wireless reception happens to intercept a private message, he is specifically forbidden to divulge it or allow it to be divulged to any unauthorised person. The relative condition of the licence reads as follows:

4. The Licensee shall not divulge or allow to be divulged to any person (other than a duly authorised officer of His Majesty's Government or a competent legal tribunal) or make any use whatsoever of any message received by means of the station other than broadcast matter sent out for general reception, and messages sent from an experimental station in connection with experiments carried out by the Licensee.

As it seems possible that there may be some misapprehension in regard to the interception or divulging of private messages which are being transmitted by wireless telegraph or wireless telephone services, the Postmaster-General would be much obliged if you would be good enough to draw attention in your Journal to the licence conditions quoted above.

I am, Sir,
Your Obedient Servant,
F. W. PHILLIPS.

General Post Office, London.

THE TRANSATLANTIC TELEPHONE.

The Editor, POPULAR WIRELESS.

Dear Sir,—I should like to confirm Mr. Collins' statement that the U.S.A. end of the transatlantic telephone service can be received in this country at quite good strength.

I use the "Sydney" Two short-wave receiver, and do not need to make it oscillate, and the wave-length appears to be more than 22 metres, as the variable condenser reading is 85 degrees.

Herts. E. J.

Ed. Note:—The attention of E.J. and other readers interested in this subject is drawn to the above letter from the G.P.O.

A WATER-PIPE WARNING.

The Editor, POPULAR WIRELESS.

Dear Sir,—Having been a regular reader of POPULAR WIRELESS for some years, I wondered if you would be interested in the following experience.

Some friends of mine wishing to improve reception, thought of trying another earth connection. Having bought an earth tube they proceeded to hammer it in the ground, when they unfortunately picked the spot where the water main happened to be with the result that the water for five houses had to be turned off for twelve hours or so.

Perhaps you could publish a warning about ascertaining first where the water-pipe runs.

I remain,
Yours faithfully,
Leamington Spa. CYRIL LANGLEY.

CORRESPONDENCE.

TRANSATLANTIC TELEPHONY

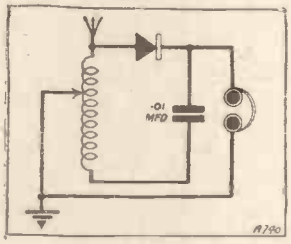
A WATER-PIPE WARNING A CRYSTAL SET IMPROVEMENT.

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 CRYSTAL-SET IMPROVEMENT.

The Editor, POPULAR WIRELESS.

Dear Sir,—Although I use a three-valve set, I often amuse myself tinkering about with a crystal for the amusement of my boy: and, quite incidentally I seem to have hit upon a way of improving to a very great extent the simple crystal circuit. It is this: Shunt a condenser (about ·01) across the free end of the coil and the 'phone side of the crystal. The difference this made in both the volume and quality of a simple little set I recently made for my boy wants hearing to be appreciated.



Yours truly,
Kennington Cross, S.E.11. E. V.

"FREE GRID BIAS?"

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to the article under the above heading in your issue for December 15th, I would like to suggest that the arrangement of obtaining grid bias by means of a resistance connected in the H.T. negative lead is fundamentally bad, and, in fact, it can readily be shown that it introduces very serious back coupling.

Whether this back coupling produces serious audible distortion depends on the excellence or otherwise of the amplifier used. The effect of a high internal resistance in an H.T. battery is well known, namely, by the production of "whistles" and the generally poor reproduction, which, of course, is caused by feed-back from the output valve due to the alternating voltage generated across the battery by the flow of the alternating-current signal through it. The addition of a 1,000 ohms resistance in the negative lead is precisely the same as having a battery of 1,000 ohms internal resistance, and when one's battery has that resistance it is in a very bad way.

The writer has observed that when using an H.T accumulator the addition of a resistance of even 200 in the negative end of the battery as indicated, cuts down the amplification and generally spoils the reproduction. The fact that there is a by-pass condenser of 2 mfd. or even 4 mfd. across the resistance is of little use, as a 4-mfd.condenser has a resistance of 400 ohms at 50 cycles and 800 ohms at 25 cycles, and consequently if one is using good amplifying devices serious distortion may result.

In conclusion, I would suggest that it cannot be emphasised too strongly that one of the first requirements of a good receiver is that it shall have a separate H.T. tapping for each valve and a separate 2-mfd. by-pass condenser from each H.T. tapping to the H.T. negative, as by this means only can one ensure the relative absence of back coupling in good amplifiers.

Yours faithfully,
Manchester. J. BAGGS.

MR. ALLINSON'S REPLY.

The Editor, POPULAR WIRELESS.

Dear Sir,—In answer to your letter of December 18th, re the attached letter, I would like to point out that the method of obtaining grid bias that I described is used in many commercial receivers and in the amplifier included in the B.T.H. Rice-Kellogg loud speaker.

As regards its effect on quality, even when shunted by a large fixed condenser on the lower frequencies where the impedance of the condenser will be highest, there is little or no tendency for feed-back to produce undesirable effects. Low-frequency oscillation due to battery resistance is usually at a fairly high frequency.

Further, if a common resistance will produce L.F. feed-back, it will not reduce amplification, but the reverse, although it may spoil reproduction by producing a peak in the voltage-frequency amplification characteristic. I have used the method described in an amplifier designed for use with, and actually employed in conjunction with a moving-coil loud speaker without impairing the quality. In the case in question the total plate current was very high, and a resistance of only 400 ohms was required to get the correct value of bias.

In any case the article describes an idea that is actually used in practice as stated above, while though it may not be suitable for use in all cases, it nevertheless has definite scope and has been proved to be useful and practicable when used under the correct conditions.

Yours faithfully,
C. P. ALLINSON.
A.M.I.E.E., A.M.I.R.E., F.Inst. P.Inc.

N.W.S.

SHORT-WAVE NOTES.

By W. L. S.

IF the number and variety of forms of wishing one "A Happy Christmas" are any indication of the amount of actual happiness one receives, then the lot of the amateur transmitter is indeed a happy one! Year after year he notices by about the 15th of December that foreign amateurs become strangely voluble at the end of their transmissions, and many are the strange forms in which their good wishes are put. Truly the English language needs some learning before one can use the idioms with any safety.

Two French amateurs wished me a "Prosperous Christmas and a Merry New Year," and one even wished me a "Convivial Feast"! And I should have a lifetime of happy years before me if the "Happy 1929, o.m." received from everyone were all to be added up.

The New Call Signs.

This being so, I cannot do better than wish a very Happy New Year to all my readers. May your valves never die and threshold howl never cross your threshold!

Little has yet been settled in connection with the new call-signs for the majority of European countries, but I should imagine that early in the new year they will all have received their official calls and the old unofficial "intermediates" will never more be heard on the air. The following groups of letters have already been definitely allotted and in most cases are already in use: C N, Morocco. C P, Bolivia. C T, Portugal. D, Germany. F, France and colonies. G, Great Britain. H B, Switzerland. I, Italy and colonies. J, Japan. K, U.S.A. (Outlying possessions). L A, Norway. O H, Finland. O K, Czecho-Slovakia. O N, Belgium. O Z, Denmark. R Y, Lithuania. S M, Sweden. S U, Egypt. U O, Austria. V E, Canada. V O, Newfoundland. W, U.S.A. Y I, Iraq. Z L, New Zealand.

If you bear in mind that the new scheme brings these two letters into force as an integral part of the call-sign and not as a prefix, you will not be confused between the old and the new rulings.

I often wonder why there is no American broadcast on 42 or 44 metres, particularly for the benefit of European listeners. True, 2 X A F's wave-length is quite suitable for "late-at-night" listening, but 2 X A D is a wash-out at this time of year, unless one is home very early in the evening. And then the "D X-itch" does not begin to irritate one until fairly late in the day. Listening to 2 X A D at 4.30 in cold blood is nothing like so exhilarating as straining one's ears after faint noises in the "wee sma' hours," and then suddenly running across 2 X A F's lusty voice.

Why Is It?

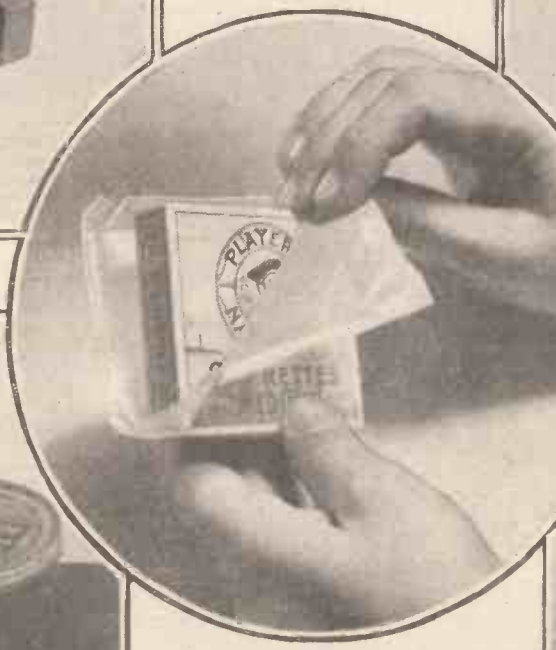
Why is it, too, that whenever I have a new set to test, conditions are invariably bad, and make me think the whole thing is a failure? Time after time I have decided that my latest short-waver is an absolute wash-out and found two or three nights later that there is nothing wrong with it? Further, I believe they change maliciously every fifteen minutes or so, because switching back to the original set seems to improve them again! Seriously, though, to be of any value at all, a test of a new short-waver should last for at least a week, so that one has a chance to judge its behaviour under all conditions.

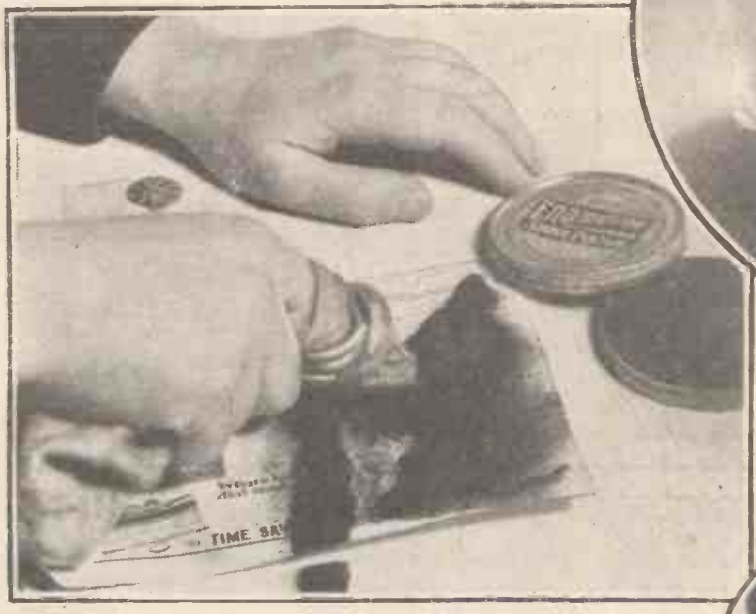
CONST

7/6d

Further Pictorial Details of the wonderful set described in "P.W." last week.

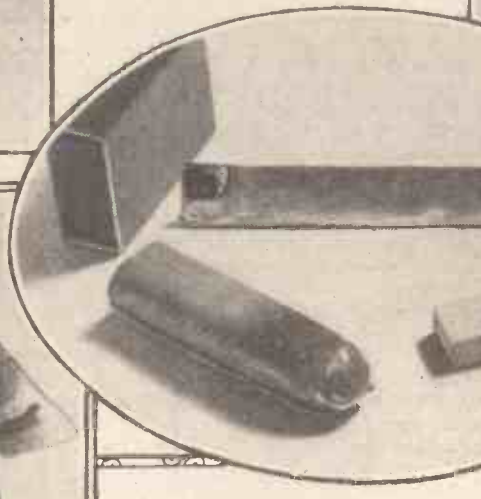
The weirdest collection of components ever seen!

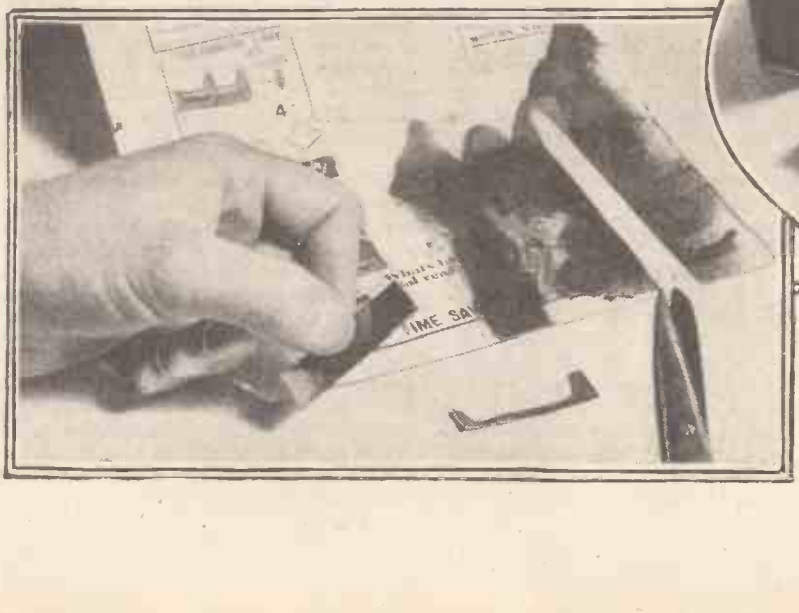




Above: Remove the wax paper very carefully to avoid the risk of tearing.

Left: Rubbing the stove polish on the paper for making the anode resistances and grid leaks.





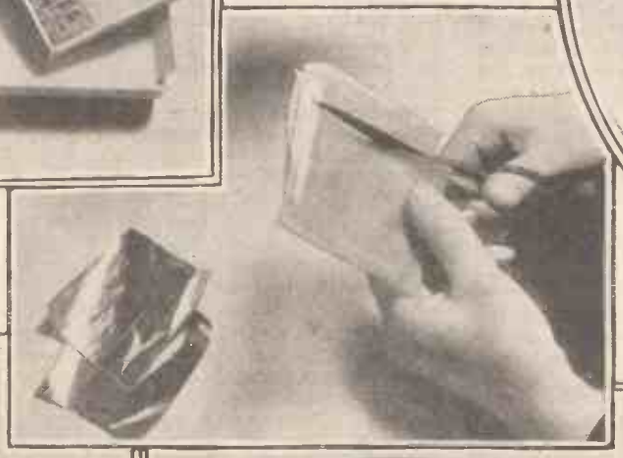
Left: An anode resistance (left) and a grid leak (close to the scissors). Above: The folded condenser ready for attachment by means of sealing wax to the wood strip. Right: Foil is used to make good contact at each end of the resistances and leaks.

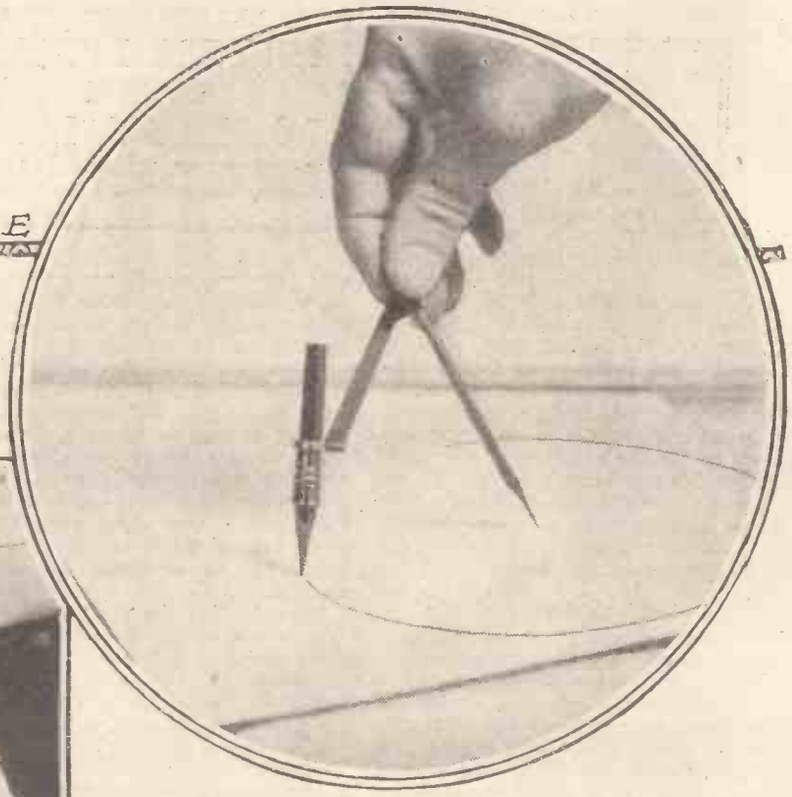
RUCTING THE THREE VALVER

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

Above: Empty out the cigarettes carefully in order to get at the tinfoil.

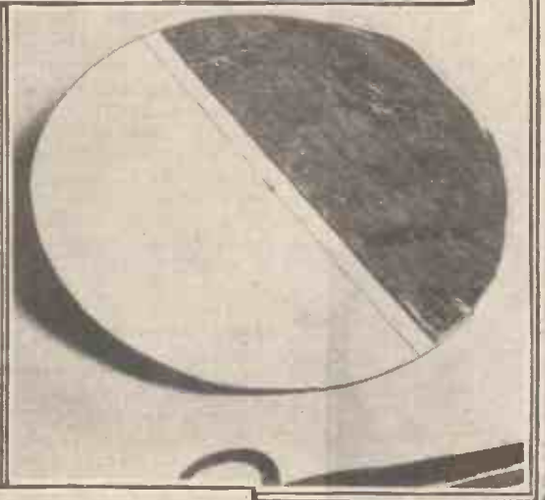
Below: The trimming of the wax paper for the coupling condensers and their subsequent assembly should be done with great care in order that no shorting shall occur.

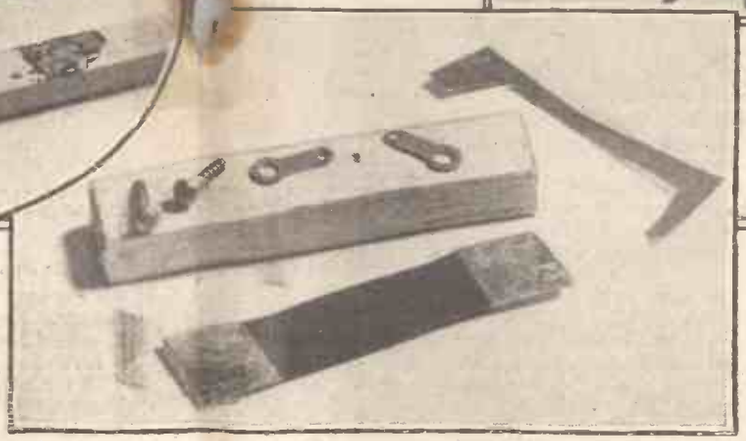




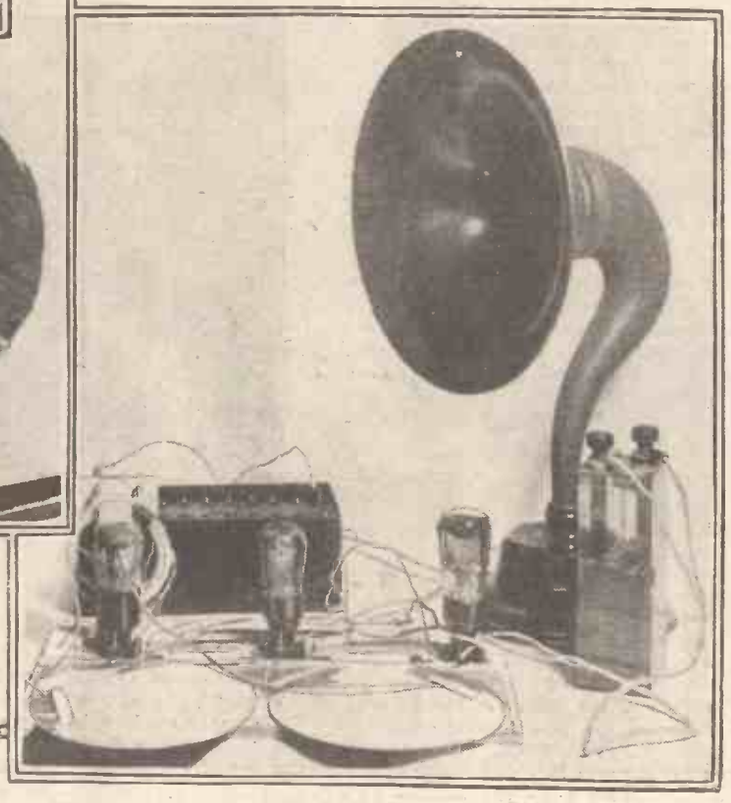
The first step in making the variable condensers is the scribing of the circles for the discs for the moving plates. Two discs are required, one for each condenser.

The "staggered" arrangement of the foil and paper in the coupling condensers is shown above.





Above: The tinfoil on one of the discs of the variable condensers ready to be pressed down.



Here is the completed receiver "ready for action." If ordinary care is taken the construction will be found to be quite easy, while the results are equal to those obtainable from some of the elaborate three-valvers which cost round about £10. It is a real loud-speaker set capable of extraordinary results.

Further constructional details concerning this set will be found on page 970.

FURTHER DETAILS OF THE 7/6 THREE-VALVER.

By PERCY W. HARRIS, M.I.R.E.
Editor, "The Wireless Constructor."

LAST week I told you how to make the two variable condensers (one for tuning and the other for reaction); together with other details. This week we will discuss the fixed condensers, anode resistances and grid leaks, and how to finish off the receiver so that it will be ready to work.

Look carefully at the photographs published last week, and you will see that there are two small pieces of wood, nearly touching, placed at the back of the baseboard. These carry the two anode resistances, and at their point of junction are joined to the H.T. battery. Between the first and the second, and between the second and third, valve holders, you will see two other pieces of wood. These carry the grid leaks, while between these and the variable condensers are what appear to be flattened rolls of paper. These are the coupling condensers. To the immediate left of the first valve holder you will see another piece of wood covered with white cardboard. This carries the grid condenser with its leak.

Grid Leak and Condenser.

To make the grid leak and condenser combination take a small piece of wood—the thickness does not matter much, but say a quarter of an inch—and cut out of it a piece 2 in. long by 1 in. wide. Next take a piece of thick cardboard and cut it to the same size, namely, 2 in. by 1 in., but cut away at each end a slot ½ in. wide by ½ in. deep so that the cardboard has an appearance something like the letter "H," but with a very wide cross-piece. Lay this piece of card aside for the time and take a strip of tinfoil ⅜ in. wide by about 3 in. long. Cut this in half so as to have two pieces ⅜ in. wide by 1½ in. long and put these aside also.

Next cut two pieces of waxpaper of the exact size of the "H" cardboard, another piece 1 in. by 1½ in., then take six small wood screws and two of the tin soldering lugs. Heat up your soldering iron and tin these lugs carefully, leaving a good blob of solder on each. These also can now be laid aside. Before we can proceed with the final assembly of the grid-leak and condenser combination we must make the grid leak, and as the method of making the grid leaks and anode resistances is practically the same, we will now prepare the necessary resistance materials for all.

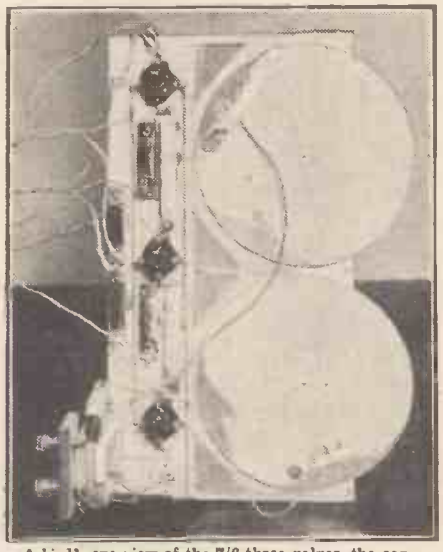
Making the Resistances.

This is done by taking a page of POPULAR WIRELESS—from a back number, or advertisement page you do not want—laying it carefully on a flat surface and covering it with a thin uniform rubbing of stove polish. The "Enameline" stove polish used for this purpose is a graphite preparation and a new threepenny tin should be purchased from your oil shop. When you open the tin (probably sticking your thumb into the polish in the process, as I did) you will find Enameline is a very smooth jet black paste. Before actually making the grid leak and anode resistance you should try a few experiments with it.

Take any old sheet of paper and a rag, and wrap two or three layers of the rag round the forefinger of your right hand. Now dip the end of the rag into the Enameline with a slight rubbing motion and rub the black mixture over the paper. Rub it very uniformly but firmly and aim at getting only just enough on the paper to make the paper jet black. You can easily put far too much on, and if you use too little the paper will look greyish and smeary.

Practice a little so that you can be sure of covering a piece of POPULAR WIRELESS paper with a perfectly uniform thin, black coating, neither too much nor too little. When you are sure of your ability in this direction take another piece of POPULAR WIRELESS paper and make a uniform black coating over about a third or half of a page. You can hold it up to a very strong light to see whether the coating is uniform.

Next, keeping the paper on a smooth, flat surface, rub it vigorously in two or three directions so as to spread the coating and burnish it. It will now shine quite brilliantly, just as will a stove when properly rubbed. You may wonder why I tell you to use POPULAR WIRELESS paper. There is a very good reason, as the paper has a particular texture and the sizes of the strips cut to give a particular resistance value depend upon the texture and how the polish is rubbed on. I could have used any kind of paper, but the strips would have been a different size for each kind of paper.



A bird's eye view of the 7/6 three-valver, the construction of which is fully illustrated on pages 968 and 969.

For the anode resistances cut two strips, 2½ in. long by ½ in. wide. For the grid leaks in the coupling units cut two strips of the same dimensions, but cut them away in the middle so that you have ½ in. wide ends, but only ¼ in. wide for a distance of 1¼ in. in the middle. For the grid leak on the grid-leak-and-condenser unit of the detector, cut a strip 2 in. long by ½ in. wide, and in fact make up the leak in exactly the same way as for the coupling leak, but only 2 in. long, and cut the middle strip thinner, between ⅛ in. and 1/16 in. wide for 1¼ in. While you are at it, it is just as well to cut several examples of each of these strips, so that you can try a few experiments later.

We will now return to the grid-leak-and-condenser combination for the detector. Take the grid leak, your three pieces of waxpaper, the two pieces of tinfoil, the piece of cardboard, and the screws and lugs. Now, with a sharp object, such as a bradawl, carefully make two small holes 1½ in. apart in the small block of wood so that you have a hole at each end, ¼ in. from the end and on a central line.

Careful Assembly Required.

Make these holes so that you can later screw the wood screws into the wood without splitting it. Now take your grid-leak, lay it on top of the wood, and press it firmly down with your finger so that you can feel in the grid-leak paper the positions of the holes beneath. Next pierce the paper carefully so that each hole comes exactly above the corresponding hole in the wood.

Now take the piece of waxpaper, measuring 1½ in by 1 in., and lay it centrally on the top of the grid leak, so that it occupies the full width of the wood, leaving ½ in. each end. Next take one of the pieces of tinfoil and place it along the centre line of the wood so that one end of the foil projects ⅛ in. beyond one end of the wood, when the other will, of course, come ⅛ in. from the other end. Next take the piece of waxpaper which is cut the same size and shape as the cardboard and lay this over the top, being careful in all these operations not to shift the pieces of paper already in position, and take the second piece of foil and lay it along the centre line in such a way that one end is flush, projects ⅛ in. from the *opposite* end of the wood, and the other comes ⅛ in. from the other end.

Now take the third piece of waxpaper which is also cut the same shape as the cardboard, lay this carefully on top and finally place the cardboard in position. With the finger held firmly on top of the cardboard make four holes on the four corners of the cardboard with a sharp instrument, and screw cardboard down with four screws. This grips everything.

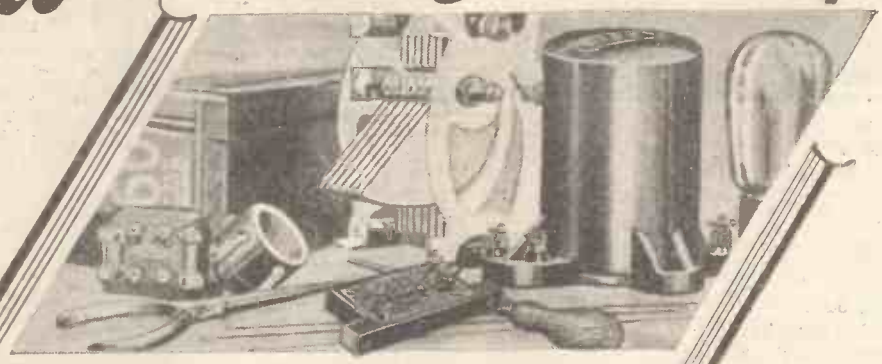
The Completed Component.

Next take the remaining two wood screws and the two soldering lugs and, after carefully "feeling" through the tinfoil for the holes beneath, make a small aperture through the foil, and then pass through each hole at each end a wood screw with a soldering lug beneath its head, and the tab of the soldering lug pointing outwards. Be very careful when you screw this into position, for you do not want the soldering lug to rotate, or it will tear the foil. The screws should be screwed down so as to hold the lugs firmly against the tinfoil. The final step is to melt some sealing wax, put a little on the baseboard and, while it is still hot and melted, press the grid leak and condenser combination firmly into position, as shown.

In this assembly we now have a small fixed condenser with waxed paper as a dielectric and across the condenser a grid leak. The method of contructing the anode resistances is much simpler.

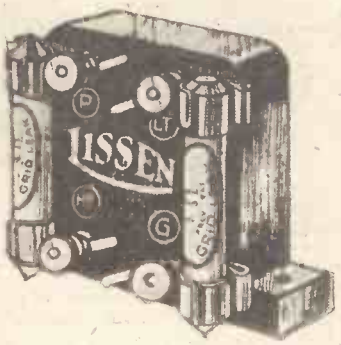
(*Continued on page* 980.)

Getting the parts together!



THE IMPORTANCE of UNIFORMITY

It is only natural that a circuit built entirely of Lissen parts will give better results than the same circuit built of mixed parts. Because, if you build with all Lissen parts you have a uniformly high standard of accuracy running throughout, you ensure closely matched values in the circuit with all the parts pulling together all the time. And because of this you will find that the receiver when built will retain its original selectivity and quality of reproduction throughout its life.



★Important CONDENSER VALUES

Particularly do the above remarks apply to condensers, where unvarying accuracy is of utmost importance.

LISSEN FIXED CONDENSERS

have become the standard fixed condensers in almost every published circuit. Accuracy to within 5 per cent of the stated capacity. ·0001 to ·001 mfd., each **1/-**

·002 to ·006 mfd., each 1/6.

LISSEN R.C.C. UNIT

It is of utmost importance in an R.C.C. unit that the condenser should be absolutely leakproof. If your condenser leaks in an R.C.C. unit you will lose volume. The Lissen condenser fitted to the Lissen R.C.C unit will never leak, never vary. It delivers all its stored up energy all the time. The resistances, too, are unchanging. Ea. **4/-**

LISSEN MANSBRIDGE TYPE CONDENSERS

Hermetically sealed in a non-conducting case, cannot be short-circuited on the case. Deliver all their stored-up energy and have the biggest margin of safety of any condenser made.

·01 to ·05	1/9
·1	1/9
·25	2/-
·5	2/3
1	2/6
2	3/6

LISSEN LIMITED

8-16 Friars Lane, Richmond, Surrey

Managing Director - - - Thos. N. Cole

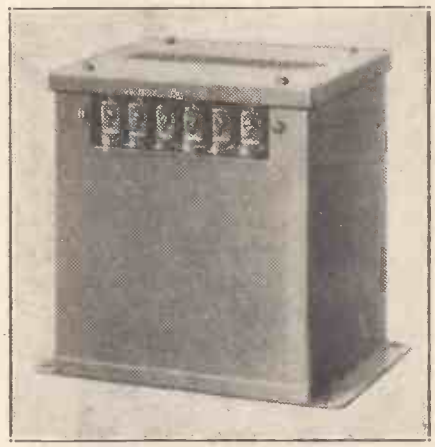
FROM THE TECHNICAL EDITOR'S NOTE BOOK

NEW GECOPHONE PRODUCTIONS.

QUITE a large parcel of apparatus was recently received from the G.E.C. people, the individual items being dealt with under the following separate headings.

H.T. Mains Unit.

The Gecophone high-tension power units are first-class productions, and are designed in accordance with electrical regulations. During the past year or so all too many mains units have made their appearance which do anything but that. The Gecophone



This is the Gecophone Condenser Bank (Catalogue B.C.1454).

units are contained in solid metal boxes, these being enamelled in black crystalline style.

The A.C. type embodies a full-wave valve rectifier (an Osram U.5). Three H.T. taps are provided, two being variable, the other being a maximum tapping for a power valve.

The unit can operate on any A.C. mains of voltages between 200 and 260, 40 to 100 cycles. At 25 milliamps the maximum output voltage is 180. Thus it will be seen that the unit can provide all the values of H.T. required on the normal kind of set, even including one employing S.G. and Pentode valves.

The variable tappings enable one to obtain smoothly and without noise a close adjustment between unusually wide limits. The price of this A.C. model is £9 10s. This might seem a lot of money; it is, in fact, a lot of money, but the unit is a first-class production, sound in design and construction from all points of view. On test we found it completely satisfactory, the voltage controls operating effectively as mentioned above, and the output being ample for the most powerful of ordinary receivers.

The direct-current type which is suitable for all D.C. mains provides for two output voltages, one of which is variable, the other being fixed to give the maximum voltage possible after smoothing. In its class this D.C. type is just as excellent a production as the A.C. variety. Its price is £6 10s.

L.F. Amplifying Choke Unit.

This Gecophone product is a compact assembly of all the essentials of a first-class low-frequency amplifier. There are three anti-microphonic valve holders and three fixed filament resistances of an interchangeable character mounted on the top panel of a stout metal container. Inside are four L.F. chokes and two fixed condensers arranged so that two valves are double-impedance coupled.

Dual impedance is very similar in diagram form to resistance-capacity coupling except that L.F. chokes replace the anode and grid resistances. It is not a particularly new idea, but is of late receiving more attention, and it certainly has advantages which merit this.

The Gecophone amplifying choke unit is nearly a complete 3-valve amplifier and to put it in use with, for instance, a gramophone pick-up, all that one needs to do is to connect a volume control and, if needed, transformer to its input. Experimenters and constructors should find it of considerable interest. With the proper valves and H.T. it provides three stages of amplification capable of providing a distortionless output suitable for anything from a small living room to a small hall. The price is £4.

A Condenser Bank.

This comprises in one compact assembly five fixed condensers ready wired up for insertion in a mains unit smoothing circuit. There is a 4-mfd. and two 2-mfds. which are provided for the normal smoothing circuit while the two 1-mfds. are embodied for use in connection with the potential dropping resistances in the output circuit in order to eliminate motor-boating.

All these condensers are, of course, of the high voltage-tested type, and the whole are built into one stout metal case. There are six soldering points mounted on a small insulating panel, the one being a common connection to all the condensers, the others representing the remaining free terminals. These points are clearly marked. The price of this condenser bank is £2 7s. 6d.

New Process H.T. Batteries.

The maker's brief description of these is as follows. ". . . these Gecophone H.T. Batteries are made of interchangeable units in two sizes, standard and super-capacity. The General Electric Co., Ltd., claim for these batteries robust construction, compactness, uniformity of discharge with silence in operation. In the standard size of cell two types are available, L.4900, a 66-volt battery, and L.4901, a 100-volt battery.

There is a 66-volter with extra large cells which is highly recommended for supplying H.T. to receivers having a super-power valve in the last stage.

It will be noticed that these batteries are described as "new process" and all we can say is that if the "new process" is markedly better than the one employed for the original Gecophone batteries then the new batteries will have extraordinarily long working lives. We remember a Gecophone H.T. battery which we placed in service some two years ago and which still had many useful volts in it at the end of twelve months.

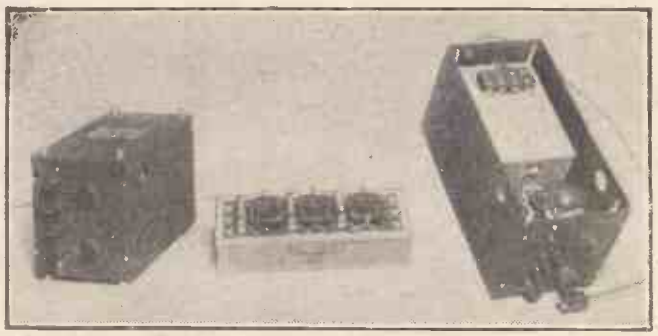
Traders and manufacturers are invited to submit radio sets, components and accessories to the "P.W." Technical Department for tests. All tests are carried out with strict impartiality under the personal supervision of the Technical Editor, and readers are asked to note that this weekly feature is intended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

Plaque Cone Type Loud Speaker.

The Gecophone plaque loud speaker is especially suitable for suspension from the picture rail. It employs a large balanced-armature driving unit mounted in a walnut frame. The cone diaphragm is of an artistic bronze colour. The price of this speaker is £3 17s. 6d. There is a junior plaque type at £1 12s. 6d.

Calvert's Mechanics' Almanack.

We have just received our 1929 edition of the above useful book. It is published by John Heywood, Ltd., at 6d., and consists of 192 pages of most interesting information relative to metals, mechanics, and general engineering. It is a book any radio experimenter would find of value.



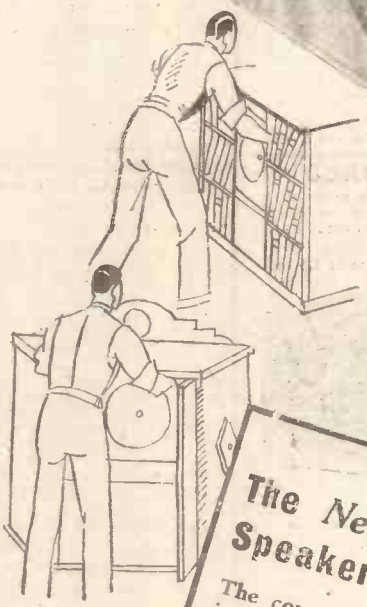
Two others of the Gecophone items dealt with on this page. Left and right, the A.C. H.T. Unit closed and open. Centre, the L.F. Amplifying Choke unit.

FOR ANY SETTING ANYWHERE

AMPLION

"LION" CHASSIS

SIMPLY a Speaker—a *New Amplion* devoid of outward show. The works — and nothing but the works. Think what you can do with this *New Amplion* in Chassis form . . . You have, perhaps, a piece of furniture into which this wonderful Speaker will fit? A corner cupboard, say—an old oak chest—a music case, a book case, a china cabinet . . . Glance round your home and probably some article will suggest itself . . . Perhaps there is some curtained shelf—some odd recess—for Amplion to fill . . . Or, maybe, you have some particular design in mind and either wish to make a cabinet yourself or have one made to suit your individual taste . . . Here, then, is the very thing—an inner Amplion, *the essential Amplion,* plain of appearance, certainly, but with all that astounding quality of reproduction to which the *New Amplion* owes its supremacy.



There is no limit to the many ways in which existing furniture can be utilised to accommodate the New Amplion Chassis. Here, for instance, is a book-case in which the Chassis will fit perfectly.

Or that old chiffonier, used nowadays for storage purposes? Why not remove the door, fix a neat curtain, and make a home for Amplion?

STANDARD CHASSIS

L.14 (14in. Cone). Height 17½ins. Width 17½ins. Depth 8¾ins. ... **£6 : 0 : 0**

POWER CHASSIS

L.18P (18in. Cone). Height 21½ins. Width 21½ins. Depth 10⅛ins. ... **£8 : 0 : 0**

The New Amplion Speaker complete

The complete Cabinet Models in the New Amplion range are obtainable in a wide variety of designs, at prices ranging from

£9 10 0

to

£42 0 0

Amplion Standard Speakers, Cone and Horn Types, 52/6 to £5. Junior Models, 35/- to £3 3 0.

Catalogue from all Radio Dealers or from Graham Amplion Limited.

LONDON: 25/26, Savile Row, W.1. MANCHESTER: 10, Whitworth Street West. GLASGOW: 6/8, West George St.

Works: SLOUGH.

RADIOTORIAL

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

The Editor will be pleased to consider articles and photographs dealing with all subjects appertaining to wireless work. The Editor cannot accept responsibility for manuscripts and photos. Every care will be taken to return MSS. not accepted for publication. A stamped and addressed envelope must be sent with every article. All inquiries concerning advertising rates, etc., to be addressed to the Sole Agents, Messrs. John H. Lile Ltd., 4, Ludgate Circus, London, E.C.4. The constructional articles which appear from time to time in this journal are the outcome of research and experimental work carried out with a view to improving the technique of wireless receivers. As much of the information given in the columns of this paper concerns the most recent developments in the radio world, some of the arrangements and specialities described may be the subject of Letters Patent, and the amateur and the trader would be well advised to obtain permission of the patentees to use the patents before doing so.

QUESTIONS AND ANSWERS.

"TWITCHING" NOISES AND RAIN.

A. T. H. (Chester).—"Can you tell me what is likely to be the cause of twitching noises, which only come in when there is rain or mist about? I have never been able to trace the cause of these noises, and they are not generally troublesome, but I have discovered that they are at their worst whenever it is wet or very damp and foggy. What could be the cause of that?"

Faulty insulation of the aerial-earth system is the likeliest cause of the trouble, for if you have any leaky insulators and you are using high H.T. (especially if this is taken from the electric-light mains) there will be a tendency for the high tension to leak away to earth over the poor insulation, thus giving rise to the noise complained of.

Not only the aerial insulators but all switch contacts, etc., should be examined, keeping a sharp lookout for any place where moisture is likely to settle and make a conductive path across the insulation. If an outdoor switch appears to give rise to the trouble, it is a good plan to give it a protective covering so as to keep it from the inclement weather, because, as you have noticed, noises of this sort are never troublesome when the insulation is dry.

CHANGING WAVE-LENGTH INTO FREQUENCY.

"KILOCYCLE" (Paddington, London, W.1).—"How is it possible to calculate wave-length if the frequency is given, and vice versa?"

If you divide the wave-length into 300,000 the answer will be the number of kilocycles, and similarly any number of kilocycles divided into 300,000 will give the corresponding wave-length.

A DUD VALVE HOLDER.

P. M. A. (Gravesend, Kent).—"The extra amplifying valve you recommended proved to be just what was needed, and I followed the diagram without the slightest difficulty.

"Being perfectly satisfied with results, I thought I would put the set and the extra valve into one big cabinet to smarten it up a bit. So I made up the set inside just as it was, and added the extra wiring for the amplifier alongside it, the whole being out of sight when the cabinet was closed. It looks fine, but now the amplifier will not work.

"All the parts and connections are as before, except a new valve holder for the amplifier to replace the old one, which I broke in removing. When using the set only it works like it used to, but on joining up the amplifier I cannot get anything at all from the loud speaker, not even the clicks as the H.T. is plugged in and out. The valve lights up all right.

"Do you think the new valve holder could cause this? It is quite a new one."

Yes, probably the valve holder is causing the trouble. It looks as though it had a disconnection inside. Possibly the socket for the plate of the leg of the valve is not making proper contact with its soldering tag or with the terminal to which it should be internally connected. You can easily check this by examination, or by the 'phones and dry cell test, as explained recently in these columns.

CURING HUM FROM AN ELIMINATOR.

B. M. B. (Chadwell Heath, Essex).—"My next-door neighbour always worked his set off the electric-light mains, and when he went away I decided to buy his eliminator, as he could not use it in the new district he was going to. I did not trouble to connect it up straight away, but left my own H.T. battery to run down first, so I have had it standing in a cupboard for two or three months.

"Last night I tried to get it going, but I found it gave out a loud hum. This I cannot understand, as my set is practically the same as his was, and of course I expected pure reception like my neighbour always had.

"As I do not understand much about this thing I have only tried to connect it up once, as per the enclosed test. What can I do to get it clear?"

Probably you had the unit connected up the wrong way round. Most D.C. mains units of this type have an unequal distribution of smoothing chokes, and sometimes all the smoothing is done on one of the mains,

(*Continued on page* 976.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page 974.*)

the other having no smoothing chokes at all. In these cases, if hum is experienced it is a good plan to try turning the whole unit round electrically.

All you have to do is to switch off the current at the mains and then turn the adaptor in the lamp socket half-way round, so running the current through to the eliminator in the reverse direction. The polarity of the eliminator's positive and negative plugs will have to be reversed to correspond, and you will then probably find that the hum has disappeared.

REACTION CONDENSER VALUES.

"CONSTRUCTOR" (High Wycombe, Bucks).—"I have a ·00025-variable on hand (in good condition), but the instructions give a ·0002 variable for reaction. Can I use a ·00025 mfd. instead of a ·0002 mfd.?"

If the set is an ordinary straightforward circuit there is no reason why you should not use a ·0002 mfd. as recommended. The only difference in operation will be that you may require slightly less reaction than would otherwise be the case, so you may have to take a few turns off the reaction coil.

CONDENSER OR FLIP-FLOP REACTION.

L. D. M. (Bakewell, Derbyshire).—"I notice that nowadays practically all the reaction schemes are condenser controlled, instead of by the moving coil as they used to be. What is the difference between these two kinds of reaction, and why is it that the flip-flop coil has gone out of fashion?"

The use of a moving coil for purposes of reaction has several disadvantages. With this type of reaction (which, by the way, is still widely used) energy from the plate circuit of a valve is fed back into the grid circuit by means of the variably coupled coils. But any change in the coupling of the grid and plate coils results not only in a change of the volume of sound due to the feed-back, but also an alteration in the frequency to which the set is tuned, i.e. this form of reaction has a marked effect upon *tuning*.

Moreover, it is often a matter of difficulty to get the reaction just below the oscillation point, and such a set in the hands of an unskilled user is liable to be a nuisance, quite contrary to the user's intentions.

In capacity-controlled reaction the relative positions of the two coils are fixed and remain stationary, the variation being made by means of the amount of current passing through the variable condenser. The capacity feed-back arrangement has the great advantage that it renders tuning very much simpler, for the reaction control affects only the volume of the reproduction and this for practical purposes, without effect upon the tuning, except on the very short waves.

A UNIT FOR AUSTRALIA.

S. R. (Mansfield, Notts).—"My father used to live near Larwood, the bowler (now in Australia), and he has got so excited about the Test matches, that he has asked me to make up the unit for getting Australia. I think it was called the 'Antipodes Adaptor.' I got the blue print ("P.W." 49), but it does not give the point-to-point connections in words, and as the print is now worse for wear, I should like these just to trace over for safety sake."

The connections of the "Antipodes Adaptor" will be as follows, when it is fitted up ready for action: Aerial to one side of the coupling coil. Other side of the coupling coil to earth, to the grid coil clip (via screen), to the variable tuning condenser C_1 and to the reaction condenser C_2 (moving vanes of both these condensers) and to the slider on the potentiometer.

The other side of the tuning condenser C_1 is connected to the remaining end of the grid coil and to the 3-megohm leak and ·0003 mfd. fixed condenser. The other sides of this grid leak and grid condenser are joined together and to the grid socket of the valve holder.

The plate socket of the valve holder is joined to one end of the H.F. choke and to one end of the reaction coil. The other end of the reaction coil is joined to the remaining side of the reaction condenser (fixed plates).

One filament socket of the valve holder is joined to one end of the potentiometer and also to the filament terminal on the valve socket. The other side of the valve holder filament is connected to the other side of the potentiometer and to the remaining filament socket of the valve plug.

(*Continued on page* 978.)

RADIOTORIAL QUESTIONS AND ANSWERS

(*Continued from page* 976.)

The grid socket on the valve plug is left vacant, but the plate socket is connected by a lead which goes to the remaining end of the H.F. choke, and this completes the wiring of the "Antipodes Adaptor."

ONE- AND TWO-VALVE BLUE-PRINT SET.

"BLUE-PRINT BILLY" (Seaford, Sussex).—"Will you please tell me the names and numbers of the one-valve and two-valve sets which are obtainable from POPULAR WIRELESS in blue-print form?"

The following blue prints are still in print, and can be obtained, price sixpence per blue print. *A stamped addressed envelope must be enclosed.*

No. 1. Straight Detector with Reaction.
No. 9. H.F. and Detector (Tuned Anode coupling with reaction on anode).
No. 10. H.F. and Detector (Transformer coupled with reaction).
No. 11. Detector and L.F. (with switch to cut out L.F. valve).
No. 21. The Two-Valve Lodge "N" Circuit.
No. 23. The One-Valve "Chitos."
No. 30. A "Reinartz" One-Valver.
No. 31. A Standard Two-Valver (Detector and L.F.). A simple and moderately selective Reinartz receiver for long-distance work on 'phones, and local reception on the loud speaker.
No. 34. An H.F. and Detector Two-Valver (Tuned Transformer, Neutralised). A simple receiver for long-distance headphone work.
No. 39. The "Sydney" Two. A simple and efficient short-wave set tuning from about 18 metres to 70 metres.
No. 41. This Year's "Chitos" One-Valver. A sensitive set for long-range headphone reception.
No. 47. The "Wave-Change" One. A neat little one-valver for headphone work, with good long-range capabilities. Covers upper and lower broadcast wave-bands without changing coils.
No. 50. The "Any Mains" Two. A compact detector and L.F. set for loud-speaker reception of the local station (and 5 G B in the south if the aerial is good), and 'phone work over greater distances. A complete H.T. battery eliminator unit is built into the set and the only external battery needed is the L.T. accumulator. Ordinary valves are used and are furnished with a constant supply of H.T., which never runs down and costs extremely little once installed.

H.F. FILAMENT AS VOLUME CONTROL.

L. E. (Lowestoft).—"I should like to know of a very inexpensive method of cutting down the volume. Would it be O.K. to dim the filaments of the H.F. valve?"

The method you suggest is not only easy and inexpensive, but in practice it gives very little, if any, distortion. We should place the volume control

rheostat in the negative lead of the two H.F. stages, and if you are using the ·1 amp. class of valve you will find that a resistance of about ten to twenty ohms is quite sufficient.

DETAILS OF FRAME AERIALS.

"RADIO" (Cardiff).—"I should like to try my hand at making one of those diamond-shaped frame aerials, but do not know how many turns are required. Can you tell me how much wire and what kind I should use for the ordinary broadcast wave-length?

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Causton

CONSTRUCTING THE 7/6 THREE-VALVER.

(*Continued from page 970*).

All we have to do here is to cut four pieces of wood ½ in. wide by 2½ in. long and to make preliminary holes in each end 1¾ in. apart. Now take each anode resistance strip, and round each end wrap a piece of tinfoil so that the exposed black portion of the strip is now 1½ in. long. Lay the strip with its tinfoil ends on a piece of wood and pass wood screws with soldering lugs into the holes already made, screwing them up tightly, but avoiding any twisting of the soldering lug likely to tear the tinfoil. The two anode resistances are mounted with sealing wax at the back of the board in the positions shown and with the soldering lugs in contact in the middle.

The Coupling Condensers.

The grid leaks are made in precisely the same way as the anode resistances, namely with tinfoil ends, leaving the strip exposed of 1½ in. long with soldering lugs attached here as before. These grid leaks are sealing-waxed to the baseboard adjacent to the grid terminals of the valve holders.

The final components we have to make are the two coupling condensers. For these we must take two pieces of foil of the full size of the wrapping, namely, 7 in. by 3⅛ in. By the way, if you are collecting the tinfoil off Players' cigarettes from your friends, tell them, when they get the packages, to remove the exterior wax paper very carefully by opening at the top without tearing, gradually unfolding and pulling the final joints apart.

If this is carefully done the wax paper can be removed without being torn, but a slight tear at the very edge will not matter much, as you will see in a moment. When they open the package tell them to pull the inside or sliding portion right out and unfold everything, so as not to spoil the tinfoil. The tissue between the foil and the cigarettes is lightly stuck along one edge, but this can be pulled away, without tearing the foil, quite easily.

Arranging the Plates.

Now take your sheet of tinfoil (of course, you can use any other foil of the same size just as well) and cut it exactly in half. This will give you two pieces 3½ in. by 3⅛ in. Flatten out your wax paper and carefully examine it. It will probably be torn slightly at one edge or the other.

If you have an untorn edge on the long side, all well and good. If not, trim off the torn portion so as to get a smooth long edge and lay one of the pieces of foil on top of the wax paper so that the tinfoil projects about ¼ in. over one long edge of the wax paper. At the opposite side, of course, there will be a space of paper. You can now trim off a strip of this paper so as to leave about ⅛ in. beyond the foil. Lift off the piece of foil and fold the wax paper in half so that the shorter edges are together.

Place the foil between the folds of the wax paper so that it projects ¼ in. as before at one edge and is just covered by the wax paper at the other. Now take the second piece of foil and lay it on top of the folded wax paper so that it projects beyond the foil ¼ in. *at the other end.* Now

(*Continued on page 982.*)

CONSTRUCTING THE 7/6 THREE-VALVER.

(*Continued from page 980.*)

fold up the assembly as shown in the photograph into a flat roll ½ in. wide, with tinfoil ends.

Next take two pieces of wood of the same size as those used for mounting the anode resistances and grid leaks, melt some sealing wax, drop it on to the middle of the wood, and while it is still melted press the condenser roll on to it. The roll will tend to spring open slightly at one edge but a further drop of sealing-wx in one of the folds will hold it securely. Sealing-wax the whole assembly to the baseboard as shown.

Making Efficient Contact.

There are two methods of making electrical contact with the ends of the condensers. One is to make a hole through the foil at each end and pass a metal screw with washers at each side and nuts, with soldering lugs. This requires delicate and careful work, otherwise you will tear the foil and this method is not recommended for the beginner.

The easier way is to take a piece of the electric-lighting flex, bare it completely, when you will get a number of fine, soft strands of wire. Scrape or rub these clean and wrap them round the foil, twisting the loop so made, so as to get good contact.

Do this lightly and you will not squash the foil too much. It does not matter if it is pressed together a little, but do not tear it. The strands of wire should be twisted together and made of sufficient length to reach the grid-soldering lug of the valve holder.

The rest of the work is quite simple. Cut two pieces of stiff wire of such a length that one will run from the soldering lug at the extreme left of the baseboard tinfoil assembly and will enable you to make a soldered contact with the three filament lugs of the valve holders. That will be the positive lead.

Completing the Wiring.

Cut another piece to join the three opposite filament lugs and this will be the negative lead. Now take a suitable length of twin electric-lighting flex (say 2 ft.) and untwist the two leads so that you can see which is which. Solder one wire to the positive filament lead and the other to the negative, and finish them off with ordinary positive and negative spade terminals so that you will be able to connect your battery. Take another 2-ft. length of flex fitted with positive and negative wander plugs, solder the lead joined to the negative wander plug to the negative filament lead, and the positive to one of the soldering lugs of the anode resistances where the two come together.

At this point solder a short length of wire so as to join these two soldering lugs. The positive H.T. lead will now be joined to each anode resistance. Now take three short lengths of single flex, say a foot long, finish with a red wander plug and solder this to the *negative* filament lead. This will be grid-bias positive.

Two other leads of the same length with black wander plugs should be soldered to the first and second of the coupling

(*Continued on page 981.*)

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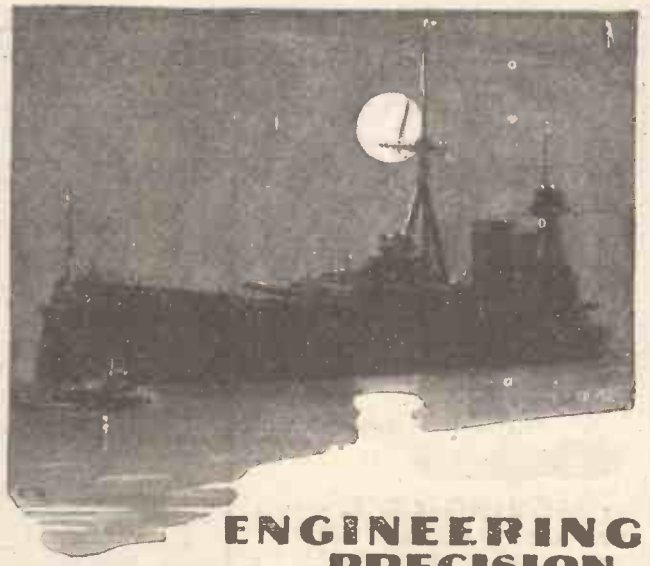
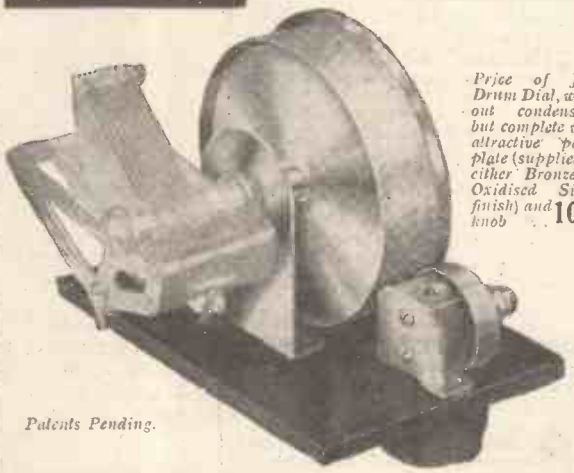


ENGINEERING PRECISION

ACCURACY is the beginning and the end of engineering. In constructing wireless instruments, no less than in constructing giant battle cruisers, not a slip must be made—either in design or execution. Absolute precision is a feature of J.B. instruments, their workmanship is exact in every detail and consequently they do exactly what they are designed to do.

The Drum Dial illustrated here is startlingly novel in design. It enables the Control Knob to be placed immediately below the scale, thus the scale may be brought flush with the panel and may be read with ease. A powerful and positive friction drive prevents backlash and slip. Vernier ratio 16-1.



Price of J.B. Drum Dial, without condensers, but complete with attractive panel plate (supplied in either Bronze or Oxidised Silver finish) and knob **10/6**

Patents Pending.

PRECISION INSTRUMENTS

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CONSTRUCTION OF THE 7/6 THREE-VALVER.

(*Continued from page 982.*)

grid leaks as shown. These will be grid-bias negative 1 and grid-bias negative 2. A single piece of flex will need to be taken from the grid coil to the variable condenser and another from the reaction coil to the variable condenser as shown in the diagram.

The ends of the flexible leads where they join the variable condensers are bared, spread into a fan shape and tucked underneath the cardboard strip so as to make a pressure contact with the upper surface of the tinfoil. Make these leads long enough so that they will reach at any position of the variable condensers. The rest of the wiring is quite simple, and is fully explained in last week's wiring diagram.

Loud-speaker leads are soldered to the plate terminal of the last valve and to the mid-point of the two anode resistances, the lead going to the plate of the last valve being marked with a negative spade terminal and that going to the junction of the two anode resistances, with a positive spade terminal. This will give you your positive and negative loud-speaker leads to obtain the correct polarity when joining up.

NEXT WEEK

the first article written by the inventor, Mr. G. V. Dowding, on his

NEW

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Tuning, of course, is very simple, and is carried out by using the thumbs against the edges of the two discs. It is just as well in order to obtain steady operation positions, to place some kind of a weight such as a pastepot or inkpot on the top of each disc, particularly when the cardboard is rather thin.

If the cardboard is substantial, however, this may not be necessary. You will find tuning is quite sharp. For the first valve I recommend an ordinary detector H.F. valve, or you may experiment with an R.C. valve here, but the detector H.F. type will often give a better effect here. For the second valve I prefer one of the high-frequency types, particularly when the set is being used near a local station, and for the third either a power or super-power valve depending on your high-tension battery. The super-power valve will enable you to get louder signals without distortion, although in itself it will not make signals louder.

Using a high-frequency valve in the second socket and 100 or 120 volts H.T., 1½ volts grid bias will generally suit, and for grid bias 2 you will use the grid bias recommended by the makers for the particular output valve you use.

TECHNICAL NOTES.

(*Continued from page 958.*)

as when the record is coming to a finish. The linear speed is proportional to the radius, and if you take the case of a 12-in. record (radius 6 in.) with 4-in. of recorded matter (that is, with a 4-in. diameter unrecorded circle at the centre) you see that the radius of the outer edge of the disc is 6 in. whilst the radius where the selection finishes is 2 in.

Consequently the linear speed of the track at the outer edge is three times as great as that when the selection is finishing. It has been asserted that the quality of the reproduction is better when the outer edge of the record is playing than when the inner edge is in action, whilst on the other hand some experts have asserted precisely the opposite.

Gradual Reduction.

With any record made in the ordinary way, it is clear that there must be a reduction in linear speed of at least 2 to 1 between the commencement and the finish of the recorded selection and, therefore, we have to strike a suitable average linear speed.

It is interesting to note that the actual speed with which the record moves under the needle (or, if you like, with which the needle moves over the record, to think of it in a different way) in the case of a 12-in. record rotating at 80 revolutions per minute, is approximately 3 ft. per revolution, or 240 ft. per minute, which is about 4 ft. per second.

At the inner edge of the recorded selection, assuming the radius there is 2 in. instead of 6 in., the linear speed will be one-third, that is about 1 ft. 4 in. per second. The effect of the greater linear speed at the outer edge of the record is to make the waves or sinuosities (representing the sound waves) correspondingly more elongated or drawn out.

Plywood Cone.

A new type of veneer-wood or plywood "cone" diaphragm for loud speakers has now made its appearance. At first you would wonder how a piece of plywood could be shaped into the form of a cone. The secret, however, is very simple. The wood is not forced *strictly* into the shape of a cone, but plane wood is cut into a series of ten or more wedge-shaped pieces, and these are fitted together in such a way as to make up a "cone" with 10 plane facets, so to speak—not unlike the reverse side of a diamond set in a ring.

The veneer strips are glued together and, when complete, the cone is mounted upon a supporting rim. If the speaker is to be of the fixed-edge type the cone will naturally be fixed to the rim, preferably through the medium of a piece of chamois leather. If of the free-edge type, the rim is lined with felt and the cone is free to move.

In order to secure the triangular pieces of plywood together, very small strips of veneer wood or tough brown paper are pasted along the junctions.

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

A NEW SERVICE FOR OUR READERS.

White Print No. 6. :: :: :: A Two-Valve Amplifier.

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

ONE of the most useful things you can have about you for general experimental work is a good standard two-valve L.F. amplifier. If you always have it at hand you can do all your experimental testing on the loud speaker, and whenever you build up a rough circuit for trial it is only necessary to complete it as far as the detector stage, and then hitch it up to the standard amplifier.

Another special point about a standard L.F. amplifier is that it forms an excellent way of progressing from a headphone receiver to an outfit capable of working a loud speaker. If you already possess a single-valver, a crystal set, or a receiver of the "H.F. and detector" type, the easiest way to get loud-speaker signals is, obviously, to add an amplifier instead of scrapping your present set and building an entirely new one.

A Good Standard Type.

The design which has been worked out for the White Print series is a specially simple and straightforward one, so that you may be sure that there will be no difficulty in using it with any normal type of set whatever. It uses the popular combination of one resistance-coupled stage and one transformer-coupled one, which experience has proved to be a very sound and useful arrangement for all general purposes.

It does not, of course, give as much magnification as two-transformer stages arranged on the latest lines with special stabilising devices, but it is very simple and easy to get going, and is probably the better scheme where the amplifier will be used with all sorts of different sets.

You will find it gives a very good amount of amplification as it stands and, of course, it has the great merit from our present point of view of being considerably cheaper than a modern type of two-transformer amplifier with its special gadgets.

Choosing the Components.

Various questions of component values call for a word or two. First, as to the anode resistance which couples the first valve in the amplifier to the set which precedes it. You will see that a value of 250,000 ohms is indicated for this in the diagrams, and you will find this a good figure for all-round work.

When the amplifier follows a detector valve of the high impedance type (over 30,000 ohms) you will probably find that a distinct improvement can be obtained by using a resistance of 500,000 ohms here, but the quality is then not quite so good as a rule, and moreover the reaction control of the set is liable to become difficult. The value shown, therefore, is to be taken as a good standard one for general purposes.

The grid leak on this stage is indicated as a 2-megohm one, and this again was chosen as a good figure for general purposes. Here you should remember that if ever you have any difficulty with a combination of set and amplifier which tends to be unstable, giving an L.F. howl or a "motor-boat," it will generally help matters if you reduce the grid leak to 1 or ½ meg.

COMPONENTS.

- 1 Panel, 12 in. × 7 in. × ¼ in.
- 1 Cabinet to fit, with baseboard 7 in. deep.
- 1 L.F. transformer (see text as to ratio).
- 1 250,000-ohms anode resistance with holder.
- 1 ·01 mfd. fixed condenser (mica, not Mansbridge type).
- 1 2-meg. grid leak and holder (see text as to this).
- 2 Sprung valve holders.
- 1 Terminal strip, 5 in. × 2 in. × ¼ in.
- 8 Terminals.
- 3 Battery plugs, 2 black and 1 red.
- 1 L.T. switch.
- Wire, flex, screws, etc.

Now about the L.F. transformer. If you want the very best possible reproduction, especially of the bass, a low ratio transformer of from 2½ to 3½ to 1 should be chosen. If your main aim is volume at a slight sacrifice of bass, a higher ratio of 4 or 5 to 1 is indicated. This, you will see, is a matter which you must decide according to your own requirements.

The amplifier as it stands is about as simple as it very well could be, all special refinements having been omitted to render it as suitable as possible for the particular requirements we have tried to meet. There is just one point calling for mention in this connection. No provision has been made in the design for keeping stray H.F. currents out of the L.F. circuits, because such "stoppers" are only occasionally needed. In most cases they can be dispensed with, and are only included in most receiver designs to deal with the exceptional case where a constructor might get trouble.

It is just as well to know what to do if ever you strike this trouble, however. The cure is generally fairly simple. Just break the lead marked X on the diagrams, and insert in series with it either an H.F. choke or a ½-meg. grid leak.

Now for the question of valves. If you want the greatest possible magnification you should use a valve of the H.F. type in the first socket and an ordinary power type in the second. Where, however, you want to handle very powerful signals with the least possible chance of overloading, a valve of the L.F. or general-purpose type is better for the first socket and a super power in the second.

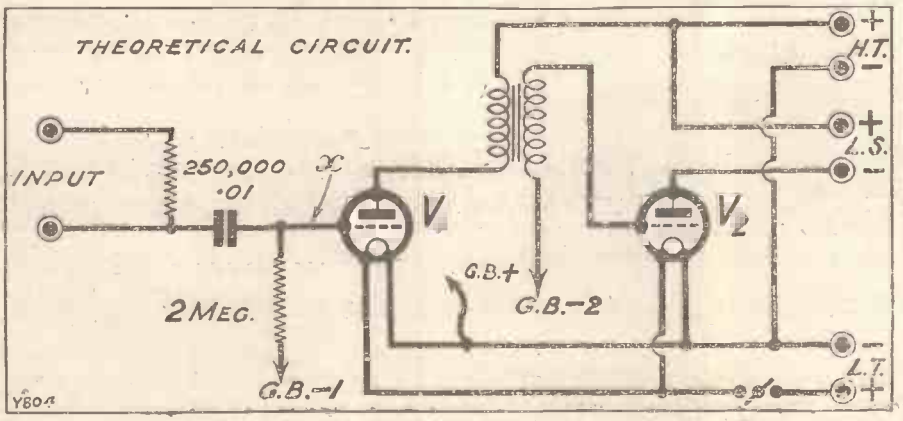
Connecting to Your Set.

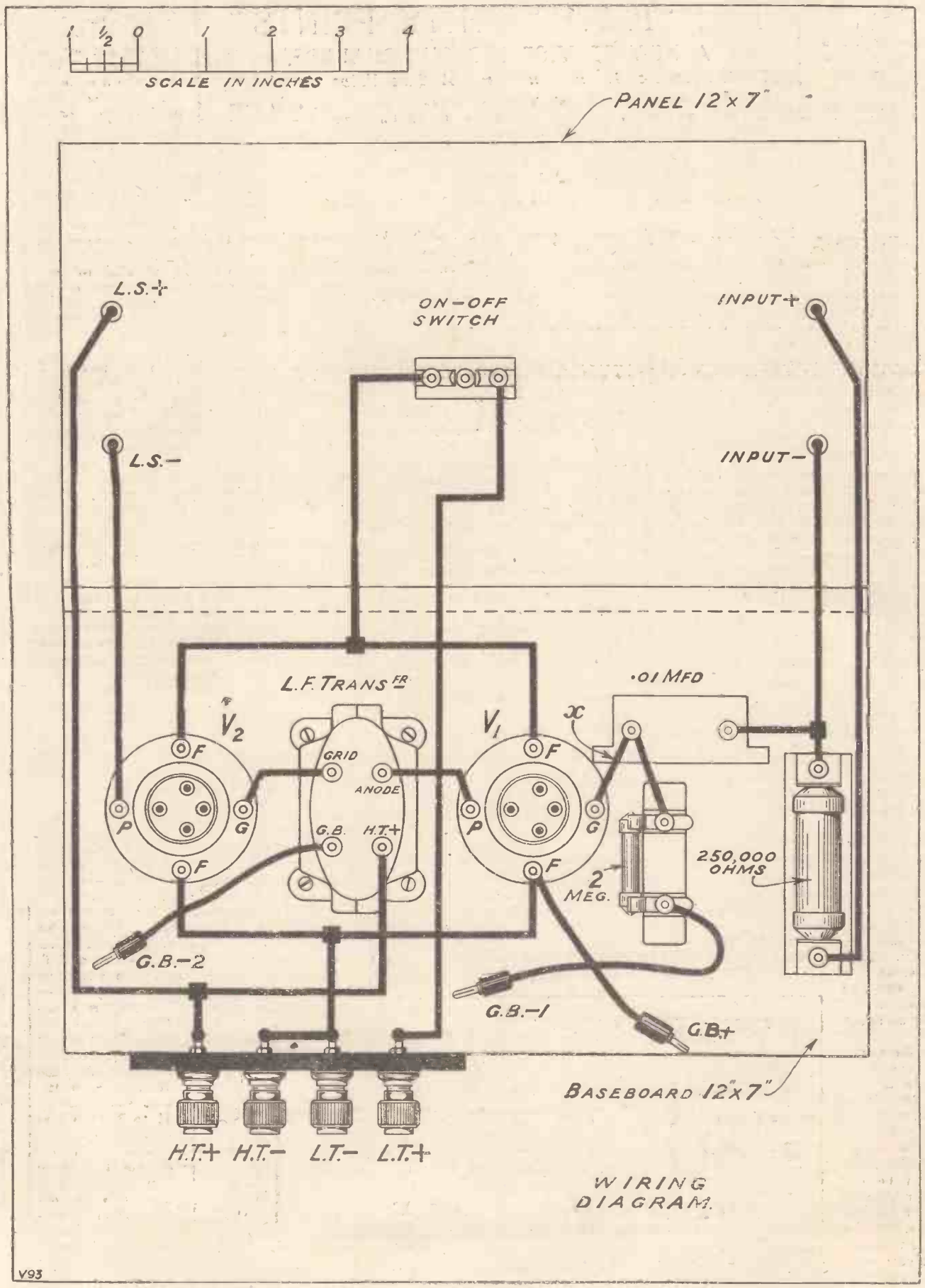
Connections to the amplifier are simple. If at first you get no results, reverse the input leads (there is a right and wrong way round). Battery connections are marked, but remember this: if you are working the amplifier after a valve set do not connect up the H.T. negative terminal on the amplifier, but only on the set.

This is important, for if you connect up H.T. negative on both set and amplifier you may short the L.T. battery, because in some sets H.T. negative is joined to L.T. negative and in others to L.T. positive. If it happens that the set is one in which H.T. minus is joined to L.T. plus, and you connect the H.T. battery to the H.T. minus terminal on both set and amplifier, a short will result.

Whenever there is any doubt about the matter, then, play for safety, and do not make any connection to H.T. — on the amplifier. In any case, this connection is quite unnecessary so long as you are using the same H.T. and L.T. batteries for the set and the amplifier. If, on the other hand, you use a separate L.T. or H.T. battery for the amplifier, then you must connect up H.T.—.

Questions of battery voltages will depend very largely on your valves. With a valve of the H.T. type in the first socket about 1½ to 3-volts grid bias will be correct, whereas with one of the L.F. type you may be able to use 4½ volts, depending on the particular type. H.T. should be at least 100 volts, and preferably 120.





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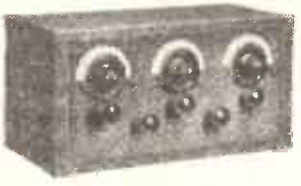

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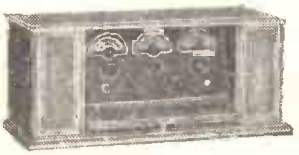

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