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

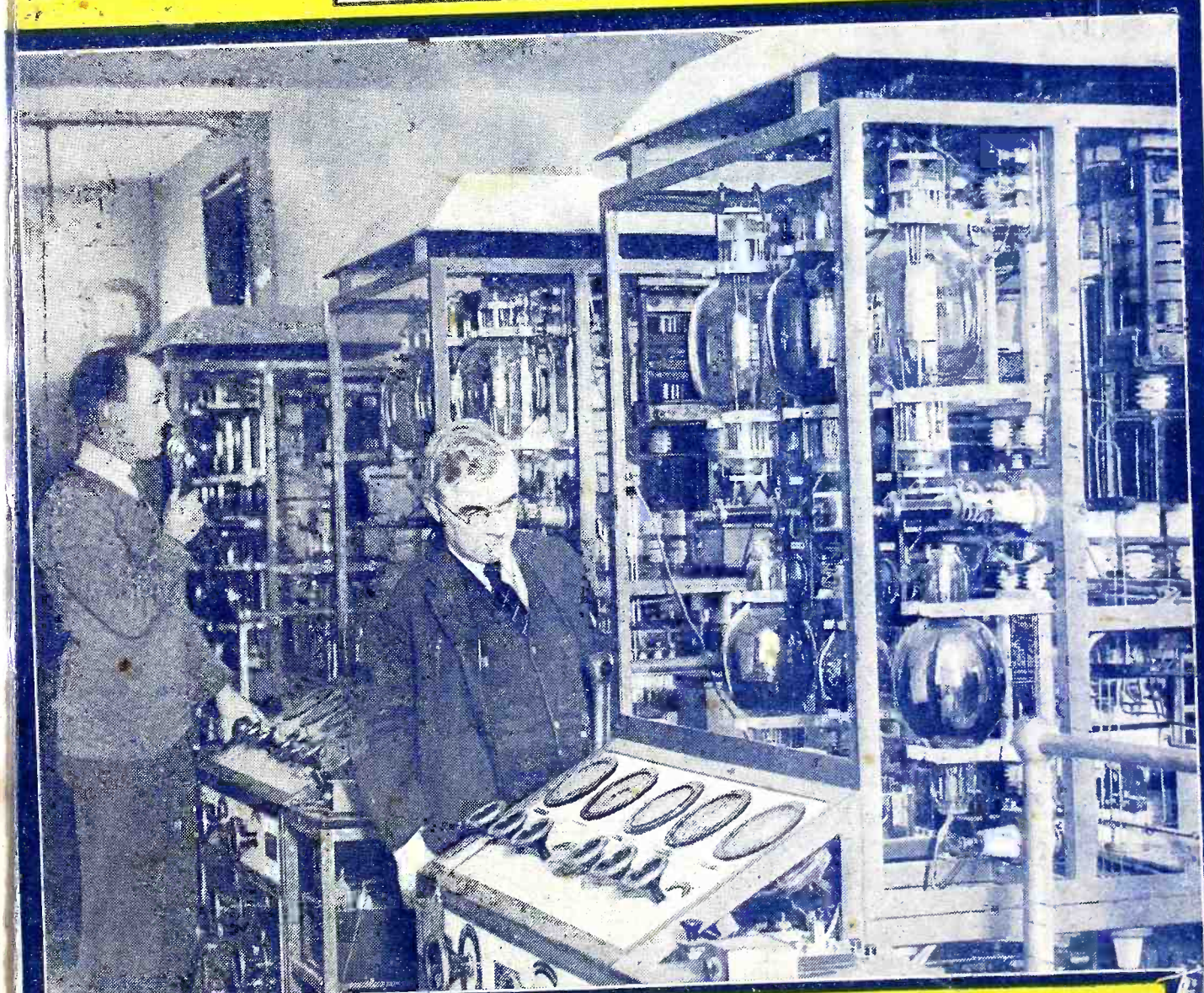
TELEVISION: SOME AUTHORITATIVE FACTS (See Page 7.)

Popular Wireless

Every Thursday
PRICE
3d.

INCORPORATING "WIRELESS"

No. 300. Vol. XIII. March 3rd, 1928.



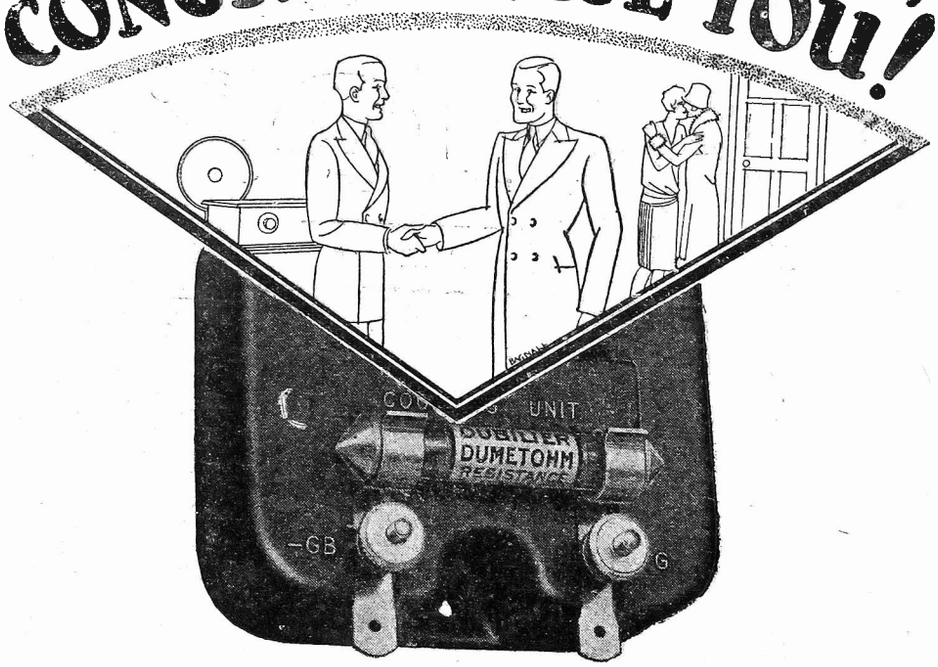
Building a Home "Television" Outfit.

A WARNING TO OUR READERS.

By G. P. Kendall, B.Sc.

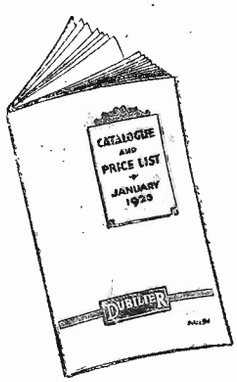
Our cover photograph shows the transmitting room at the new Air Ministry Radio Station at Mitcham.

YOUR FRIENDS WILL CONGRATULATE YOU!



—on the improved performance of your set; on its remarkably increased clarity of reception with yet sufficient volume: meanwhile they might wonder at the cause. They would be astonished if you told them—that it was due to your having fitted a Dubilier R.C. Coupling Unit to your set.

Some may tell you they have tried Resistance Capacity Coupling as the recommended means of obtaining purer amplification, but with a disappointing decrease in volume. Yet the fault lies not in the method—mostly it emanates from the various components in the set having been carelessly selected.



Thousands are now being delighted by the purer reproduction, combined with adequate volume, which their sets have given since they installed the Dubilier R.C. Coupling Unit—proof enough of the supremacy of the Dumetohm for R.C. Coupling.

The Dubilier R.C. Unit will take Dumetohms of various values to suit your particular requirements, an advantage second only to that of price; for this efficient component costs no more than 7/-.

DUBILIER

REGISTERED TRADE MARK

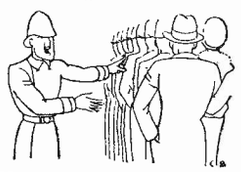
DUBILIER DICTA

No. 8

There was a man who considered himself destined to become a great singer; wherefore he dreamed of his voice moving vast crowds at Covent Garden. And as, day by day, he dreamed, he sang constantly: until a neighbour reproached him for his imperfect playing of a saxophone.

* * *

Whereupon his dream was shattered.

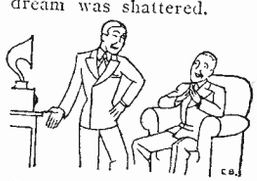


Nevertheless it happens vast crowds *are* moved by his voice at Covent Garden; for he cries to them "Move on" as he stands on point duty.

Moreover, there was a man who had a Wireless Set; and strange sounds came forth from his loud-speaker. They were not of France, nor of Germany, neither were they of Italy. Verily, thought the man, they are of Walloolooo land: and the man was proud of his achievement; but a neighbour declared them to be of distortion.

* * *

Whereupon the man's dream was shattered.



Nevertheless, his neighbour prevailed upon him to fit a Dubilier R.C. Coupling Unit to his Wireless Set: whereupon its reproduction so vastly improved that the man forgot his unhappiness.

* * *

Whether the above appeals to you or not, what undoubtedly will appeal to you is the Dubilier R.C. Coupling Unit, embodying the famous Dumetohms.

Advt. of The Dubilier Condenser Company (1925), Ltd., Ducon Works, North Acton, London, W.3. W119

Back to Methuselah

f all the good things a Marconi alve offers you, one of the most tstandingly good is its very, very ng working life. Marconi Valves e very Methuselahs (or is it Methu-lae?) for age. And they are one ndred-per-cent bullmen for work.

ead this for instance, Mr. E. Revill, adworth, writes, Feb. 9th, 1928.

I have one of your L.T.1. type valves, hich has been in constant use for practically x years . . . and the filament is still intact."

Take now the D.E.P.215. Try it alongside any 2-volt low-frequency power amplifying valve you've got. *Hear* the difference. Note the volume. See how clear and *true* it is. Then measure the current from your L.T. Battery and realise what an economist this good valve is.

G. Marconi

TYPE D.E.P. 215
Low-Frequency Power-Amplifying Valve for 2-volt accumulators.

Price 12/6

Fil. volts - 2.0 max.
Fil. current 0.15 amps.
Anode volts - 120 max.
Amplification Factor 6.25.
Impedance - 6,250 ohms.

FREE ADVICE

Our Engineers will furnish free advice as to best possible valves for your set if details of the circuit and any valves at present in use are given.

MARCONI VALVES
—do everything that a valve should do

COUPON

BOX P.,
MARCONIPHONE COMPANY LTD.,
210/212, TOTTENHAM COURT RD., LONDON, W.1.

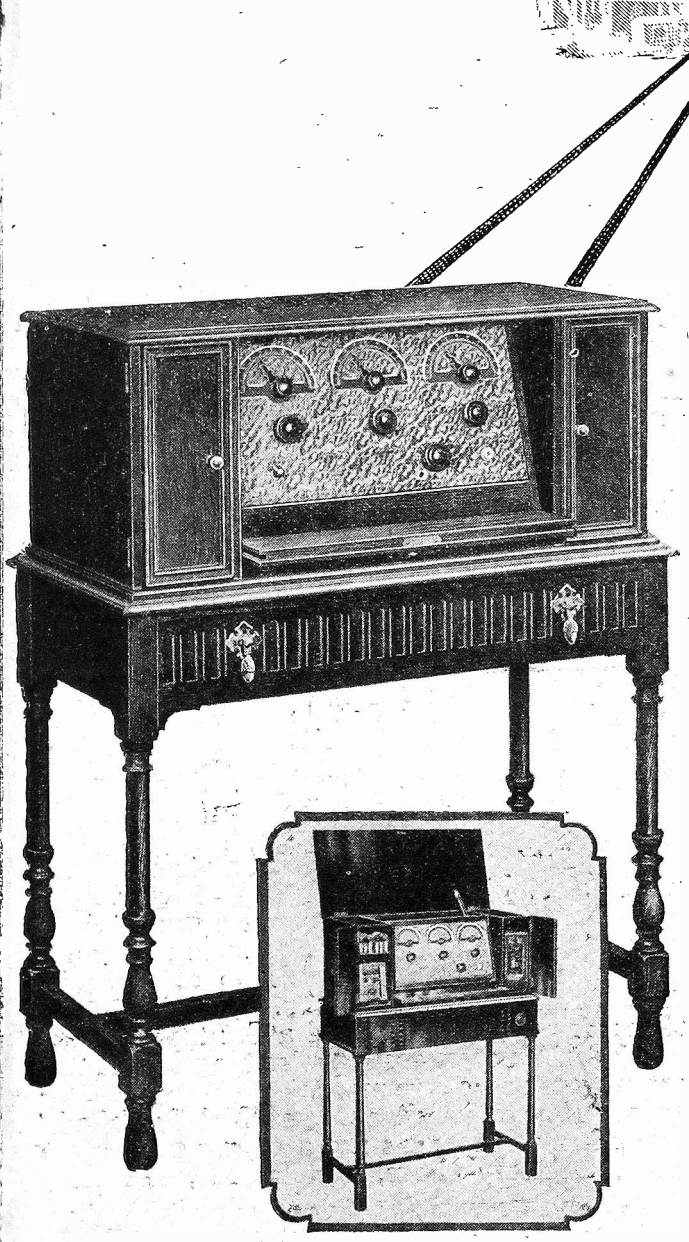
Please send Marconi publication 443L.

NAME .....

ADDRESS .....

P.W.14.

Does the Power Station keep your set going?



Does it supply you with music as well as light and other home comforts?

With the Met-Vick 5 Mains Set this is now possible. It is just plugged into a lamp socket or wall plug and switched on, like any other Electric Appliance, and all the little annoyances of accumulators that *will* run down, and H.T. batteries that cost so much and last such a short time, trouble you no more.

Inherently better than a battery operated set, the reproduction is so near perfection that to ask for more is hypercritical. Selectivity and range are outstanding features, and the controls, while quite simple to use, do respond to that little extra skill of the sympathetic operator which is so delightful.

With the Met-Vick 5, it is at last possible to obtain a wireless receiving set which will always give the satisfaction that only comes from really brilliant performance, and which will remain a constant source of pleasure and interest to all who hear it.

Ask your dealer for a copy of Brochure 7117/9, or write to the makers.

Those who are content with the alternative programme of their Local and Daventry Stations, but who desire the advantage of Mains operation cannot do better than obtain the Met-Vick 3 Mains Set fully described in List 7117/10.

MET-VICK

VALVES, COMPONENTS & SETS

R
Z139

METRO-VICK SUPPLIES, 155, CHARING CROSS ROAD, LONDON, W.C.2.

EUROPE IS HERE!

BROUGHT TO YOUR HOME

Good evening, everybody! We're here! Germany, France, Switzerland, Holland, Italy and Spain. We're brought every night to thousands of homes, by the wonderful Cossor "Melody Maker." We come to cheer the lives of the people with music, song and speech.

Anyone can build the Set that brings us. Not an atom of Radio knowledge is needed. No technical skill is necessary. The free chart your Dealer will give you shows you how to do it. Everything has been made as easy as A.B.C. It's no more difficult than your boy's Meccano. There's no soldiering to thwart you. No blueprint to puzzle you. Just follow the instructions and in a few hours you'll build a Set that is better than many factory-built Receivers costing twice the price. A Set, too, that is as easy to work as it is to make.

Ask your Dealer for "How to build the Cossor 'Melody Maker'," and bring us to *your* home. If he has not a copy, a postcard to A. C. Cossor, Ltd., Highbury Grove, London, N.5, will bring it by return.

BY THE WONDERFUL

Cossor "Melody Maker"

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

Popular Wireless

Scientific Adviser :
Sir OLIVER LODGE, F.R.S.
Editor :
NORMAN EDWARDS, M.Inst.R.E., M.R.S.L., F.R.G.S.
Technical Editor : G.V. DOWDING, Grad.I.E.E.
Assistant Technical Editors : K. D. ROGERS, P. R. BIRD,
G. P. KENDALL, B.Sc., A. JOHNSON RANDALL.

RADIO NOTES AND NEWS.

Kalundborg—The Latest Marvel—A Record Meeting?—Cologne on a Crystal Set!—France Breathes Again—Safety First—Royal Listeners.

"Merrie England."

WHAT did you think of those two performances of "Merrie England?" Is not this opera a delight? The B.B.C. should repeat it six times a year, and do the same with Liza Lehmann's "Song Cycle," and Gounod's "Faust."

Kalundborg.

UNDER a recently-published photograph of the Kalundborg station we mentioned that we had not received many reports of its reception. Our readers promptly remedied the matter, writing in overwhelming numbers. Please accept our thanks for all the letters; it is difficult to pick out any for special mention. They all agree that this station is a "star"; some report slight fading and Morse interference; unanimously agreed that but for this and a few other Continentals, the B.B.C. would lose a lot of licence money.

The Latest Marvel.

TALK about the genie in the bottle! It's come true at last. A Glasgow paper, describing Mr. Baird's transatlantic experiments, says, "Meanwhile, wireless communication in Morse was being kept up between the chemists at 3s. and 7s. per bottle, or direct, post free, from," etc. I am surprised that a Scotsman should buy bottled Morse when such a large free supply is available. Why doesn't the B.B.C. bottle Chamber Music and sell it as weed-killer? It's a long time since they branched out into a new business.

The Broken Promise.

I AM reminded by a reader that when 5 G B was put into service the B.B.C. promised that its programmes should be free from "Talks," but that these have at last begun to creep in. Too bad! Enough to give one the heebie—G B's! Will the B.B.C. kindly overhaul its records relating to this matter, and, as Captain Cuttle would say, "When found, make a note of?"

A Record Meeting?

NOT *all* British learned societies are old-fashioned and conservative, for surely the very successful joint-meeting of the British Institution of Electrical Engineers in London and its American counterpart in New York, held by means of the wireless telephone service, was bang up-to-date. All went without a hitch, and speeches and votes of thanks were exchanged; loud speakers were used for reception. Pretty good, eh? Three thousand miles of water, or thereabouts, and twelve hundred miles of land line!

New Valve Test.

JUDGING by the trend of science, the best way to test a valve is to put it under a steam-hammer. The Edison Swan Electric Company states that they gave a railway porter a case of 50 Ediswan valves (P.V. 2) to test. Instinctively he threw the case on the line in front of an express train. The valves were then collected and taken to the mortuary; 41 sat up and asked for a cigarette—quite O.K.; 4 were past hope; 2 had broken filaments; 2 were distorted but had intact filaments, and 1 was like the eleventh little nigger-boy—not there. Why not use triplex glass? And did they search the station-master for the fiftieth valve?

Cologne on a Crystal Set!

THIS is not one of those yarns so beloved of the Ancient and Honourable Order of Cat's-whisker knights, but a pretty way of putting what the B.B.C. may make possible this month, during its experiemnts with Continental relays. The first attempt will be on March 11th, 10.5 p.m. to 10.30 p.m., when the Legia Choir from Liège will be relayed by 2 L O and 5 X X; the second on March 12th, 8.0 p.m. to 9.0 p.m., when the same stations will relay an opera or concert from Cologne. "Where is that lovely music from?" says the wife. "Oh—de Cologne."

PCJJ.

WE are informed that P C J J will transmit, until further notice, on Tuesdays and Thursdays, from 15 to 19 G.M.T., and on Saturdays from 14 to 17 G.M.T.

Amateur Transmitter.

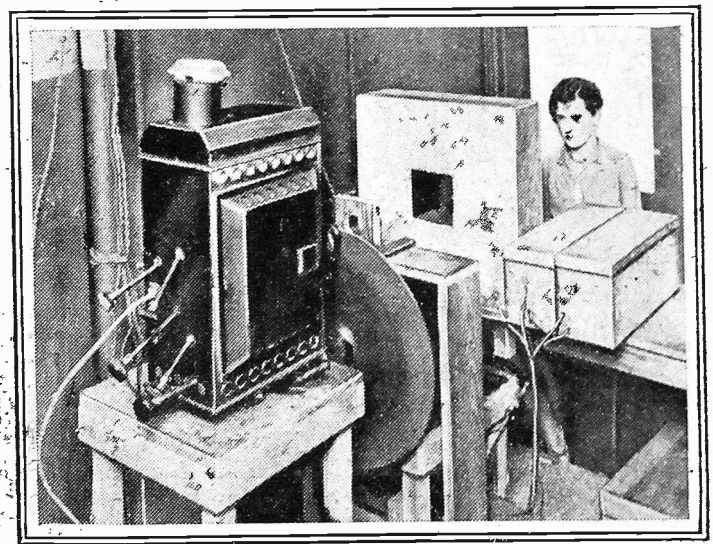
MR. D. E. PETTIGREW, 20, Hollin Park Mount, Oakwood Lane, Roundhay, Leeds, asks me to say that he hopes to be transmitting before long on 150-200 metres, under the call-signal G 2 D P. He is fully licensed. But—

The Over-Ruling Passion.

IT is sad to read about the Rochdale lad, aged 21, who having been denied a transmitting licence in 1925, was discovered in 1927 to be sending like one o'clock. Cautioned and ordered to dismantle. That was in June, but in October he was found to be in full blast again. Now somebody has had to find £10 5s. 0d. to satisfy the law, and

(Continued on next page.)

AMERICA'S "TELEVISION" PROGRESS.



This is the "Television" transmitting gear used in the recent demonstration staged by Dr. Alexanderson, the Research Engineer of the American General Electric Co. Backed by a mighty organisation, this scientist has been unable to show that true "television," or, shall we say, *useful* television, is, as yet, even a remote probability.

NOTES AND NEWS.

(Continued from previous page.)

the gear is forfeited. One cannot condone his law-breaking, but nevertheless a youngster with an enthusiasm like that ought to be encouraged by the issue of a licence.

More Shakespeare.

There was an old monk of Medina,
Who tried to get Stoke on galena.
Though he listened and prayed
'Till his ears were quite frayed
. . . . . .

Fill in the missing line. No prizes!

Wireless Classes.

I HAVE pleasure in drawing further attention to two series of radio classes which are being held by Captain Jack Frost, on Tuesdays, 7.15 p.m., at the Streatham and Tooting Literary Institute, Bec Secondary School, Beechcroft Road, S.W.17, and Putney Literary Institute, Putney Secondary School, West Hill, S.W.15, on Wednesdays, at 7.15 p.m. These classes, which are really nothing but jolly and interesting club meetings, are crying out for more members of both sexes. Fee: 2s. to Easter, or 4s. to Midsummer. If you want more details before you enrol in person, please write to either of the Institutes.

France Breathes Again.

THE decree forbidding any private station except Radio-Paris to broadcast came as a blow to the French people and to many in this country. Luckily, however, it was recently decided that the matter is one for the Council of Ministers and the French parliament, and so the decree has in effect been quashed. Whatever may be the disadvantages of the B.B.C. monopoly, our method certainly saves our nerves from shocks due to the threatened closure of all our stations while the Government thinks.

His Majesty, the Customer.

QUITE a lot of interest has been shown by readers in the various kinds of treatment meted out by traders to customers, and I have under my hand sufficient libellous material to blow up the Law Courts. One of the funniest letters was from a Scot, who was plainly scandalised to the point of apoplexy. He bought a—a sort of a coil, which wouldn't behave; complained to the seller; seller said: "Coils reversed," and connections must therefore be reversed, but "if you do not feel disposed to do this, return the coils and I will wind 'em properly." Mon! I tell ye! Retur-rn the coil and lose a week's broadcasts for which I can get no rebate from the B.B.C.? Hoot!

A New Idea.

THE radio trade shows no lack of enterprise and ingenuity, and my post generally contains a lot of "literature" which is well worth perusal. Only to-night, for instance, I have received from Harlie's a neat folder with illustrated descriptions of some components which make the coins burn holes in one's pocket, and in this folder is a "log," giving names, call-signs and wave-lengths of stations, with spaces for dial settings and notes. A handy thing for the radio man. For discriminating set builders the Harlie components are well worth examination.

A Present for a Good "Ariel."

TALKING of "trade" literature, which I have to study in the interests of "P.W.'s" ten million readers, I thankfully acknowledge the gift of a copy of "The Rag Bag," an Annual produced by the University of Manchester. It proved to be, as the donor hoped, a reviver. From cover to imprint it is a colossal "skit," exceedingly witty and laughter-provoking. How I wish the Editor would issue a "P.W." Annual on the same lines. Even the ads. in this tonic are humorous. I quote one gem from the text. "What is at the bottom of the Manchester Ship Canal?" Answer: "Lancashire." I am always open to such refreshers, including complete sets of Hardy, Conrad and Bennett.

Scientific Note.

A PUZZLED "P.W."-ite sends me a clipping from some of the aforementioned "trade literature," wherein an H.T. battery is advertised as providing "pure D.C. current," and asks what kind of current is that? Answer: We have hitherto demanded only voltage from our H.T. battery. The current is thrown in as a gift. D.C. current is a sort of cousin, twice removed, to L.F. frequency; bred from A.C. current out of H.F. frequency. Very sporting!

Royal Listeners.

AMPLIONS tell me that the mother of the King of Roumania has acquired one of their cone loud speakers. "Radiomania in Roumania," eh? This firm is to fit up the Melbourne Motordrome with twenty loud speakers. So Britain still has a shout coming.

SHORT WAVES.

SIMPLIFIED.

Teacher: Johnny, how do you spell Schenectady?

Johnny (without hesitation): W G Y.—"Radio News."

* * *

REACTION—The morning after that bachelor night party.

* * *

A SLIGHT DIFFERENCE.

"Is your neighbour's set portable?"

"No, insupportable."

* * *

Bold Fellow: The B.B.C. announcer who said: "Good-night, everybody. I'll see you all later at the night clubs."—"Sunday Pictorial."

* * *

Broadcasting is still in its infancy; that is why we hear so much howling.

* * *

LOCATION UNSUITABLE FOR RECEPTION.

Mouse No. 1: Why aren't you going to be married here at Station 2 L O? Don't you think this nice basement is suitable for the wedding?

Mouse No. 2: No, indeed! I don't think any self-respecting mouse should marry beneath her station.

* * *

An enterprising housewife puts the clothes-horse in front of the loud speaker whenever political speeches are broadcast.

A novel method of drying the washing by hot air.

* * *

THIS EVOLUTION.

As a culminating effort in the history of broadcasting talks the B.B.C. has acquired a parrot which is being trained to appear before the microphone.

Thus culture broadens slowly down from precedent to precedent.—"Daily Herald."

* * *

A Radio Announcer named Bevan
Was out motoring with his family of seven,
When his steering gear broke
He said to his folk—
"We're now changing over to Heaven."

Tonsorial Note.

MY revelation a few weeks back about my red whiskers has evoked a number of letters, mostly sceptical. Being now a marked man I am looking for a good permanent dye. I saw some of my talkative co-lunchers again last week and observed their ill-concealed nervousness as one of them described a most wonderful circuit. But I had the danger-signal tucked into my collar.

"Safety First."

I WAS telling a friend about the little flash-lamp gadget mentioned in my Notes of February 18th, and he said why not connect the lamp permanently in series with the filament, so that it can act as a safety-fuse? The idea looks good, especially for sets entirely operated from the mains.

The "Variocycle."

WHAT'S this about the alleged new wonder-unit designed by a Worthing man? I gather that it is a component which takes the place of the aerial tuning condenser, coil-holder and coils. This knowledge, plus the name, points to an improved type of variometer. Bare wire is wound off one threaded drum on to another, which is made of ebonite; "dead end" effect is said to be absent. May be very efficient but does not sound novel, and I myself prefer good plug-in coils. A reader who draws my notice to this, says he cannot often get 5 G B at full L.S. strength on his 4-valve set at Willingdon, near Eastbourne. For goodness sake, why not? Friend, you need a radio doctor, not a variocycle. Are you screened by the Long Man of Willingdon?

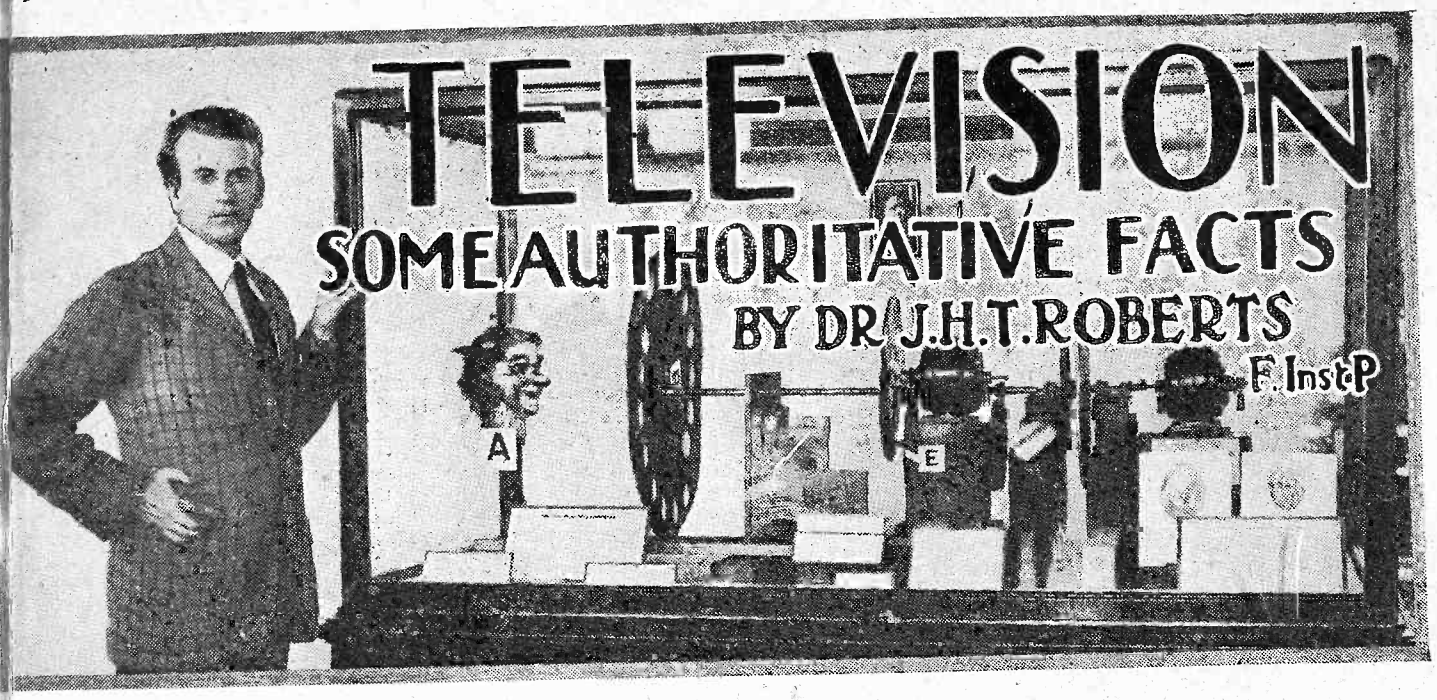
The Business Touch Again.

I CAN see that if Britain is to increase its trade it must encourage the colonies to migrate to our shores, for some of them appear to be populated by a race of hard-bitten bargain-biters. Here is a letter, just received from a certain coral strand. "Dear Sir, dear sir or madam, adverting to the adverts in your esteemed advt. columns you are hereby requested to enrol my name and address as agent for only best engineering houses in realm. Principals required to send numerous samples, returnedable if not sold presently, and quote highest discounts to guaranteed Br. Citizen, vaccinated and passed 2nd class Freehand Drawing." Yes, sar!

Radio, Rain, and Heat.

DORLAND Advertising, Ltd., have sent me a pamphlet called, "Climate and Commerce." The idea is that with this to guide him the British trader will know when to export his goods. I fancy the radio trader does not care a hoot about rainfall so long as he gets his cash. I have, however, taken the trouble to analyse the figures. If you make umbrellas you should export to Bombay in July, it is the rainiest place on earth then, with Rangoon a good second. On the other hand, if you make refrigerators you should try the Nagpur (India) market in May, when the average temperature is 94·46 degrees.

ARIEL.



TELEVISION

SOME AUTHORITATIVE FACTS

BY DR. J.H.T. ROBERTS

F. Inst P.

Below we publish an article on the problems of Television by our Scientific Consultant. Dr. Roberts is one of the most distinguished of the younger generation of British scientists. He has been connected with three British Universities, and has been engaged in scientific research for over ten years with conspicuous success, having collaborated with some of the leading scientists in the world, such as Sir J. J. Thomson and Sir E. Rutherford. Dr. Roberts worked at the world-famous Cavendish Laboratory of the University of Cambridge, and after numerous academic honours and various important scientific posts he has specialised in the commercial and industrial applications of science. Dr. Roberts has marked characteristics of moderation and caution in all his opinions, and, therefore, we think his views on Television should be of peculiar interest and value to the public. THE EDITOR.

N view of the interest which has lately been aroused by the phrase "seeing-by-wireless," I have been requested, as ientific Consultant to this journal, to set t some of the facts as to what has already en accomplished in this direction and, as the likelihood of further progress in the ar future.

The idea of seeing-by-wireless, on a reen, a moving picture of events taking ace at the same moment many miles away certainly one to seize the imagination id, therefore, it might be expected that any ggestion that such a thing was an accom-lished fact would give rise to considerable terest in the public mind. People have y now become so accustomed to the repre-ntation of moving events as shown by the nema that they are probably ready to elieve that similar representations of multaneous moving events may be possible y means of radio.

What Has Been Accomplished?

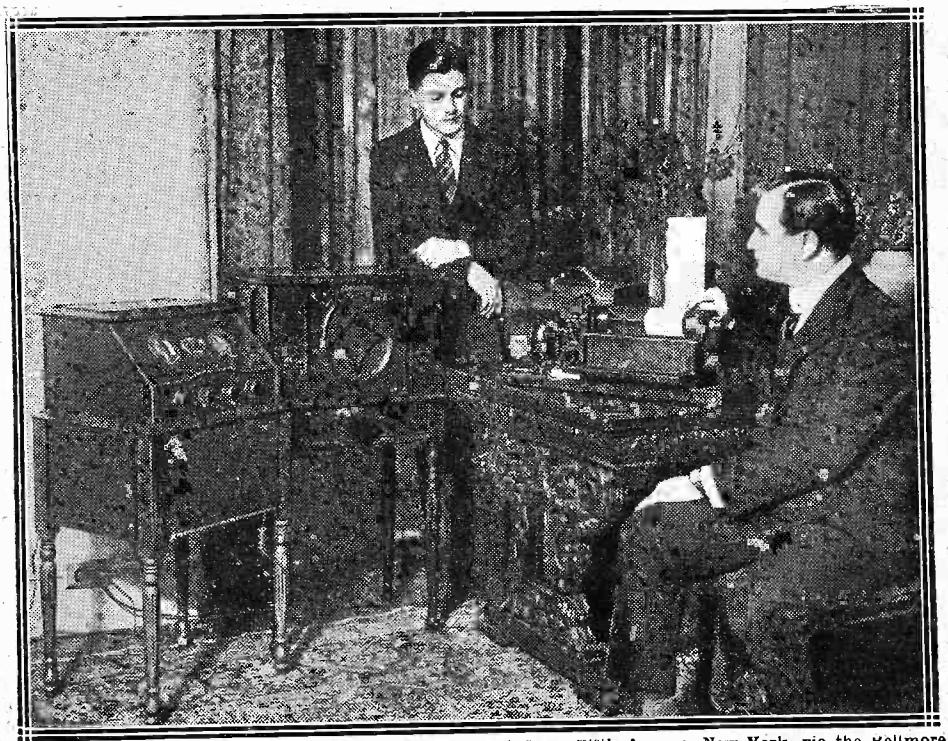
If you could go into a cinematograph neatre and see on the screen the same kind f pictures that you are used to seeing at resent but with the added knowledge that he events portrayed were actually taking lace at that moment miles away, you would ndeed feel that a wonderful aid had been iven to mankind.

When the public hears the phrase "seeing-y-wireless" there is little or no doubt hat something along the lines I have just ketched is what arises in their minds. If hey are told that "seeing-by-wireless" is n accomplished fact they quite naturally xpect—without giving any serious thought o the matter—that they are going to see omething more or less equivalent to what they see in their ordinary daily experience, or what is put before them at a cinemato-graph theatre.

Now let us turn to the question of what has actually been accomplished by tele-vision. The subject of television (seeing-by-wireless) is one which has engaged the attention of experimenters in several parts of the world for some years past. The best-known investigators in this field are probably Dr. Alexanderson, the Chief

(*Continued on next page.*)

SENDING PHOTOGRAPHS BY RADIO.



By means of the apparatus shown above, photographs sent from Fifth Avenue, New York, via the Bellmore (Long Island) broadcasting station, were picked up in the home of a New York scientist. After reception they required developing and fixing, just like an ordinary photograph.

TELEVISION.

(*Continued from previous page.*)

Consulting Engineer to the General Electric Company, New York; Dr. Ives, of the American Telephone and Telegraph Company; Mr. C. Francis Jenkins, United States; Mr. J. L. Baird, of London; and Mr. Mihaly, Germany.

Most of these investigators claim to have demonstrated television in a more or less rudimentary form over distances ranging from a few miles to a couple of thousand miles (across the Atlantic), and hopes have been expressed that the quality and "definition" of the transmitted pictures will be improved in the near future.

As to the actual transmission of crude moving representations, there is no reason to doubt the claims made by various investigators. Indeed, it is a comparatively simple matter to send, either by line-conductor or by radio, crude representations of a simple object such as a face or a hand. But I do not think the most optimistic sponsor of television would pretend for a moment that television is out of its infancy, or that (unless enormous improvements be made in the quality, detail and recognisability of the transmitted images) it is of much service beyond that of a scientific toy.

Distance No Real Difficulty.

In passing, let me remark that the transmission of a moving representation by radio over a considerable distance (2,000 miles across the Atlantic) is a matter of scarcely more difficulty than the transmission of representations over a distance of two yards, although in the former case it is obviously much more spectacular. The point I want to bring out is that, having accomplished radio-transmission of moving pictures *at all*, the increase in the distance between the sending and receiving stations involves comparatively little further technique.

If television has any real future it lies, in my opinion, not in the increase of the *distance* over which moving representations are sent, but in the improvement of the quality, recognisability and "detail" of the moving pictures received. Up to the present, television transmissions have been confined to simple objects such as a face or hand where, even in the absence of "detail," it is possible to recognise the object. If television can be so improved that objects can be transmitted which require for their recognition enormously greater detail then television will be entering the realm, so to speak, of practical politics.

Take, for instance, a view of the interior of a room, which is the kind of scene so commonly forming the background of a cinematograph picture. Here the objects upon which interest centres, namely the actors, occupy a comparatively small part of the whole picture area and, consequently, very much greater detail is necessary in the picture as a whole in order that the details of objects, themselves small compared with the whole picture, may be faithfully brought out.

An Enormous Difficulty.

I will show by a more detailed examination of the *modus operandi* of present-day television systems that the step from the transmission of a simple object, such as a face, which occupies virtually the whole of the picture, to the transmission of a view of a distant scene or of the interior of a room, or even to the transmission of a face in any close detail, is a step of enormous difficulty.

My readers may think that, although this step may be one of great difficulty, it is not necessarily insuperable when we have regard, as we must do, to the way in which the seemingly insuperable difficulties in other directions have been surmounted. At one time aviation by heavier-than-air machines seemed impossible, and, indeed, it might well have remained so had it not been for the invention of the internal-combustion engine which completely revolutionised the science of aeronautics. Radio telephony (as used in broadcasting) might have been impossible but for the invention of the thermionic valve. Moreover, as a scientific man I should be the last to assert that anything was absolutely impossible, even flying to the moon, or perpetual motion.

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

In order to appreciate what are the technical difficulties involved in this problem, let us consider for a moment the technique of television.

When we look at an object by the ey in the ordinary way, we receive rays o light from the *different parts* of the objec and these rays are focussed upon differen parts of the retina of the eye in corre sponding positions. The rays of ligh from the various parts of the object ar received *simultaneously*, and consequentl the vision of the whole object is simul taneously perceived.

It is a very simple matter to transmi moving pictures if we rely on rectilinea propagation of radiation as with ordinary light rays. But when we attempt to ge away from the use of directional radiation (as used by Nature in the faculty of vision) and to send out radiation more or less at random (as in broadcasting), which radiation carries, impressed upon it, features which are characteristic of the picture, and which are capable, with appropriate appliances, of being transformed back into a representation of that picture, then we enter an entirely new field of technique.

It is obvious—or, at any rate, it seems to me obvious, and I think it is universally agreed—that for transmission of pictures by line or by radio it is necessary to convert the picture, so to speak, into a *series* of effects, which effects are transmitted in a chronological or time-succession; in other words, *one after another*. These effects—which, to be more particular, we may now call "impulses"—are received at the receiving end in the appropriate way, and are built up to re-form the reproduction of the original picture.

"Progress has been held back in all these systems I have mentioned, however, by the fact that it is extremely difficult—impossible, some will tell you—to construct a mechanism to achieve a speed and accuracy necessary for television. To have any appreciable detail, a picture made up of dots, squares or patches, as television pictures are, should have at least 10,000 dots. When the picture is flashed on the screen ten times a second to give it the appearance of continuous movement, that means that 100,000 dots of light and shade have to be 'seen' separately and in exact order, and transmitted every second—which needs mechanism more delicate than most.

"Professor Max Dieckmann, whom I met in Munich, has scrapped his apparatus which depended on mechanism. His receiver uses streams of electrons, like that of M. Holweck, and now he is trying to make use of electrons at the sending end.

"I shall watch Dieckmann. All the other men will make progress during the year, but unless they discover some revolutionary new idea, any machine they bring out will not be able to approach detail of cinema pictures."

(Extract from an article on Television by Wm. J. Brittain, in "The Review of Reviews.")

Present "Television" Systems.

In television systems the method employed by all investigators, so far as I am aware, is to "explore" the object—a picture, a face, or whatever it may be—by means of a spot of light, or by the focus of an optical system, or by some equivalent. Let us suppose, for simplicity, the object is explored by a small spot of intensely bright light, and let us also suppose, for simplicity, that the "object" is a picture 10 in. square. The exploring spot of light may start at the top left-hand corner and travel rapidly downwards along the left-hand edge until it reaches the lower left-hand corner, after which it commences again at the top, but a little bit to the right, and follows a second path close and parallel to the original one. In this

(*Continued on next page.*)

RADIO AID TO ART.

"When something lively comes on I imagine horses moving, and that makes me want to draw them," says this twenty-three-years-old Surrey workman, who has had an oil-painting accepted for exhibition in the Dublin Salon.

TELEVISION.

(Continued from previous page.)

ay it rapidly traverses a series of parallel nes, starting at the left-hand edge and rogressing across the picture, and finishing t the right-hand edge. Of course, instead f moving always from top to bottom, it ıay vibrate up and down, and the motion ıay be from right to left, or the lines f exploration may be of a circular character, ıd so on.

The amount of the light which is reflected om the picture will obviously depend pon whether the exploring spot is passing ver a dark or a light portion of the picture. f it is passing over a dark portion, less ght will be reflected, and conversely. he reflected beam thus varies in intensity r strength in accordance with the features f the picture as the exploring spot passes ver them.

Now it will be evident that the exploring pot will be unable to pick out objects r details of the picture which are smaller han itself. Therefore, in order that fair etail may be picked up from the transmitted picture, it is essential that the xploring spot be at least as small as the etails which are to be brought out.

Analysing the Picture.

Let us take, as a very rough notion, square spot 1-20th in. square. When his spot has travelled down the picture t the left-hand edge, and is making its econd journey, it will be clear that its econd path should as nearly as possible e edge-to-edge with its first path, without ither overlapping or leaving a space. f perfect conditions are secured, the xploring spot must make 20 excursions n the space of an inch along the upper dge of the picture; or, if the picture is 0 in. wide, a total of 200 excursions in rder to get across the picture. The whole picture must be explored in this way in a period of time which is smaller than 1-16th of a second, as the whole system depends upon what is known as the "persistence of vision."

Here are the "Snags."

It has been found that if the eye receives a number of separate but slightly differing impressions at the rate of not less than about 16 per second, they are not distinguishable as separate impressions, and the brain receives them as a continuously-moving effect. As a matter of fact, although 16 pictures per second must be sent, the actual time for the exploration of the picture is considerably less than 1-16th of a second; and, to put the most favourable construction on it, we may put it down as 1-25th of a second. It has even been estimated by some experts in America as being 1-80th of a second. However, let us take it as 1-25th of a second for the moment.

The exploring spot, then, has to make 200 tracks across the picture in 1-25th of a second, or it makes one passage across the picture in 1-5,000th of a second.

Now let us see what is going to happen when the spot is passing over a fairly small detail of the picture. Let us suppose that the detail in question is a man's eye, and that it occupies an area of 1-20th of an inch square in the picture. The exploring spot will travel over this feature (since it has to travel 10 in. in 1-5,000th of a second) in 1-1,000,000th of a second (one millionth of a second).

The variation of the intensity of light in the picture which is to be transmitted is sent out as a modulation upon a radio carrier-wave. If we use a wave-length of about 100 metres (which is about the kind of wave-length that investigators in this field have used) we have a carrier-wave frequency of approximately 3,000,000 vibrations per second. Therefore, we have to impose upon this carrier-wave a modulating feature which persists over the duration of only three oscillations or waves of the carrier-wave itself.

I will not attempt to enter into the question as to the possibility of modulating a carrier-wave at this enormous frequency, or into the still more vexed question as to the handling of such modulation frequency by the valve apparatus either at the transmitting or at the receiving end. Those who are expert in the theory of radio transmission and reception by valve apparatus will readily appreciate that this is an extreme problem.

The figure of 1-1,000,000th of a second was arrived at by considering a detail of 1-20th in. square in a picture 10 in. × 10 in. But, as a matter of fact, this is stating the problem in far too easy terms, for, in order to obtain proper "detail" to make the picture comparable with a real picture as ordinarily understood, it would be necessary to give the equivalent of a much finer "screen," and it is propable that by the time really adequate conditions were reached we would find ourselves called upon to transmit details of the picture, the transit time of which was 1-10,000,000 or 1-20,000,000th of a second, or even considerably less.

It must also be remembered that the exploring apparatus at the transmitting end and the corresponding apparatus at the receiving end are basically mechanical, and it is not difficult to appreciate that extreme mechanical refinements are necessary *properly* to explore a picture in a manner to correspond to a "screen" of even so coarse a grade as 50 to the inch.

More Difficulties.

But this is by no means the only difficulty involved. At the transmitting end, the light received from the exploring spot must be made to operate a light-sensitive device, such as a "photo-electric cell." This device must be able to respond to *variations* in the strength of luminosity, which may in any case be feeble in average strength, and, furthermore, it must respond faithfully at the enormous speed of variation which has been indicated above. Television experimenters have, as a rule, maintained secrecy with regard to their photo-electric pick-up devices, but from my general experience of this subject (and I think other scientific men will have no hesitation in agreeing with me) it seems exceedingly unlikely that a photo-electric device, capable of responding to variations in an already feeble illumination and at a rapidity represented by a change in 1-20,000,000 of a second, will be forthcoming in the near future.

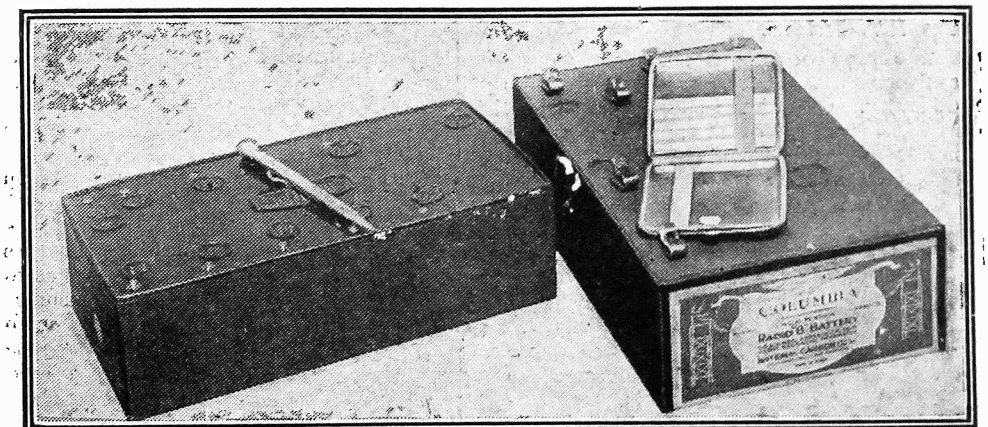
In thus outlining the main difficulties involved in television, and in stating, in effect, my opinion that television, so to speak, "has a very long way yet to go," I do not wish to be unduly sceptical as to the prospects of development, nor do I seek to minimise in any way the efforts and achievements of those who are studying this problem in different parts of the world. But at the same time I feel that the obstacles in the way of any appreciable further progress are so enormous that undue optimism and pious hopes ought not to be indulged.

It may be that some totally new principle will be discovered, but at present that appears to be extremely unlikely.

So far as I am concerned, I can only say that if anyone can reproduce, by television, moving pictures even remotely comparable with those shown by the present-day cinema, and if they can do this within the next ten years, they will have accomplished something which is entirely beyond my humble expectation or the expectation of any of the distinguished scientific friends with whom I have ever discussed this matter.

"I do not wish to be unduly sceptical," says our Scientific Consultant, "nor do I seek to minimise in any way the efforts and achievements of those who are studying this problem. . . . But, at the same time, I feel that the obstacles in the way of any appreciable further progress are so enormous that undue optimism ought not to be indulged in."

DON'T DO IT!



A sure way to spoil an H.T. battery is to short it. This can be easily done by carelessly putting a metal pencil, cigarette-case, or similar object on the battery. This is a sure way to spoil a battery that might with fair treatment have lasted months longer.

BUILDING A HOME "TELEVISION" OUTFIT!

In the first issue of "Television" the constructor is invited to build a home television outfit and, as we have always made it our business to advise amateur constructors, we publish below an impartial but critical review of the instructions given.

By G. P. KENDALL, B.Sc.

MY own attitude towards this televisor is that of the keen constructor exploring for the first time what seems superficially a most fascinating field for experimental work. Naturally, one's first impulse is to inquire what results will be forthcoming when the apparatus has been built, and, after reading the whole article carefully, it was realised that the instrument seemed to be of the nature of a working model rather than a practical equipment for reproducing images transmitted from a distance. All that should be expected, apparently, is that simple objects placed in one part of the apparatus will be reproduced in outline at another point in the same instrument.

An Expensive Valve.

One's next thought is obviously as to the cost of the outfit, and at first sight this does not seem likely to be very heavy. On looking into the point a little more closely, however, two features are discovered which put a very different complexion on the affair. First, it is to be observed that the last valve of the L.F. amplifier "should be of the transmitting type (for example, a Mullard O.40)."

Now, the O.40 valve costs £2 15s., according to my list, and requires an 8-volt accumulator large enough to supply its filament with the necessary 2·4 amps, which means a pretty big battery (remembering that there are four other valves as well). In some cases it may be possible to run this filament with A.C. from a step-down transformer, but there are considerable difficulties.

The other financial point concerns the H.T. supply, and here one learns that "As much as 600 to 700 volts may be necessary on the circuit shown to give a bright image." (NOTE.—No circuit is shown in this article.) At this point it becomes obvious that the cost is going up by leaps and bounds. Where is one to get a 600-volt direct-current supply capable of running a valve as big as the O.40?

The H.T. Problem.

The problem is a familiar one to the amateur transmitter, who realises its difficulty. One of the simplest and most satisfactory solutions is to use a high-tension motor generator running either from the mains or a 12-volt accumulator of considerable size, but the cost of such a machine will be in the neighbourhood of £20 to £25, unless one is very lucky in getting an ex-Government outfit really cheap. Again, it is possible to make a rectifying and smoothing apparatus to work from A.C. mains with a step-up transformer; but even so the expenditure will be heavy, and the job is most emphatically one for a really experienced experimenter who is familiar with the risks.

So much for "What will it do?" and "What will it cost?" Now comes the final question, "Will it be easy to make and operate?" Here again my first impression on looking over the design and considering its construction was that nothing very difficult was involved. Certainly, the actual constructional work seemed such as any reasonably handy man with a few tools could tackle successfully, but on turning to the operating side I was very greatly surprised (I choose my words carefully) to find that no less than FIVE stages of TRANSFORMER-COUPLED L.F. amplification are recommended in quite a matter-of-fact fashion.

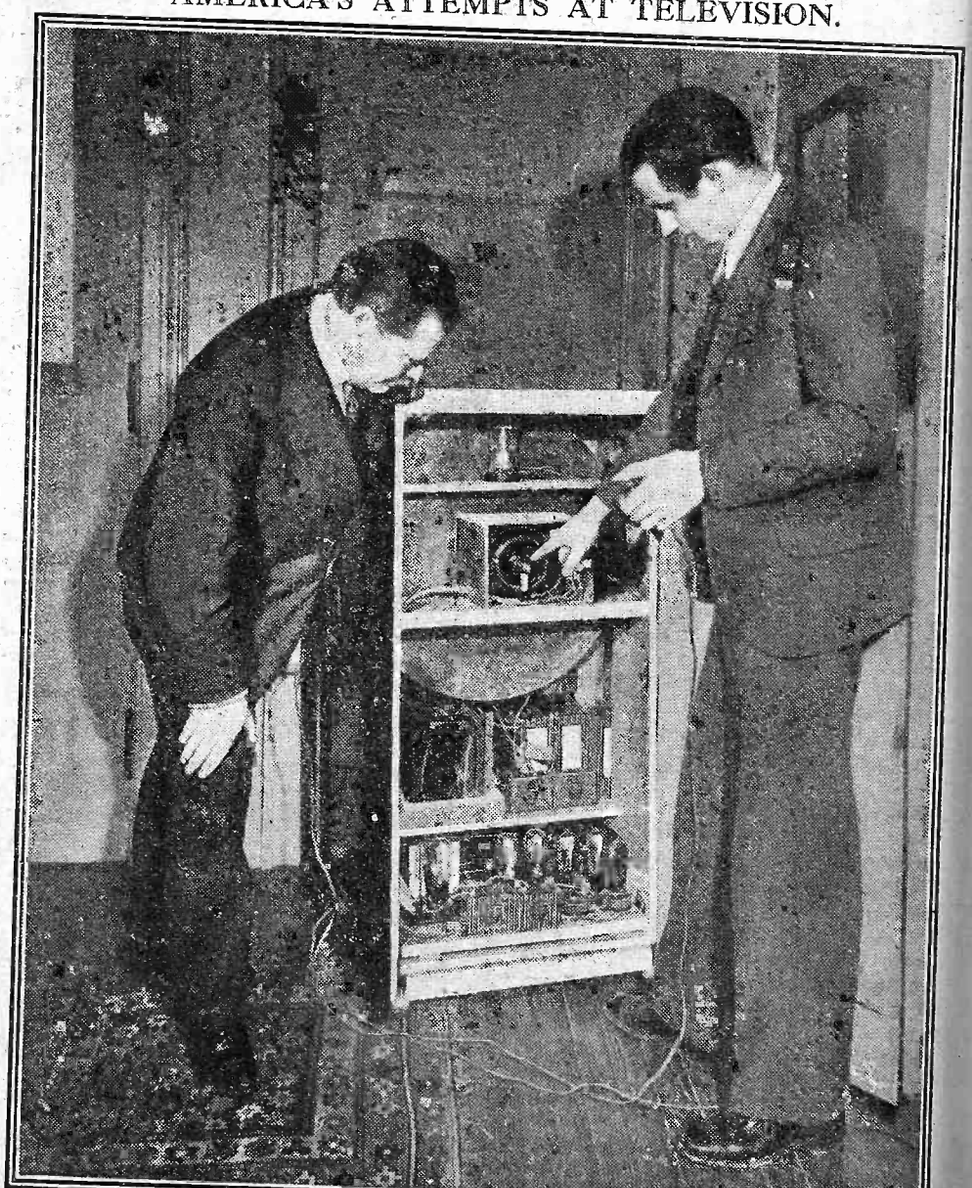
I do not propose to go very far into technical details on this point, but I think that it should be pointed out that to stabilise and operate such a circuit is an extraordinarily difficult task for even a fairly experienced experimenter.

It is a job from which a good radio or telephone engineer would shrink if he were limited to the resources of even quite a well-equipped amateur.

A Grave Danger.

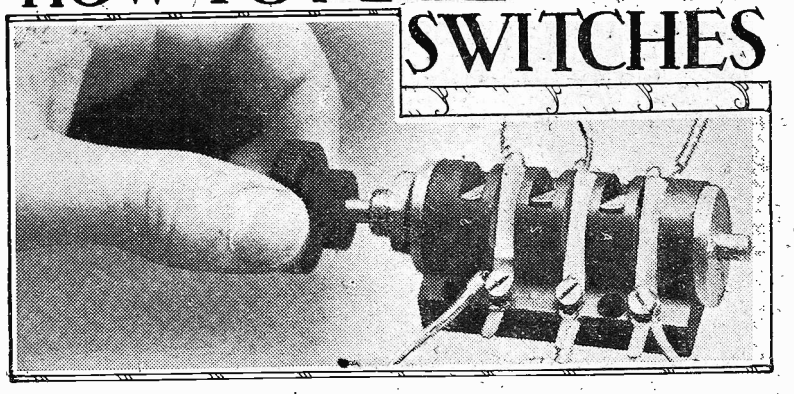
Finally, what about the difficulty of handling the "600 to 700 volts" which is advised for the H.T. supply to the last valve? Having had some experience of high-power amplification work for moving-coil speakers, the first thing which strikes me here is the very serious danger involved in the use of voltages like this without far more elaborate precautions than any ordinary constructor is likely to think of taking, unless he is most solemnly warned and unless appropriate safety devices are explained in detail. The risk is a very grave one. Such voltages are quite capable of administering a *fatal* shock.

AMERICA'S ATTEMPTS AT TELEVISION.



Backed by the gigantic resources of the General Electric Company, Dr. E. F. W. Alexanderson is tackling television problems at Schenectady, N.Y. He is shown above (left) inspecting an outfit designed for television in the home.

HOW TO MAKE PANEL SWITCHES



A little patience, very little skill, and some pieces of "junk" are the main ingredients of a neat, efficient, double-pole, double-throw, push-pull type of switch.

By A. V. D. HORT.

BARREL switches combine some of the advantages of lever-operated panel switches with those of the open switchboard type. A barrel-switch can have quite heavy contacts, and yet it can be mounted behind the panel, operated by a single knob in front of it. The switch shown in the photograph was made to carry fairly heavy currents, while neatness of the exterior of the apparatus was a consideration.

The component shown provides for a 4-point double change-over, but by making the shaft longer or shorter switches may be made on similar lines of any required size. The minimum length of shaft required between the blades of the switch is $\frac{3}{8}$ in., to allow clearance between the contacts. To lower the capacity between the contacts, the distance between the blades is $\frac{3}{4}$ in. in the switch illustrated.

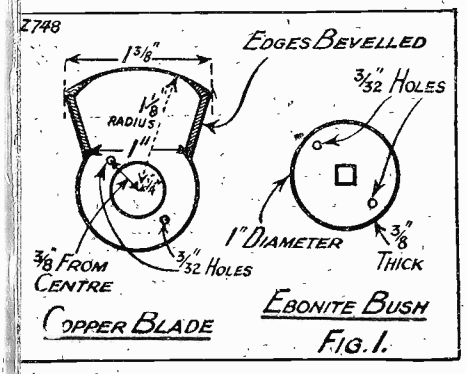


FIG. 1.

The shaft is a variable condenser spindle, which has a squared portion in the middle. Ebonite bushes are "keyed" on the shaft by means of square holes through their centres, and the switch-blades are mounted on the bushes, so that they are insulated from the shaft. Fig. 1 gives the dimensions of the parts needed for one blade and its bush. The blade is cut out of No. 20 gauge copper sheet. A $\frac{3}{16}$-in. hole is drilled through the centre of the bush, which is cut from $\frac{1}{2}$-in. ebonite rod.

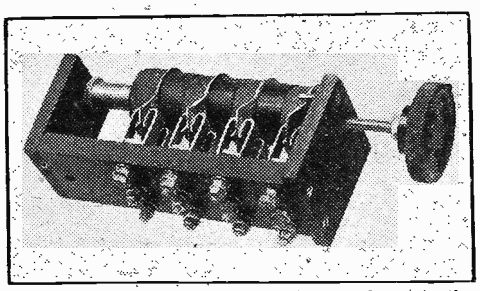
Mounting the Blades.

Then the shaft is heated, and the squared portion is pushed through the hole to cut its own "keyway." Do not have the shaft too hot—just hot enough for it to burn its way through slowly is sufficient, or the bush will be damaged. Drill the $\frac{1}{2}$-in. hole in the blade, and the two smaller holes outside this.

Place the blade on the bush, with its large hole concentric with the square hole in the latter, and mark on the ebonite the centres of the small holes. Drill them about $\frac{1}{4}$ in. deep, put on the blade again, tap in two pins of No. 14 S.W.G. wire, and file them off flush with the surface of the blade. The blade is then ready for mounting on the shaft.

Constructing the Frame.

Put on one end of the shaft a nut, a flat washer, a $\frac{1}{8}$-in. thick ebonite bush, and the blade and $\frac{3}{8}$-in. bush, in that order. Prepare the next bush and blade, but do not mark the centres of the pinholes in the bush yet. Assemble the second blade on the shaft



Here is the completed switch. The one shown in the heading photograph is a commercial type of barrel switch.

with its bush, and align the edges with those of the first blade. Slide off the blade and bush together, taking care not to separate them, and mark the centres of the pinholes on the ebonite. This procedure ensures that the blades are correctly aligned when the switch is assembled.

If the shaft is too long for the blades, the "spare" part of the squared portion may be filled with large condenser spacing washers, the whole assembly being clamped with nuts at each end. In the switch shown extra $\frac{3}{8}$-in. bushes are placed between the blades to space them.

The frame of the switch is constructed as shown in Figs. 2, 3 and 4, the top and ends being screwed together. Small spacing washers are let into the ends, as bearings for the shaft. When the completed shaft is in the frame, mark the positions for the rows of contact clips. Three clips are needed for each blade, bolted through the top of the frame. On assembling the switch, the blades should pass smoothly in and out of the clips, the bevelling of their edges assisting this motion. To prevent the blades from passing right out of the clips, stops are fitted in one end plate.

The switch is most conveniently mounted with bolts through the panel and the front end of plate. The shaft projects through the panel, and a knob is fitted for operation.

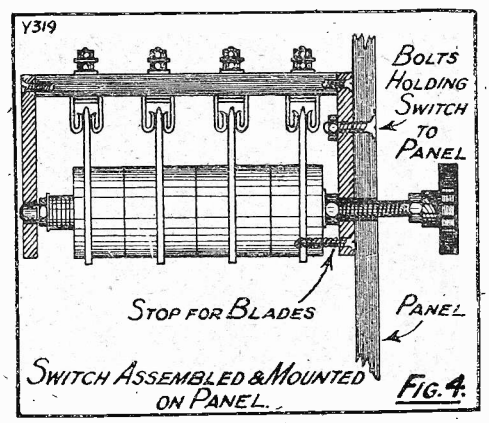


FIG. 4.

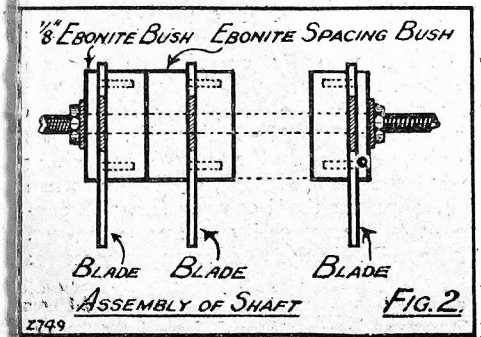


FIG. 2.

B.B.C. BREVITIES

2 L O, the London Station, was opened on October 14th, 1922.

* * *

The Birmingham Station began broadcasting on November 15th, 1922, and the Manchester Station started on the same day.

* * *

It was on Christmas Eve, December 24th, 1922, that the Newcastle Station called the British Isles for the first time.

* * *

Cardiff commenced its official broadcasting career on February 13th, 1923.

* * *

Glasgow gave its first programme on March 6th, 1923.

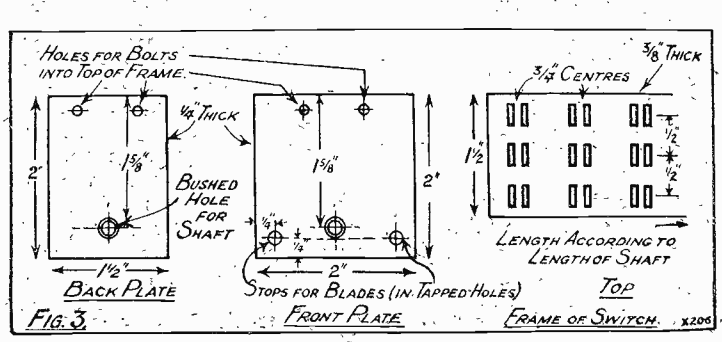


FIG. 3.

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

METHODS OF AMPLIFICATION

THE "LIGHT" SPEAKER—LIVES OF RADIO SETS—SUPPLY DEVICES.

Methods of Amplification.

THE amplification of gramophone record reproductions by means of pick-ups is usually effected by simple low-frequency amplification of the electrical impulses received from the pick-up device. According to one system, however, the electrical impulses from the electrical pick-ups are used to modulate the high-frequency oscillations in a self-excited oscillatory circuit, the energy from which is then transferred to the high-frequency input side of the receiving circuit (usually to the detector) by means of a plug-jack or alternatively by a throw-over switch. The receiving circuit may thus be connected either to the aerial (for reception of broadcast) or to the oscillator circuit which, as already mentioned, is modulated by the electrical signals from the gramophone pick-up.

Quite good results can readily be obtained by means of an electro-magnetic pick-up, the making of which is within the scope of the home constructor, and a number of constructional articles dealing with this component have already appeared.

In view of the great popularity of wireless receivers, it seems to me that the method of electrical reproduction from the gramophone is likely, in course of time, to supersede altogether the direct method of reproduction from the record as used exclusively in the gramophone of a few years ago.

"Light" Speaker.

There have been, during the last couple of years, all kinds of artistic devices incorporating loud speakers, the ornamental exterior taking the form of figures, vases, lamp-shades, ships and so on; the "ship" variety seems to be having quite a run of popularity in the 'States at the present time.

I see that a rather ingenious form of combined ceiling lamp and loud speaker has been designed by C. A. Volf, a well-known American radio engineer, and is known as a "light" speaker. It is designed so that any standard reproducer unit may be used with it.

Apart from the shell of the device being in the form of a lamp, it has the rather novel feature that it includes both a horn and a cone loud speaker. There are two separate reproducer units, the sound from the upper one passing up a vertical tube, then being reflected downwards, whilst the lower unit is directly connected by means of a driving pin to the centre of the cone, the latter being in a horizontal position and forming the lower external part of the whole device.

The horn type of loud speaker is generally better for the reproduction of higher-pitched tones, whilst the cone speaker is adapted for the reproduction of lower notes; by the use of these two together it is claimed that faithful reproduction of the whole of the audio scale is obtained.

Lives of Radio Sets.

How long should a radio set last? This is a question which is often asked by beginners or those contemplating the purchase of a set, although the question seems rather a curious one to the experienced experimenter since, in the ordinary way, apart from the valves and the batteries, there is nothing in the set itself to wear out. It is hardly like a motor-car where, in the course of normal use, there is definite wear and tear.

It would probably be true to say that with ordinary care the essential components of a radio receiving set should last indefinitely, and the receiver should only die of "old age" in the sense that the circuit or the components might become obsolete.

Of course, with any carelessness in the handling of the set, or even with an accident that may happen to the most cautious user, such a thing as a burnt-out transformer or condenser may result, but it is a simple matter to replace a component of this kind at relatively small cost.

The valves naturally have a limited life, but even these, especially if of any of the better-class modern makes, should last for a very long time with careful handling. Of course, the real maintenance cost of a set relates to the high-tension and low-tension batteries, particularly the former.

Supply Devices.

If one of the various electric-supply devices is used for the H.T. and L.T., there is really no appreciable wear and tear or deterioration of the receiver, except in regard to the valves, and here again, as I have already indicated, the improvement in valve manufacture has been so rapid during the past two or three years that the present-day receiving valve is a remarkably stable and long-lived component. A receiver equipped with high-grade valves and provided with an electric supply device operating from the mains for the H.T. and L.T. and grid bias, is just about as near a no-trouble outfit as can reasonably be expected.

"MIKE" AT AN ELECTION.

Are you in favour of broadcasting politics? Opinion seems very sharply divided on this question, some considering it would be very boring. Meanwhile, "Mike" is peacefully penetrating into election campaigns, and, as shown above, is invading village greens in these causes.

NEWS FROM SAVOY HILL. FROM OUR OWN CORRESPONDENTS.

A REMARKABLE PLAY.

MISS CABLE ON TIBET—BELFAST NEWS—A NEWCASTLE EVENT.

A Remarkable Play.

Here is something about "Rampa," the important four-act play by Max Mohr, which has had a great success as a stage production, and which Mr. Cecil Lewis has translated and adapted for radio. It is the story of a man, who after the death of his partner in the frozen Northern wastes, becomes friendly with bears and other animals until eventually, using only their language, he loses the power of real speech. Later, when rescued, he is bought by the proprietor of a travelling circus, manacled and exhibited in a cage as a "beast man."

Subsequently he becomes the property of a doctor, who by experiments restores him to a natural human being, though the only gratitude the benefactor receives is that the man goes off with his wife. We last see him, standing on the quay-side watching boats leave for the North, longing to return to his former animal companions, and convinced of the hypocrisy of human nature. "Rampa" is in the London programme for Wednesday, March 7th.

(Continued on page 38.)

The "Handyman" Two

PART II.

Embodying the ever-popular "Det. and L.F." circuit, this home-made receiver is efficient on both long and short waves. In this article the final details are given, including the method of constructing coils for Sydney (N.S.W.), East Pittsburg, and the other short-wave stations.

By G. P. KENDALL, B.Sc.

CONTINUING the general description of the "Handyman," it is to be noted that in addition to the usual features detector circuit, there are two devices provided to enable the best results to be obtained on short waves. The first of these is a small fixed condenser, which can be brought into circuit in series with the aerial by connecting the aerial lead to the terminal A_1 instead of A_2.

Short Wave Features

This condenser is exactly the same as the one used for the same purpose in the "Sydney" Two, and consists of two pieces of copper sheet mounted horizontally with a light space (about $\frac{1}{8}$ in. at first; adjust later by bending) between them, on a strip of ebonite. A detailed diagram of this condenser will be given in "Radiotorial" next week for the use of readers who do not possess "P.W." No. 284.

The other point is the use of a potentiometer to adjust the grid potential of the detector valve (through the grid leak), and this is a very useful feature on all waves. A very little experimenting with the position of the slider will enable you to find a setting which gives you the smoothest reaction control combined with the loudest signals. As a rough guide it may be mentioned that this is usually about two-thirds of the way from the positive round to the negative end of the potentiometer.

Just one point calls for mention concerning the constructional work, which can otherwise be followed out from the diagrams and photos. The reaction condenser used in the original set was an Ormond, and this has two sets of fixed plates, and one of moving. To obtain the full capacity the two sets of fixed plates are joined together, whereas in most other types only one connection would be made. This point is mentioned lest someone using an alternative make should be puzzled by the extra connection on the wiring diagram.

Operating the set is simple. For the detector a valve of the H.F. type is advised, with a small power or L.F. valve in the other socket. (If you are very near to your

(*Continued on next page.*)

POINT-TO-POINT CONNECTIONS.

One filament socket of each valve holder to one side of each respective rheostat.

Remaining sides of rheostats joined together, to one end of the potentiometer winding and to one side of the L.T. switch.

Other side of L.T. switch to the L.T.+ terminal.

L.T.— to H.T.— terminal, to the G.B.+ plug via a flexible lead, to the remaining end of the potentiometer winding, to the remaining filament contacts on the valve holders, to the earth terminal, to the extreme right socket on the 4-socket base for the aerial coil unit, and to the moving vanes of the reaction condenser and the secondary tuning condenser.

Fixed vanes of the reaction condenser (there are two sets of fixed vanes, and they should be joined together by a piece of wire) to the right hand reaction socket on the aerial coil unit base. The socket is the second from right looking at set from back of baseboard.

Remaining reaction socket to one tag of the ·001 mfd. fixed condenser.

Other side of ·001 mfd. fixed condenser, to the plate of the 1st valve holder and to one side of the H.F. choke.

Other side of H.F. choke to the IP of the L.F. transformer.

OP to the H.T.+1 terminal.

Grid of the 1st valve holder to one side of the grid-leak holder and to one side of the ·0003 mfd. fixed condenser.

Other side of ·0003 to the left-hand socket on the aerial coil unit base, and to the fixed vanes of the secondary tuning condenser.

Remaining side of grid-leak holder to the handle (or slider) on potentiometer.

OS of the L.F. transformer to the grid of the 2nd valve holder.

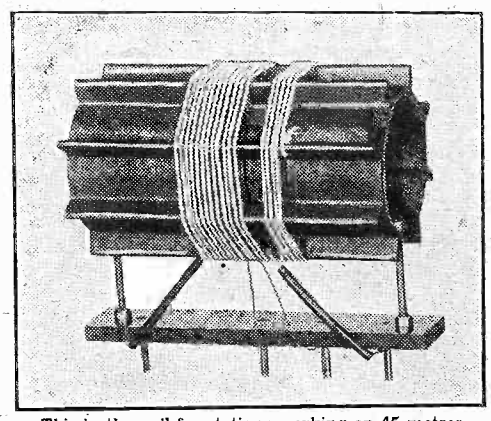
IS to the G.B.— plug via a flexible lead.

Plate of 2nd valve holder to the L.S.— terminal.

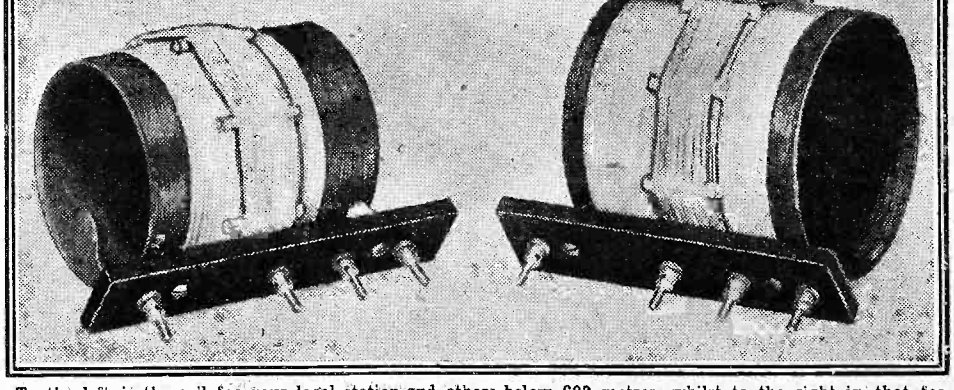
L.S.+ terminal to the H.T.+2 terminal.

Aerial A1 terminal to one side of the two plate air condenser.

A2 terminal to the remaining side of the condenser and to the aerial coil tapping clip via a flexible lead.



This is the coil for stations working on 45 metres. The tuning with this coil will go up as high as 60 odd metres for K D K A, etc.



To the left is the coil for your local station and others below 600 metres, whilst to the right is that for Daventry, 5 X X, Hilversum, Zeesen (Berlin), and the other excellent long-wave transmissions now "on the air."

THE "HANDYMAN" TWO

(*Continued from previous page.*)

local station and get very strong signals a power valve is most desirable). The H.T. on the terminal H.T.+1 should be about 60 volts, or perhaps a little less, for most valves. At least 100 volts is desirable on H.T.+2 for loud-speaker work.

One other point. Do not forget to try the tapping clip on each aerial tapping point in turn.

The coils used in the "Handyman" are exactly the same as those employed in the "Reinartz One Valver," described in "P.W." No. 273, but the specification will be repeated for the benefit of those who may not possess this issue, commencing with the unit for the ordinary B.B.C. waves.

It is wound upon a piece of insulating tube, 3 in. in diameter and 3½ in. long, and consists of three separate windings. The largest is the secondary, consisting of 50 turns of No. 24 double cotton-covered wire in a single layer, the ends being secured by passing them through small holes in the tube in the usual way. The beginning of this winding is half an inch from one end of the tube, and the finish is about an inch and a quarter from the other end of the tube, leaving a space upon which the reaction winding will be placed. This consists of 30 turns of No. 32 double-silk-covered wire in the same direction as the secondary.

THE AERIAL COIL.

Over the top of the finishing end of the secondary is wound the aerial coil, consisting of 25 turns of No. 24 D.C.C. in the same direction as the secondary. This winding is supported away from the secondary by a simple scheme. Eight pieces 1½ in. long are cut from one of the sticks used as stiffening in a packet of "Glazite," and equally placed round the coil, being held by a rubber band until gripped by the winding. Tapping points are made at the tenth, fifteenth, and twentieth turns as winding proceeds by twisting up a small loop in the wire which is subsequently scraped bare, so that a tapping clip may be attached. The end is also fastened off and left projecting to the extent of about half an inch for the same purpose.

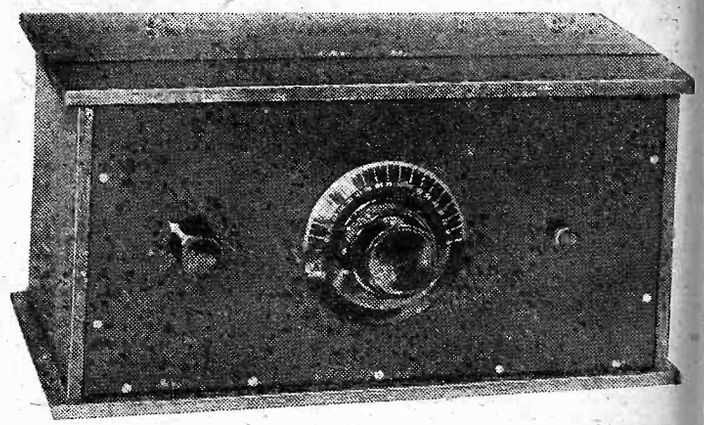
The coil is mounted upon a strip of ebonite 5½ in. long and 1 in. wide, carrying four "Eelex" plugs. It is attached by two brass screws and nuts, and spaced away from the strip by means of two of the insulating sleeves which are supplied with the plugs, and which are not otherwise required. These are slipped over the screws, between the ebonite strip and the coil former. The screws, of course, are placed near the ends of the former.

The base or socket into which the coil plugs consists of another strip of ebonite 6 in. long and 1 in. wide, carrying four "Eelex" sockets, and fastened to the baseboard by means of two screws passed through two more of the insulating sleeves, so supporting it just clear of the wood. Looking at the wiring diagram, the spacing between these sockets is 1 in., 1 in., 2 in.

The connections are as follow. With the coil placed in the set, imagine that you are looking at it as it would be seen in the wiring diagram. Then to the right-hand pin is connected the finish of both aerial and secondary windings. The other end of the secondary goes to the left-hand pin. The reaction coil is connected to the two middle pins, the end nearest the secondary going to the right-hand pin, and the end furthest from the secondary to the left-hand pin.

The coil for the Daventry range is made in exactly the same way, but on a 3½-in. diameter former, and the details are as follow: Aerial, 80 turns of No. 34 S.S.C. wire (with a tapping at 60); secondary, 170 turns of No. 34 S.S.C. wire; reaction, 60 turns of No. 34 S.S.C. wire.

* * *



The "Handyman" Two complete. The cabinet is a home-made one, built from a set of parts, and full details of this part of the construction at work were given in last week's issue of "Popular Wireless."

* * *

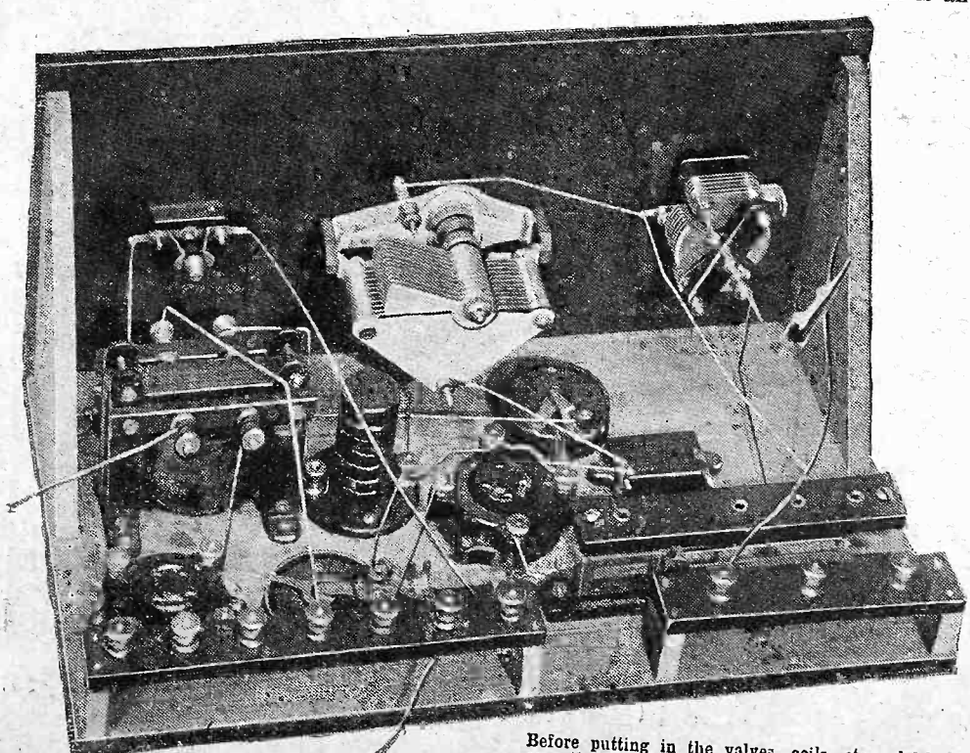
Until quite recently the reception of short waves was decidedly a hobby for the ultra-enthusiastic amateur, who was often so keen on the subject that he took only a passing interest in ordinary broadcast reception. We have all heard his favourite theory to the effect that the only correct procedure is to have one set for broadcast reception, and another very special one for short waves.

As a "counsel of perfection" this is all very well, but short-wave reception is now appealing to a much wider circle, simply because there is now a good deal of actual broadcasting going on below 100 metres, and to the ordinary listener the idea of two separate sets seems an extravagance.

In the case of the "Handyman" Two, however, by taking particular pains to include the special features desirable in a short-wave receiver it has been found possible to get really good results on short, medium and long waves merely by plugging a suitable coil unit into the holder. Details of the special short-wave coil follow, but first some notes should be given on short-wave working in general.

The first thing which you must realise is that the tuning and reaction adjustments are both much more critical on the lower waves, and a lighter touch must be cultivated in consequence. You must learn to turn the tuning dial *very* slowly and carefully, lest you miss stations altogether, and to adjust reaction very delicately.

Again, you must adjust the set very carefully so that the smoothest possible reaction control can be got, and this is done by trying different voltages on H.T.+1, and adjusting the position of the potentiometer slider. You will probably find that reaction becomes smoother as you take the slider towards the negative end, but if you go too far strength of signals will suffer.



Before putting in the valves, coils, etc., check over the wiring by the list of connections given on the previous page.

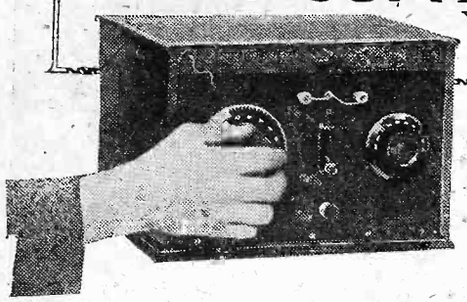
The Valves Recommended.

Now as to valves. In all the well-known makes the H.F. type will enable you to get plenty of reaction, but the use of cheap foreign valves (especially 2-volters) may lead to trouble, and it may then be necessary to use one of the power type as detector to get the set to oscillate.

The short-wave coil is wound on a standard Redfern former, 5 in. long, 3 in. diameter, with 8 ribs. The windings for a unit to cover about 35 to 70 metres are as follows. Secondary, 12 turns No. 24 gauge wire (bare or covered) spaced out to occupy about 1 inch. Aerial winding (primary), 5 turns of the same wire, with a tapping loop twisted up at the third turn. Reaction, 6 turns of No. 34 D.S.C. wire wound in a saw cut in the ribs immediately underneath the end of the secondary nearest the aerial winding, and in the same direction as the secondary.

To enable you to get down to the stations working between 20 and 35 metres (2 X A F, Sydney, etc.) you will need another unit with 6 turns secondary, 4 primary (tap at 2), 5 reaction, made in the same way.

HOW TO CONTROL VOLUME



Correct and incorrect methods compared and explained in an interesting manner. By O. J. RANKIN.

VOLUME control means the regulation of the degree of sound from the loud speaker. This is usually effected by switching L.F. amplifying valves in or out of circuit, but, owing to the almost universal use of the modern "point one" dull-emitter valve, such a method is becoming less popular, and it is becoming more usual

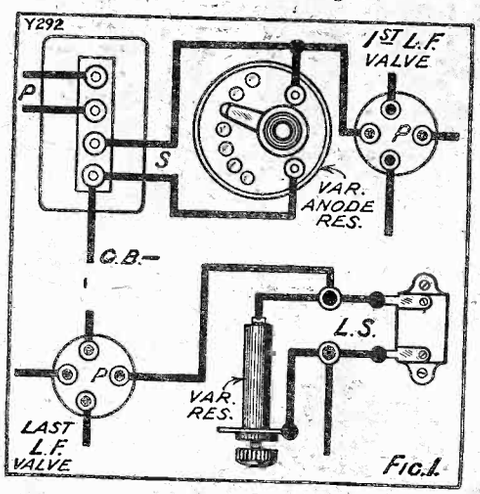


FIG. 1.

to dispense with complicated switching systems and employ the more simple and practical method of inserting a variable damping resistance in a suitable part of the circuit.

An Easy Method.

In the case of a multi-valve receiver with a stage of H.F. amplification the volume may often be reduced, without introducing distortion, by dimming the filament of the H.F. valve, and it will sometimes be found advantageous to place the H.F. rheostat on the panel so that it may be adjusted, if necessary, to give the desired effect. The rheostat, of course, should be well made and capable of smooth adjustment.

It is, however, a great mistake to imagine that the same method may be adopted when no H.F. valve is used. Dimming the filament

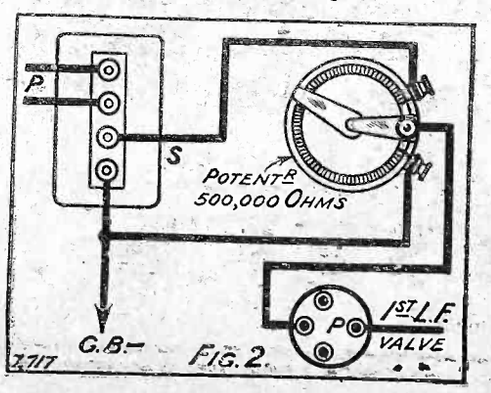


FIG. 2.

of a detector valve will cause distortion, as will also the dimming of the L.F. valve filaments.

Three common make-shift methods, often tried but seldom adopted, are: (1) Detuning the aerial circuit; (2) decreasing the H.T. battery current; and (3) altering the value of the grid-bias battery. With the first mentioned it is sometimes possible to obtain a decided decrease in volume with very little distortion, but the two latter methods can, for obvious reasons, only result in failure, distortion being unavoidable.

Use of Potentiometers.

Other common mistakes are illustrated in Fig. 1. In the upper sketch a variable resistance (usually a tapped anode resistance having a value of from 15,000 to 100,000 ohms) is connected directly across the secondary winding of the first L.F. transformer, and in the lower sketch a variable resistance (having a similar value) is shunted across the loud-speaker terminals. Both methods are incorrect, and should be avoided at all costs.

Fig. 2 shows the correct method of connecting a variable resistance across the secondary terminals of the first (low-ratio) L.F. transformer. Here the resistance consists of a 500,000 ohms potentiometer, and it will be seen that the "ends" of this go direct to the transformer and the arm to the grid of the L.F. valve. This is the only method whereby the input to the grid of

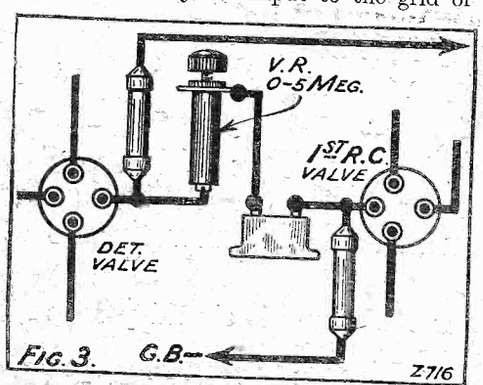


FIG. 3.

the first transformer-coupled L.F. valve may be controlled effectively without impairing the purity.

In the case of a detector valve followed by one or two resistance-capacity coupled amplifiers, good results are often obtained by placing a variable grid leak in series with the plate of the detector valve and the first coupling condenser in the manner shown in Fig. 3. The maximum value of the leak should be 5 megohms, and if arranged to short out at the zero position the volume may be adjusted from full strength down to one-tenth full strength without causing distortion.

Generally, however, the arrangement shown in Fig. 4 will be found more satisfactory. Here the first coupling condenser is connected to the plate of the detector valve as usual, but the first grid leak is replaced by a 500,000 ohms potentiometer, one side of which is joined to the other side of the first coupling condenser, the other side to the negative grid-bias wander-plug, and the moving arm to the grid of the first L.F. valve. This gives a perfectly smooth control without affecting the purity, and the method can be highly recommended for use in conjunction with resistance or choke-coupled amplifiers.

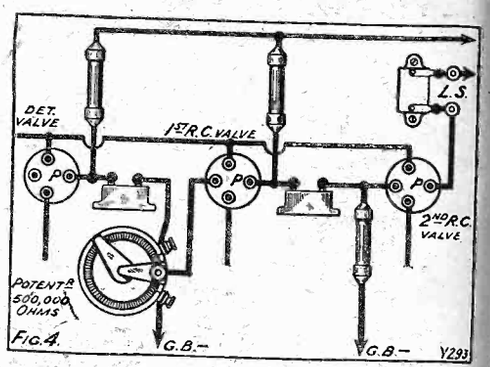


FIG. 4.

TELEPHONE EXTENSIONS.

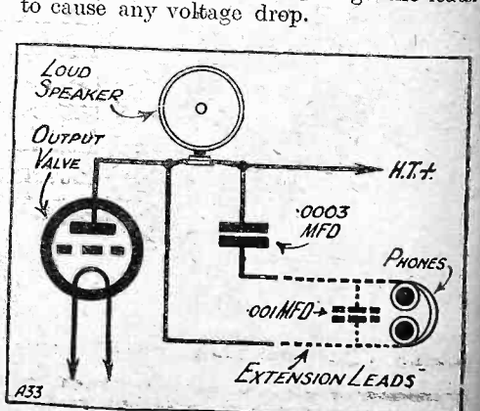
NO doubt many of us, at some time or another, have wished to run a 'phone extension to another room, perhaps to an invalid in bed, and have also wished to work the loud speaker direct from the set at the same time. Now, in the ordinary course of events, the volume at the end of the extension would be loud-speaker strength, at any rate far too great for ordinary listening on 'phones, but there is a method by which the volume can be cut down to comfortable 'phone strength, and yet in no way affect the loud speaker.

A Simple Scheme.

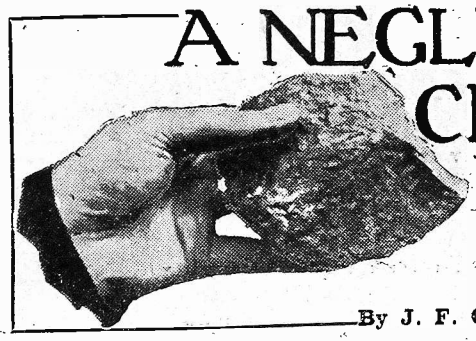
All that need be done is for a fixed condenser of fairly small capacity, say ·0003 mfd., to be inserted in series with the extension lead joined to H.T.+, the capacity determining the volume; if desired, a miniature variable condenser, such as the Formodenser, could be used, and this would act as a volume control. The diagram should clear up any difficulties.

Should reproduction be inclined to be in any way coarse, a ·001 mfd. fixed condenser shunted across the 'phones may modify the tone favourably.

An additional advantage is the fact that no H.T. current wanders through the leads to cause any voltage drop.



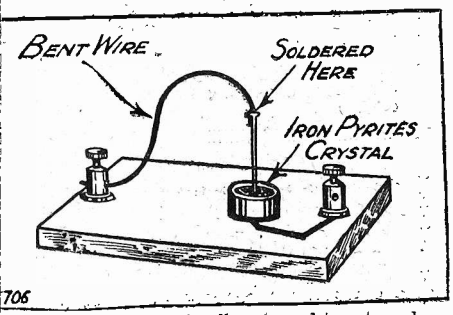
A NEGLECTED CRYSTAL



Iron Pyrites can be picked up in certain parts of the country or it can be made quite easily by the experimenter. And it is a most excellent rectifier.

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

has often seemed to me to be a strange fact that the use of iron pyrites never really "taken on" this country. Probably, course, the reason for this y be looked for in the nparative scarcity of the neral in good sensitive dition in the British Isles, l in the superabundance the galena mineral which shipped over here from nes in France and in Spain. But *is* iron pyrites exactly rce over here? Vast quantities of the neral are shipped to England from Italy the purpose of manufacturing sulphuric d; but, quite apart from this fact, there e regions up and down England in which ecimens of the pyrites may be picked up the roadside or hammered out of arries, and, very often, quite 60 per cent the mineral so obtained provides an cellent material for crystal-set working. I am still more than ever confirmed in this inion by the fact that from time to time aders send me specimens of sensitive nerals which they have picked up in



This simple detector is all you need to get good results with iron pyrites.

arious districts, such crystals almost inariably turning out to be composed of iron yrites.

The great characteristic of iron pyrites s a radio rectifier is the high degree of tonal urity which it produces in the reception. or this reason, the pyrites not only makes n excellent rectifier for crystal-set use lone, but it is also very well adapted for se in crystal-valve receivers. Used in sets f the latter description, a crystal of iron yrites often removes "mush" and xtraneous noise from the reception, and, hould a loud speaker be employed in conunction with the set, the tonal purity of he reception will often be startlingly imroved in consequence.

Extremely Simple to Make.

Iron pyrites can be used as a rectifier in nany ways. Generally, however, it is best mployed with a fairly rigid cat's-whisker ontact. The exact nature of the metal ontact is not very material to the results btained, though it is probably true that a rass, phosphor-bronze, or a steel contact gives rather better results than any others. An ordinary pin or needle used in contact vith iron pyrites, in the manner illustrated n the diagram (Fig. 1), will give excellent esults, despite the crudity of the arrangement. A fairly heavy contact is necessary, although, of course, such a contact must not be as heavy as that obtainable in the case of a zincite-tellurium or similar "perikon" type of rectifying contact.

Iron pyrites, again, will rectify well when used in a perikon or semi-permanent type of detector in contact with a fragment of tellurium. The volume obtained from such a contact is generally less than that derived from the lighter type of contact; but nevertheless the rectifier so formed is a stable and enduring one, and it will therefore commend itself to the attention of valve-crystal enthusiasts.

A word now as to the nature of the mineral. Iron pyrites, as is more or less well known among wireless amateurs, consists for the most part of iron sulphide (FeS_2). Generally it is admixed with natural impurities, which influence its sensitive properties to a very considerable extent. Perfectly pure iron pyrites is hardly a rectifier at all.

Detectors for Nothing.

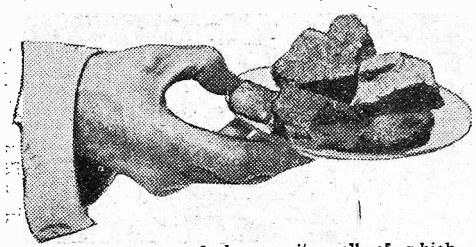
Quite a number of the specimens of iron pyrites which can be found up and down this country in rocks, quarries, on the roadsides, and, very often, on the seashore, contain as much as 2 per cent by weight of selenium. Other specimens, also, contain a little tellurium. Other iron pyrites specimens, again, are contaminated with copper, manganese, and other metals; whilst quite a large number of specimens coming from Australia contain gold.

Iron pyrites exists in many different forms, but in almost every case its colouring is identical. You can at once recognise a specimen of the pyrites by its bright lemon-yellow colour. Generally, too, the surface of the mineral has quite a polished appearance, although this is not the case with every specimen.

The pyrites is found (in England) sometimes in the form of irregular-shaped masses of mineral which do not show any particular crystalline formation. Nevertheless, on breaking up such lumps of mineral, they will often be found to exhibit good sensitive properties. Again, iron pyrites often occurs in the form of single crystals, or clusters of cubical crystals which present the appearance of having been fused together in a furnace. As a matter of fact, such has actually been the case, for their crystalline formation has taken place when the earth's surface was still molten, and the cubical crystals have resulted from the very slow cooling of the molten mass.

It is for such reasons that cubical iron pyrites crystals are sometimes found adhering to the surface of soft rocks, the mass of crystals illustrated in the photograph (Fig. 2), being an example of this type of crystalline formation of iron pyrites.

Contrary to the general opinion, iron pyrites in a fairly sensitive form may be



These specimens of iron pyrites, all of which rectify well, were collected in Derbyshire during the course of one afternoon.

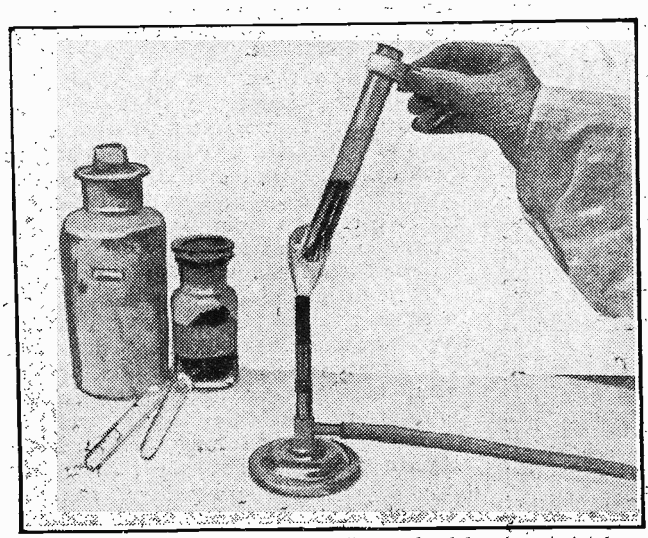
prepared artificially, and with a minimum of expense and trouble. The material necessary for the process comprises merely a handful of iron filings, and a similar quantity of powdered sulphur.

Construct Your Own Crystals.

Mix two parts of the sulphur with one part of fine iron filings, and stir them intimately together, so that they form a yellow-grey mixture, and heat it strongly in a non-luminous gas or spirit lamp flame. A chemical reaction will take place within the tube. The contents of the tube will glow red hot, even when the tube is removed from the flame.

After the red glow has finally died down, the tube should be left to cool. Afterwards, it should be broken, and the contents extracted. They will be found to consist of a grey, coke-like porous mass, having, sometimes, a yellow-greenish cast about them. Careful testing of this material will prove it to possess considerable rectifying powers if used with an ordinary cat's-whisker contact.

In fact, a perfectly synthetic or artificial form of iron pyrites will have been prepared. Amateurs interested in the simple preparation of this substance should experiment with varying relative proportions of sulphur and iron pyrites before they arrive at the final form of the pyrites most satisfactory for crystal use.



The heating of the mixture of iron filings and sulphur in a test tube, which is a process in the simple method of preparing synthetic iron pyrites described by Mr. Corrigan.

TELEVISION.

"In view of the fact that apparatus for making home television sets is now obtainable . . . we are forced to take a more serious view of what we have, perhaps, regarded hitherto as the natural excitement and optimism of certain parties interested in recent television experiments."

By THE EDITOR.

STATEMENTS in connection with television have been made in this journal and in "Modern Wireless" and the "Wireless Constructor," in an endeavour to provide our readers with a truthful account of the progress made, and an accurate explanation of the problems which confront television experimenters — and, further, an explanation of the reason why certain known television systems are faced with such definite limitations that true television can only be realised by the discovery of a new system.

These statements, and the various explanatory articles we have published would, we hoped, at least provide our readers with information which would enable them to judge the television problem in right perspective—necessary in view of the hysterical and exaggerated reports which have been so current of late in connection with television.

SIR OLIVER LODGE'S VIEW.

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

"The idea of transmitting the Boat Race with any degree of success by wireless according to any known system is absurd.

"And as for the idea of placing Televisor receiving sets on the market at the present time, with Television in its present undeveloped stage, this is too optimistic."

"Carping Critics."

However, in view of the fact that apparatus for making home television sets is now obtainable, and certain information has been published instructing the amateur how to make these home "television" sets, we are forced to take a more serious view of what we have, perhaps, regarded hitherto as the natural excitement and optimism of certain parties interested in recent television experiments.

In the first issue of a journal devoted to television we find the following statement:

"There is no doubt about it that television is an accomplished fact in spite of the verbose statements to the contrary which have been made in certain quarters, and in spite of the pseudo-scientific arguments, designed to prove the impossibility of its achievement, which have been loudly voiced by carping critics. Mr. Baird has publicly demonstrated it in this country innumerable times, and according to a recent newspaper announcement has lately transmitted between London and New York."

And in the same issue this statement:

"In the meantime we, from our own knowledge of this new science, would strongly advise the public to take no heed of the irresponsible remarks of ignorant critics; for it must not be overlooked that the actual knowledge of these same carping critics is but little greater than that of the 'Man in the Street,' and their practical achievements in the field of television, nil.

"The Baird Company, secure in the knowledge of the results which it has already obtained, will, we feel sure, treat such worthless criticisms with the supreme contempt which they deserve, and continue to work steadily towards the realisation of the plans which it has made."

In the above extracts we find reference to "pseudo-scientific arguments" and to carping critics with knowledge very little greater than the "Man in the Street." And the hope is expressed that the Baird Co. will "treat such worthless criticisms with the supreme contempt which they deserve," etc.

Scientific Views.

All perfectly good journalese and quite amusing if regarded as such, but remember there are shareholders in the Baird Co., besides many hundreds of thousands of people deeply interested in television, who might be persuaded by such statements that the criticism which points out the real facts about television may be biased, and further, based on "pseudo-scientific" knowledge, etc., etc., and consequently not worth considering.

And so, although we feel sure that the majority of our technical readers clearly understand the technical problems of television, and the criticisms we, among others, have made with regard to television, we feel it only fair to the readers of POPULAR WIRELESS, and to all those who are interested in television, to provide them with the views of some of the eminent scientific authorities with whom we have consulted on the question of television.

In this issue we include the views of our Scientific Adviser-in-Chief, Sir Oliver Lodge. A wireless pioneer and a scientific authority of wide-world fame, such as is Sir Oliver, needs no further introduction, nor does Dr. J. H. T. Roberts, F.Inst.P., whose scientific experience, based on years of research work at the Cavendish Laboratory, Cambridge, with Sir J. J. Thomson and Sir Ernest Rutherford, and whose inventive genius was fully demonstrated during and after the war, is more than well known among those privileged to judge what is "pseudo-scientific" and what is not.

The Right Perspective.

The views of these two eminent scientists are published elsewhere in this issue, and we intend, in future issues, to publish the views of other scientific authorities, for it is our definite intention to keep our readers informed of the facts about television, and not to encourage them by optimistic and inaccurate statements about the possibilities of television.

We have, as we have stated many times, admiration for the work done by Mr. Baird, and we realise—none more fully—the value of his pioneer work.

But that pioneer work must, in the interests of scientific truth, and in the interests of the large public interested in television, be judged accurately and in the right perspective, and we can only hope that Mr. Baird will not countenance the exaggerated impressions which have been current of late with regard to the progress of television and in particular with regard to the prospects, scientific and otherwise, of his particular system.

"In view of the recently reported transmission of pictures between London and the United States, it may be as well to point out that television is hardly a practical matter yet. The transmission is an important event, but it does not denote that the problem of television has been solved.

"A face can be seen by a few spectators, and might be recognised if the subject is well known, but detail is missing. This is due to the fact that no practical method has yet been evolved to transmit more than a somewhat blurred image, and to the fact that sufficiently effective apparatus for transmuting light into electricity is yet unknown.

"The picture cannot be sent as a whole, but has to be sent in a multitude of pieces with such rapidity that the succession of pieces may affect the eye as a complete picture. Breaking up the image in this way is technically known as "searching." When the pieces are unduly large, a blurred representation results. The limit to the smallness of the pieces is governed by mechanical considerations in the transmitting apparatus.

"Due to the lack of a highly-sensitive photo-electric cell, intense light has usually to be used, and only the parts so lighted can receive adequate representation."

(From the "Yorkshire Post.")

* * *

"It was satisfactory to find so much had been achieved in the fifteen or sixteen years' work. It was disappointing to find that Baird still pins his faith to his mechanical system of splitting up the image into the points requisite for television, for no wheel can revolve at the rate which would be needed to give the fine points requisite for clear vision."

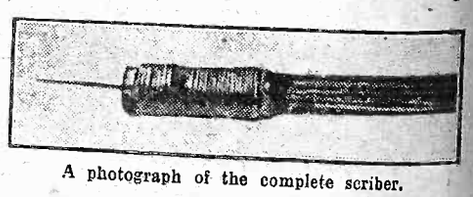
(Extract from an article by the Wireless Correspondent writing in the "Leeds Mercury.")

A SIMPLE SCRIBER.

A SCRIBER for the purpose of marking out ebonite panels before cutting can very easily be made, as the accompanying illustration depicts.

Procure an ordinary pen-holder and, with the aid of a sharp knife, carefully split one end of it for a distance of an inch or two. Squeeze a little seccotine, or other form of liquid glue, into the slit thus made, and then insert a strong needle into the slit so that it projects into the wood for a distance of at least an inch.

Bind the end of the pen-holder with a number of turns of thin but strong cord or string, as shown in the illustration, and finally give the turns of cord a rubbing over with the liquid glue so as to hold them tightly together. Allow the glue to harden over a period of twelve hours, after which the scriber will be ready for use.



A photograph of the complete scriber.

Such an implement will not only be useful for the purpose of marking out ebonite sheets, but it will also serve a purpose in picking out sundry pieces of dirt which have been allowed to collect in an out-of-the-way corner of the set. In fact, the scriber made as above can be put to all sorts of uses.

The "POPULAR" ONE-VALVE AMPLIFIER

Here is an efficient L.F. amplifier suitable for attaching to any sort of set. Next week the same circuit will be incorporated in "flat-panel" design for those who prefer this arrangement. Designed and constructed by the "P.W." Research and Construction Department.

Described by

A. JOHNSON-RANDALL.

DO you sometimes sigh for that little bit of extra power on distant stations?

Perhaps you have wished that your set, which gives you such good telephone strength, would work a loud speaker, and thus enable you to listen to the broadcast programmes in greater comfort. If so, here is a simple and efficient single-valve amplifier which will enable you to realise these hopes.

This unit can be joined up to any existing crystal set, valve set, or, in fact, to any receiver not already employing two transformer-coupled stages of L.F. It is particularly suitable for sets which give very loud telephone strength, but not quite enough volume to operate a loud speaker. Perhaps you will wonder why a transformer has been chosen instead of a resistance. The reason is that a transformer amplifier has a much more universal application than any other type and, in addition, will give greater magnification.

1 Ebonite Panel, 7 in. × 7 in. × ¼ in.
1 Baseboard, 7 in. × 9 in.
1 Cabinet to fit.
1 Sprung type valve holder.
1 Baseboard variable resistor (Lissen).
1 L.F. transformer (R. I.-Varley).
1 ·0005 fixed condenser, and base (Igranic), only required for R.I. transformer.
1 push-pull switch (L. & P.).
1 500,000-ohms potentiometer (Centralab, Rothermel Radio Corporation).
8 terminals marked as follows: H.T.+, H.T.−, L.S.+, L.S.−, L.T.+, L.T.−, and two marked "Input."
1 Terminal strip, 4¾ in. × 2 in.

Different Designs.

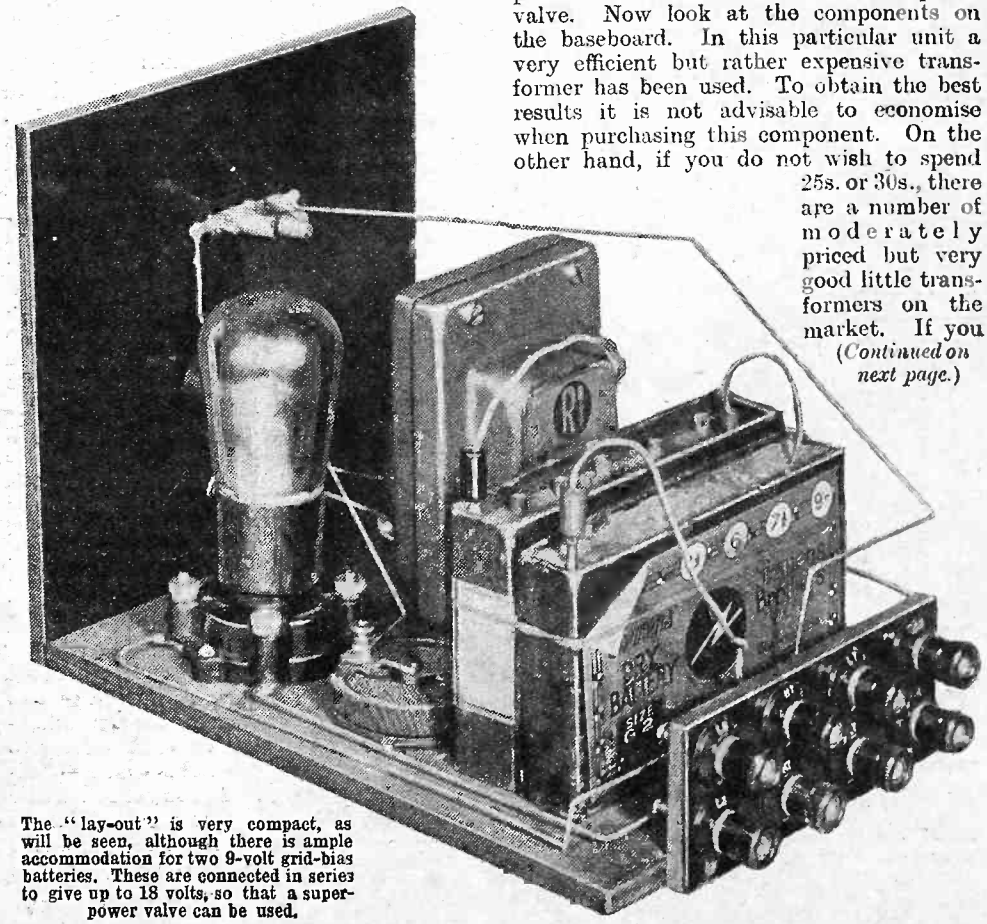
In this, and in the continuation next week, you will see two apparently different designs. One of them utilises the popular American vertical panel and baseboard scheme. The other makes use of an ordinary flat-top panel, all the components being mounted on the panel itself. In each case, however, you will see that the actual circuit and most of the components are identical. The reason for these two entirely different lay-outs is to enable the constructor to choose which of them better matches his existing set. Some reader may have one of the older pattern flat-panel receivers. If so, the second lay-out will be more suited to his needs than the one which incorporates the vertical panel and baseboard. On the other hand, the possessor of a more recent design will prefer the American type of lay-out, as described in this article.

Now let us look at the vertical panel amplifier. You will see that there are two knobs on the panel. One is fairly large and the other is a simple push-pull switch. The idea of the larger knob is to give you a control of volume so that you can adjust the strength of the signals to suit your own requirements. For instance, if the station you are listening to is overpoweringly strong a slight adjustment of the knob will tone down the signals to a comfortable strength.

The L.F. Transformer.

The push-pull switch is just an independent filament control to the amplifier valve. Now look at the components on the baseboard. In this particular unit a very efficient but rather expensive transformer has been used. To obtain the best results it is not advisable to economise when purchasing this component. On the other hand, if you do not wish to spend 25s. or 30s., there are a number of moderately priced but very good little transformers on the market. If you

(Continued on next page.)



The "lay-out" is very compact, as will be seen, although there is ample accommodation for two 9-volt grid-bias batteries. These are connected in series to give up to 18 volts, so that a super-power valve can be used.

TELEVISION.

"In view of the fact that apparatus for making home television sets is now obtainable . . . we are forced to take a more serious view of what we have, perhaps, regarded hitherto as the natural excitement and optimism of certain parties interested in recent television experiments."

By THE EDITOR.

STATEMENTS in connection with television have been made in this journal and in "Modern Wireless" and the "Wireless Constructor," in an endeavour to provide our readers with a truthful account of the progress made, and an accurate explanation of the problems which confront television experimenters — and, further, an explanation of the reason why certain known television systems are faced with such definite limitations that true television can only be realised by the discovery of a new system.

These statements, and the various explanatory articles we have published would, we hoped, at least provide our readers with information which would enable them to judge the television problem in right perspective—necessary in view of the hysterical and exaggerated reports which have been so current of late in connection with television.

SIR OLIVER LODGE'S VIEW.

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

"The idea of transmitting the Boat Race with any degree of success by wireless according to any known system is absurd.

"And as for the idea of placing Televisor receiving sets on the market at the present time, with Television in its present undeveloped stage, this is too optimistic."

"Carping Critics."

However, in view of the fact that apparatus for making home television sets is now obtainable, and certain information has been published instructing the amateur how to make these home "television" sets, we are forced to take a more serious view of what we have, perhaps, regarded hitherto as the natural excitement and optimism of certain parties interested in recent television experiments.

In the first issue of a journal devoted to television we find the following statement:

"There is no doubt about it that television is an accomplished fact in spite of the verbose statements to the contrary which have been made in certain quarters, and in spite of the pseudo-scientific arguments, designed to prove the impossibility of its achievement, which have been loudly voiced by carping critics. Mr. Baird has publicly demonstrated it in this country innumerable times, and according to a recent newspaper announcement has lately transmitted between London and New York."

And in the same issue this statement:

"In the meantime we, from our own knowledge of this new science, would strongly advise the public to take no heed of the irresponsible remarks of ignorant critics; for it must not be over looked that the actual knowledge of these same carping critics is but little greater than that of the 'Man in the Street,' and their practical achievements in the field of television, nil.

"The Baird Company, secure in the knowledge of the results which it has already obtained, will, we feel sure, treat such worthless criticisms with the supreme contempt which they deserve, and continue to work steadily towards the realisation of the plans which it has made."

In the above extracts we find reference to "pseudo-scientific arguments" and to carping critics with knowledge very little greater than the "Man in the Street." And the hope is expressed that the Baird Co. will "treat such worthless criticisms with the supreme contempt which they deserve," etc.

Scientific Views.

All perfectly good journalese and quite amusing if regarded as such, but remember there are shareholders in the Baird Co., besides many hundreds of thousands of people deeply interested in television, who might be persuaded by such statements that the criticism which points out the real facts about television may be biased, and further, based on "pseudo-scientific" knowledge, etc., etc., and consequently not worth considering.

And so, although we feel sure that the majority of our technical readers clearly understand the technical problems of television, and the criticisms we, among others, have made with regard to television, we feel it only fair to the readers of POPULAR WIRELESS, and to all those who are interested in television, to provide them with the views of some of the eminent scientific authorities with whom we have consulted on the question of television.

In this issue we include the views of our Scientific Adviser-in-Chief, Sir Oliver Lodge. A wireless pioneer and a scientific authority of wide-world fame, such as is Sir Oliver, needs no further introduction, nor does Dr. J. H. T. Roberts, F.Inst.P., whose scientific experience, based on years of research work at the Cavendish Laboratory, Cambridge, with Sir J. J. Thomson and Sir Ernest Rutherford, and whose inventive genius was fully demonstrated during and after the war, is more than well known among those privileged to judge what is "pseudo-scientific" and what is not.

The Right Perspective.

The views of these two eminent scientists are published elsewhere in this issue, and we intend, in future issues, to publish the views of other scientific authorities, for it is our definite intention to keep our readers informed of the facts about television, and not to encourage them by optimistic and inaccurate statements about the possibilities of television.

We have, as we have stated many times, admiration for the work done by Mr. Baird, and we realise—none more fully—the value of his pioneer work.

But that pioneer work must, in the interests of scientific truth, and in the interests of the large public interested in television, be judged accurately and in the right perspective, and we can only hope that Mr. Baird will not countenance the exaggerated impressions which have been current of late with regard to the progress of television and in particular with regard to the prospects, scientific and otherwise, of his particular system.

"In view of the recently reported transmission of pictures between London and the United States, it may be as well to point out that television is hardly a practical matter yet. The transmission is an important event, but it does not denote that the problem of television has been solved.

"A face can be seen by a few spectators, and might be recognised if the subject is well known, but detail is missing. This is due to the fact that no practical method has yet been evolved to transmit more than a somewhat blurred image, and to the fact that sufficiently effective apparatus for transmuting light into electricity is yet unknown.

"The picture cannot be sent as a whole, but has to be sent in a multitude of pieces with such rapidity that the succession of pieces may affect the eye as a complete picture. Breaking up the image in this way is technically known as "searching." When the pieces are unduly large, a blurred representation results. The limit to the smallness of the pieces is governed by mechanical considerations in the transmitting apparatus.

"Due to the lack of a highly-sensitive photo-electric cell, intense light has usually to be used, and only the parts so lighted can receive adequate representation."

(From the "Yorkshire Post.")

* * *

"It was satisfactory to find so much had been achieved in the fifteen or sixteen years' work. It was disappointing to find that Baird still pins his faith to his mechanical system of splitting up the image into the points requisite for television, for no wheel can revolve at the rate which would be needed to give the fine points requisite for clear vision."

(Extract from an article by the Wireless Correspondent writing in the "Leeds Mercury.")

A SIMPLE SCRIBER.

A SCRIBER for the purpose of marking out ebonite panels before cutting can very easily be made, as the accompanying illustration depicts.

Procure an ordinary pen-holder and, with the aid of a sharp knife, carefully split one end of it for a distance of an inch or two. Squeeze a little seccotine, or other form of liquid glue, into the slit thus made, and then insert a strong needle into the slit so that it projects into the wood for a distance of at least an inch.

Bind the end of the pen-holder with a number of turns of thin but strong cord or string, as shown in the illustration, and finally give the turns of cord a rubbing over with the liquid glue so as to hold them tightly together. Allow the glue to harden over a period of twelve hours, after which the scriber will be ready for use.

A photograph of the complete scriber.

Such an implement will not only be useful for the purpose of marking out ebonite sheets, but it will also serve a purpose in picking out sundry pieces of dirt which have been allowed to collect in an out-of-the-way corner of the set. In fact, the scriber made as above can be put to all sorts of uses.

The "POPULAR" ONE-VALVE AMPLIFIER

Here is an efficient L.F. amplifier suitable for attaching to any sort of set. Next week the same circuit will be incorporated in "flat-panel" design for those who prefer this arrangement. Designed and constructed by the "P.W." Research and Construction Department.

Described by

A. JOHNSON-RANDALL.

DO you sometimes sigh for that little bit of extra power on distant stations?

Perhaps you have wished that your set, which gives you such good telephone strength, would work a loud speaker, and thus enable you to listen to the broadcast programmes in greater comfort. If so, here is a simple and efficient single-valve amplifier which will enable you to realise these hopes.

This unit can be joined up to any existing crystal set, valve set, or, in fact, to any receiver not already employing two transformer-coupled stages of L.F. It is particularly suitable for sets which give very loud telephone strength, but not quite enough volume to operate a loud speaker. Perhaps you will wonder why a transformer has been chosen instead of a resistance. The reason is that a transformer amplifier has a much more universal application than any other type and, in addition, will give greater magnification.

1 Ebonite Panel, 7 in. × 7 in. × ¼ in.
1 Baseboard, 7 in. × 9 in.
1 Cabinet to fit.
1 Sprung type valve holder.
1 Baseboard variable resistor (Lissen).
1 L.F. transformer (R. I.-Varley).
1 ·0005 fixed condenser, and base (Igranic), only required for R.I. transformer.
1 push-pull switch (L. & P.).
1 500,000-ohms potentiometer (Centralab, Rothermel Radio Corporation).
8 terminals marked as follows: H.T.+, H.T.−, L.S.+, L.S.−, L.T.+, L.T.−, and two marked "Input."
1 Terminal strip, 4¾ in. × 2 in.

Different Designs.

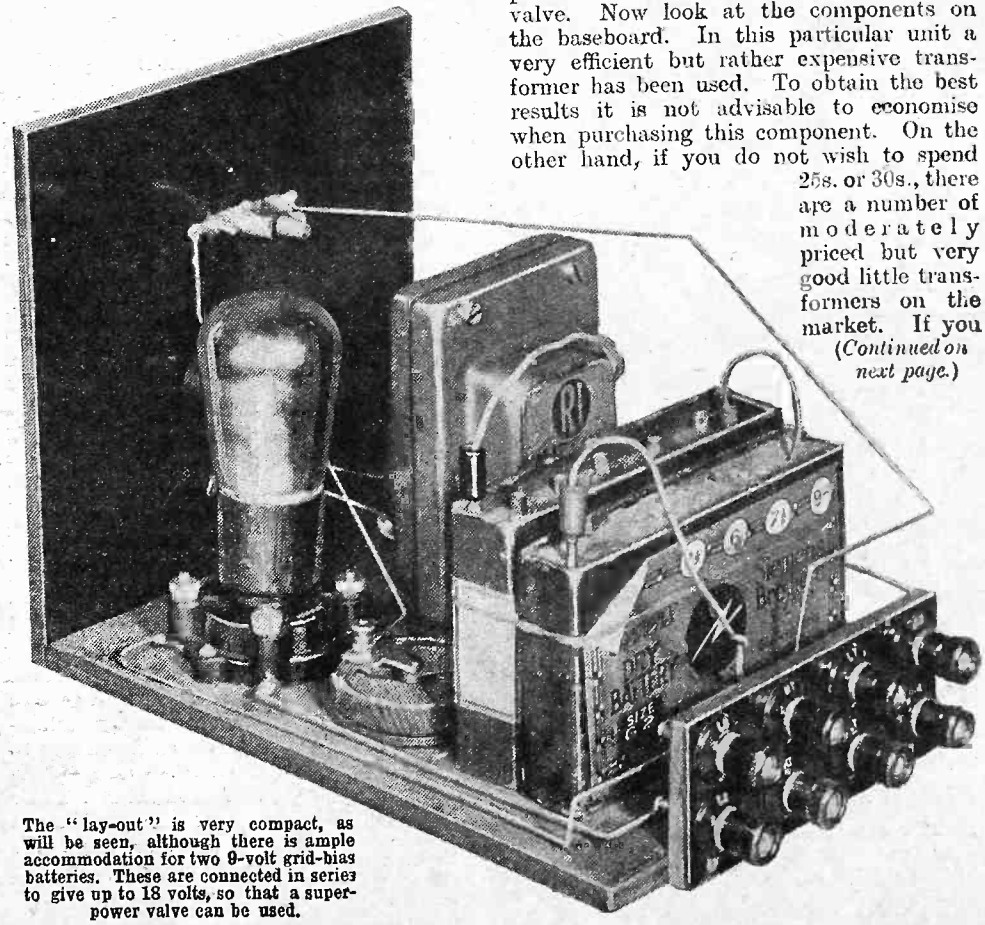
In this, and in the continuation next week, you will see two apparently different designs. One of them utilises the popular American vertical panel and baseboard scheme. The other makes use of an ordinary flat-top panel, all the components being mounted on the panel itself. In each case, however, you will see that the actual circuit and most of the components are identical. The reason for these two entirely different lay-outs is to enable the constructor to choose which of them better matches his existing set. Some reader may have one of the older pattern flat-panel receivers. If so, the second lay-out will be more suited to his needs than the one which incorporates the vertical panel and baseboard. On the other hand, the possessor of a more recent design will prefer the American type of lay-out, as described in this article.

Now let us look at the vertical panel amplifier. You will see that there are two knobs on the panel. One is fairly large and the other is a simple push-pull switch. The idea of the larger knob is to give you a control of volume so that you can adjust the strength of the signals to suit your own requirements. For instance, if the station you are listening to is overpoweringly strong a slight adjustment of the knob will tone down the signals to a comfortable strength.

The L.F. Transformer.

The push-pull switch is just an independent filament control to the amplifier valve. Now look at the components on the baseboard. In this particular unit a very efficient but rather expensive transformer has been used. To obtain the best results it is not advisable to economise when purchasing this component. On the other hand, if you do not wish to spend 25s. or 30s., there are a number of moderately priced but very good little transformers on the market. If you

(*Continued on next page.*)



The "lay-out" is very compact, as will be seen, although there is ample accommodation for two 9-volt grid-bias batteries. These are connected in series to give up to 18 volts, so that a super-power valve can be used.

THE POPULAR ONE-VALVE AMPLIFIER.

(Continued from previous page.)

decide to buy one of these cheaper instruments, then I would suggest that you choose one having a ratio of about 3 to 1.

The transformer in the unit has connected across its primary terminals a .0005 fixed condenser. This will not be necessary with transformers of other makes and if you prefer to use some other type, then you will not need to include the fixed condenser in your list of components.

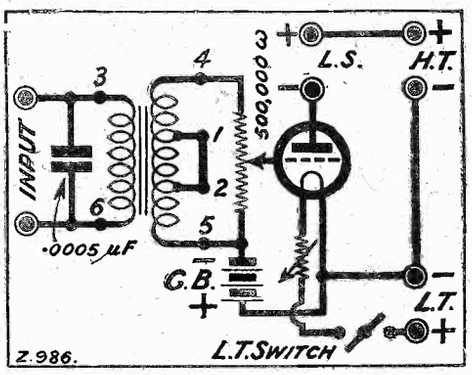
Constructional Details

The actual construction of the amplifier is very simple and there is no reason why the whole of the work should not be completed in a single evening. Drill the holes in the panel first. For the filament "on-and-off" switch and the volume control you will need a $\frac{3}{8}$-in. twist drill. You will also require a small terminal strip which can be screwed to the back of the baseboard. The terminal holes can be arranged in two tiers of four, and it is usual to space them 1 in. apart.

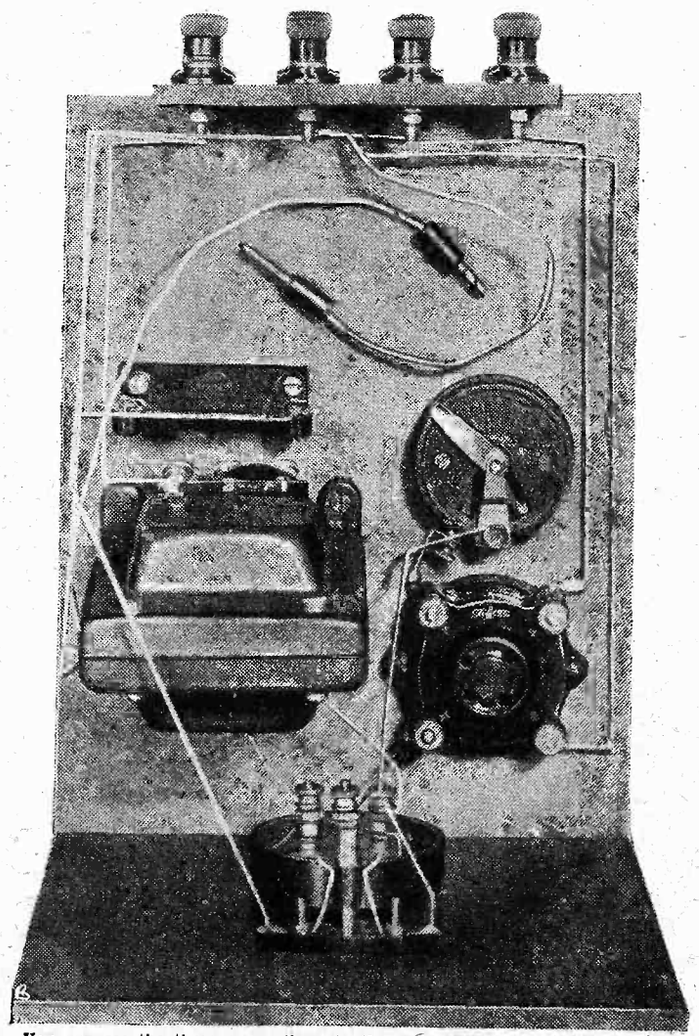
This strip may be a piece of $\frac{3}{16}$ or $\frac{1}{4}$ in. ebonite, $4\frac{3}{4}$ in. long and 2 in. high.

The transformer connections which are shown apply only to the R.I.-Varley straight-line super transformer. For makes having the more usual method of marking the terminals, the two "input" terminals would be joined to OP and IP. IS would go to G.B.—and that side of the volume control which is shown connected to terminal 5 on the R.I. transformer. OS would be joined to the other side of the 500,000-ohm potentiometer.

The actual wiring up is so very simple



that it is difficult to find any points which need explanation. It is a matter of individual choice as to whether bare tinned-copper or covered wire shall be used. Some constructors may prefer to employ one of the insulated wires, such as Glazite. This certainly forms an effective guard against accidental "shorts" and is probably to be advised in the case of the beginner. On the other hand, bare wire is easier to handle and, provided fairly stiff "busbar," say, 16 gauge, is used there is very little danger of any of the leads touching, especially if they are well spaced. Do not forget to leave sufficient room for the grid-bias batteries on the baseboard.



You can see the three connections to the potentiometer volume control in this view of the amplifier, which will also help you to position the components correctly on the baseboard.

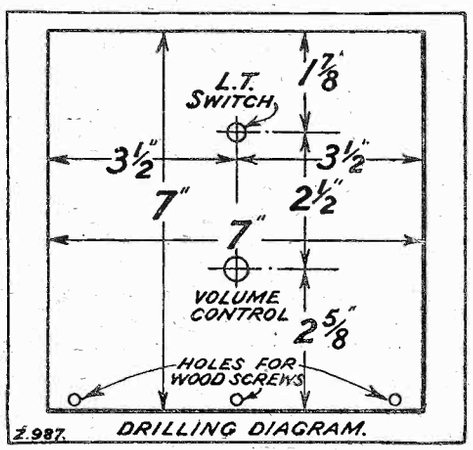
Connections

There are two shown in the photograph. Each battery has a value of 9 volts and the two are joined in series. You will only need two batteries if you intend to use a super-power valve.

The method of connecting up the unit to the existing receiver will be as follows. The two input terminals should be joined to the existing "output" or telephone terminals in the set. H.T.+ will be connected inside the set to one of these 'phone terminals. Take the top input terminal to this telephone terminal which is joined to H.T.+. L.T.+ and L.T.— will be connected to a lead which goes to your existing accumulator or alternatively to the L.T.+ and — terminals on the set. There is no need to join the H.T.— lead from the H.T. battery to the H.T— terminal on the existing set, because one lead, namely, that to H.T.—, on the unit will suffice, provided a common H.T. battery is used throughout. Plug in a lead from H.T.+ on the unit to the 120-volt tapping on the H.T. battery and join up your loud speaker to L.S.+ and —.

Valves and Grid Bias

As stated previously, the grid-bias battery is placed on the baseboard, and the value of this battery will depend on the type of valve you intend using in the socket of the amplifier. If signals are not extremely powerful an ordinary small power-valve, such as the Marconi or Osram D.E.5, Cossor 610L.F., B.T.H. B4, Mullard P.M.6, etc., can be used in this socket. On the other hand, if signals are very loud indeed, then perhaps you will prefer a "super"-power valve. If you employ an ordinary small-power valve you will only need about $7\frac{1}{2}$ volts grid bias and a single 9-volt battery will be adequate. If you think that you will prefer one of the super-power valves then about 16 volts grid bias will be required, and you will have to purchase two 9-volt batteries, placing them in series by joining the positive



socket of one to the negative socket of the other. In this way you will be able to obtain any value of grid bias from $1\frac{1}{2}$ to 18 volts.

If your set does not already include an L.F. stage it is very unlikely that a super-power valve will be required. A super-power valve does not give louder signals, but it is designed to handle great volume. Hence it is only in those cases where the signal strength is big that such a valve is necessary. I mention this because it is sometimes thought that replacing a power valve with a super-power valve will bring about an increase in volume. This, of course, is incorrect, and you should only purchase the latter if you find that your power valve will not deal with the volume you require, without distortion.

Alternative Components

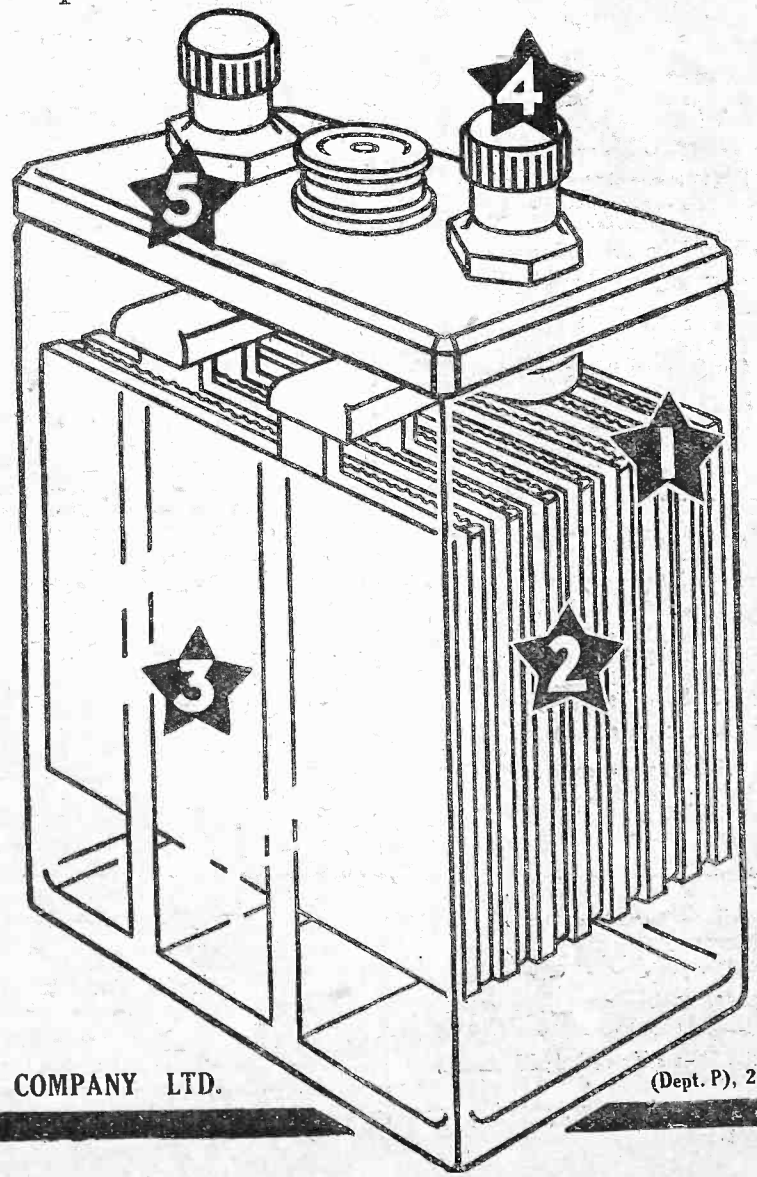
I have said nothing about the suitability of 2-volt valves for use with this unit. The 2-volt type are quite satisfactory, and any small power valve in this class can be employed. Another point which may puzzle the constructor concerns the value of the baseboard filament resistance.

For 6-volt valves when used in conjunction with a 6-volt accumulator, or 2-volt valves employed with a 2-volt cell, this resistance may have a maximum value of 5 or 7 ohms. You will only need a small

(Continued on page 25.)

YOU GET MORE FROM MARCONIPHONE L.T ACCUMULATORS

It is the *plates* that mean most in any accumulator. How strong they are—how long they can resist the incessant attack of the acid. That's where a Marconiphone scores. The immensely strong plates are made from a new and *improved formula especially to resist acid attack.* How well they do so is proved by the immensely long and useful service they give. All parts of Marconiphone Accumulators are protected by an electro-lead deposit against sulphuric fumes and there is a host of other features that ensure unfailing service under even the severest conditions. A glance below will show you six good reasons why "You get more from Marconiphone."



1 *The Plates—the heart of every accumulator—specially constructed to resist the attack of sulphuric acid.*

2 *The Separators, made from the finest ebonite, thus eliminating the impurities frequently encountered with other material.*

3 *The substantial Container, made from the finest quality celluloid, allows easy inspection of acid level.*

4 *The Terminals are shrouded in bakelite—the finest insulating and acid-protecting medium.*

5 *The Flush Top can be cleaned in a moment after recharging.*

6 *It is a guaranteed Marconiphone product, built entirely at our modern Dagenham factory.*

PRICES:

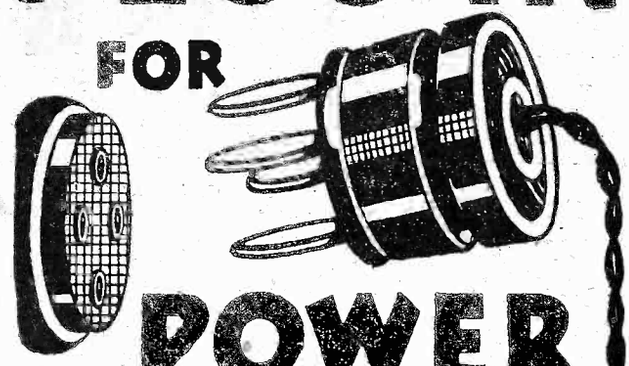
2 volt.	30 amp. hours.	13 6
2 volt.	40 amp. hours.	16 0
4 volt.	30 amp. hours.	£1 7 0
4 volt.	40 amp. hours.	£1 12 0
6 volt.	30 amp. hours.	£2 0 6
6 volt.	40 amp. hours.	£2 8 0

Send now, mentioning "Popular Wireless," for Publication No. 438, fully describing the complete range of Marconiphone Wireless Apparatus.

THE MARCONIPHONE COMPANY LTD. (Dept. P), 210-212, Tottenham Court Rd., W.1.

BS59

PLUG IN FOR POWER



FOR YOUR COSSOR "MELODY MAKER"

CONSTANT—ECONOMICAL—SAFE

CONSTANT. *Power from the mains is even, steady and silent. Entirely dispenses with run down battery annoyance and H.T. crackle.*

ECONOMICAL. *Power from the mains costs less than a penny per day. No more recharging expenses.*

SAFE. *An H.T. Eliminator built the T.C.C. way is a unit of proved reliability. Using T.C.C. 600 volt Condensers, it is safe.*

The T.C.C. book "How to build your own H.T. Eliminator" will convince you how simple it is for you to build this efficient unit. It is free—of course.

Write for it to-day and—

GET YOUR POWER FROM THE SWITCH

T.C.C. CONDENSERS

I enclose 1d. stamp. Please send a copy of "How to build your High Tension Eliminator for A.C. or D.C." to:

Name .....

Address .....

P.W., Mar. 3

SEND COUPON TO-DAY

To Telegraph Condenser Co., Ltd., Wales Farm Rd., N. Acton, London, W.3.

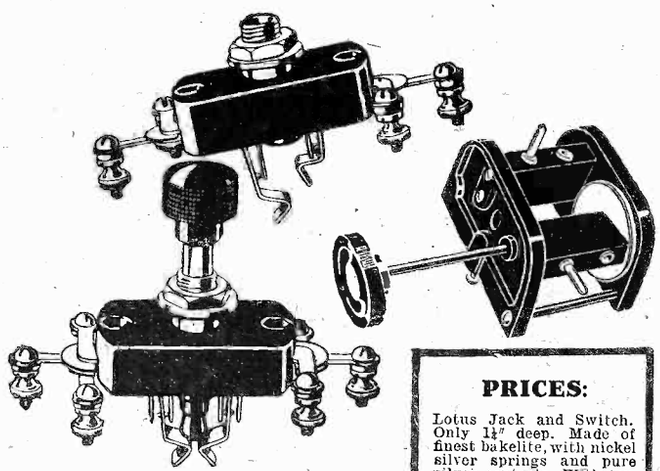
1961

NO MORE JACK TROUBLES

NOW you can eliminate the old, messy soldering troubles when fixing Jacks and Switches. The famous Lotus Jacks and Switches are being made with terminals instead of soldering tags. The terminal makes as good a permanent connection as the most expert soldering job.

Lotus Jacks and Switches are made of finest bakelite, with nickel silver springs and pure silver contacts. To establish reliable connections in any set you make, choose Lotus Jacks and Switches. They occupy the minimum space—only 1¼ in. behind the panel.

The Lotus Coil Holder holds the heaviest coil in position. The moving block cannot fall. Prevents fading away of volume. Vernier movement reduces speed of moving coil block by eight times. For left or right hand.



PRICES:

Lotus Jack and Switch. Only 1¼" deep. Made of finest bakelite, with nickel silver springs and pure silver contacts. With terminals. Jack No. 3, **2/6**; others from **2/-** to **3/-**. Jack Switch No. 9, **4/-**; others from **2/9**.

Lotus Jack Plug. Spring sleeve fitment supplied. Can be used with any Jack. Bakelite mouldings, nickel-plated brass parts. Price **2/-**.

Lotus Coil Holder. 2-way, for outside panel mounting, **7/-**; 3-way, **10/6**; for inside baseboard mounting, with 6-in. handle, **8/-**; 3-way, **12/6**.

LOTUS

JACKS · SWITCHES · PLUGS

Made by the Makers of the famous Lotus Remote Control and Lotus Buoyancy Valve Holder.

GARNETT, WHITELEY & CO., LTD.,
Broadgreen Road - LIVERPOOL.

THE POPULAR ONE-VALVE AMPLIFIER.

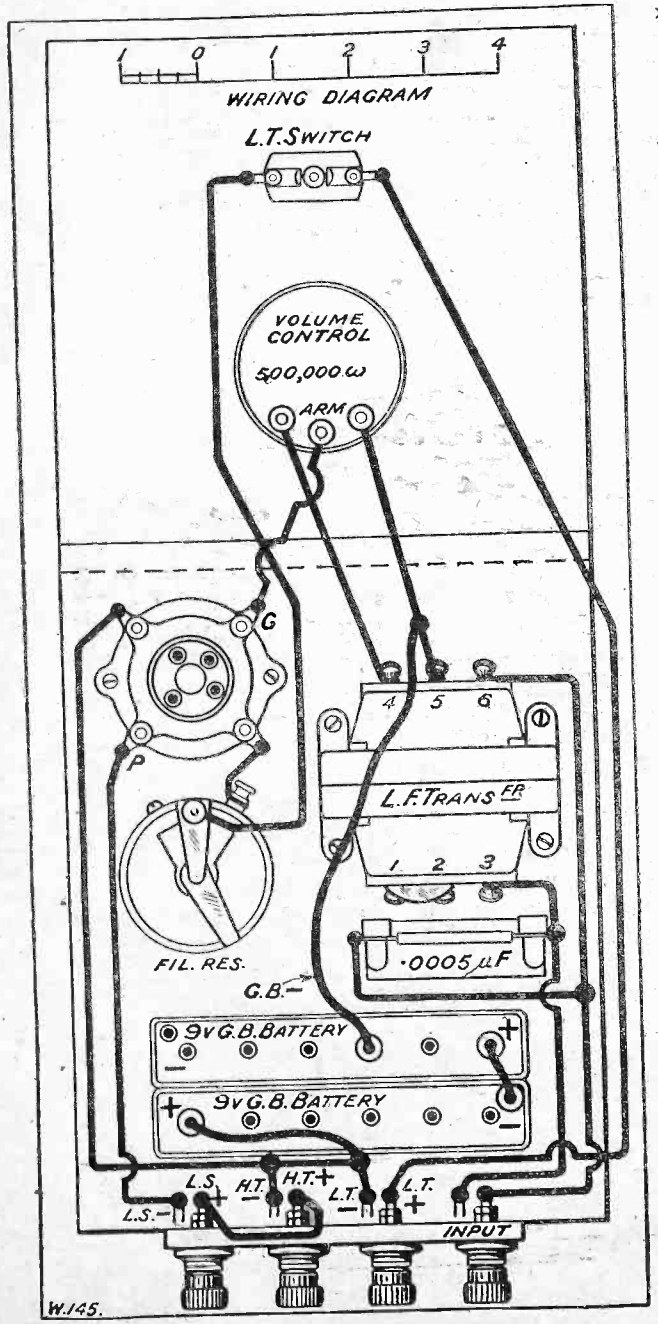
(*Continued from page 22.*)

portion of the total resistance in circuit for 2-volt valves, say, approximately 1 ohm. For 6-volters about 4 ohms will be necessary, or roughly one-half of a 7-ohm winding. Only use one H.T. lead, because if H.T.— is joined to L.T.+ in the set the L.T. battery will be short-circuited. Therefore, leave the H.T.—terminal on the set blank, unless you intend to use two separate H.T. batteries.

NOTE.—The list of components on the first page indicates the parts actually used in the set. It is, of course, understood that components of any good standard make can be chosen throughout. For example, in the case of the valve-holder the following good alternative makes are available, Ashley, Benjamin, Bowyer-Lowe, Burndept, Burne-Jones, Lotus, Pye, W.B. For the fixed condenser, the usual range of Clarke, Dubilier, Lissen, Mullard, T.C.C., etc., are available, and so on.

POINT-TO-POINT CONNECTIONS.

Join L.T.+ to one side of filament "on-off" switch.
Other side of filament switch to moving arm of baseboard resistor.
Other side of baseboard resistor to one filament terminal on valve holder.
Join L.T.— to H.T.— and to remaining filament terminal on valve holder.
Join top "input" terminal to terminal 6 on L.F. transformer, and to one side of ·0005 condenser.
Join other "input" terminal to remaining side of ·0005 condenser and to terminal 3 on transformer.
Join terminals 1 and 2 together. Connect terminal 5 to one side of volume control, and terminal 4 to other side of volume control.
Connect centre terminal on volume control to G of valve holder.
Join H.T.+ to L.S.+ and L.S.— to P on valve holder.
Join flexible lead for G.B.+ to L.T.—.
Join other flexible lead for G.B.— to terminal 5 on L.F. transformer.



DO YOU KNOW THAT——?

Eight motor-cars, with portable sets, are maintained by the Canadian Government, to investigate cases of interference with broadcasting caused by power, lighting, or other electrical apparatus.

* * *

A gang of thieves in Berlin were recently tracked down by the police as a result of a wireless set which they had stolen being unskilfully handled and allowed to oscillate, thus spoiling the programmes of a detective who lived near! He tracked down the offenders and discovered accidentally that the apparatus had been stolen.

* * *

The best-equipped radio hospital in the world is at Miami Beach, Florida. Every patient has a complete radio set for himself with a separate aerial, so that he may tune in any programme he pleases instead of listening to the same programme as the other patients, as in most hospitals.

* * *

According to reports from Russia there are now fifty-six broadcasting stations in the Soviet territories, five being situated in Leningrad and nine in Moscow.

* * *

Dr. J. A. Fleming, of University College, London, took out the original patent for the thermionic valve detector on November 16th, 1904.

* * *

New Zealand is reputed to be the long-distance listener's paradise. Owing to the extraordinarily good conditions, a New Zealand listener has been able in one day to re-broadcast Holland in the morning, listen to W G Y Schenectady for two hours in the afternoon, and finish by tuning in the Tokio, Japan, programme on the loud speaker for an hour in the evening.

* * *

The Irish Free State issues free receiving licences to blind persons.

* * *

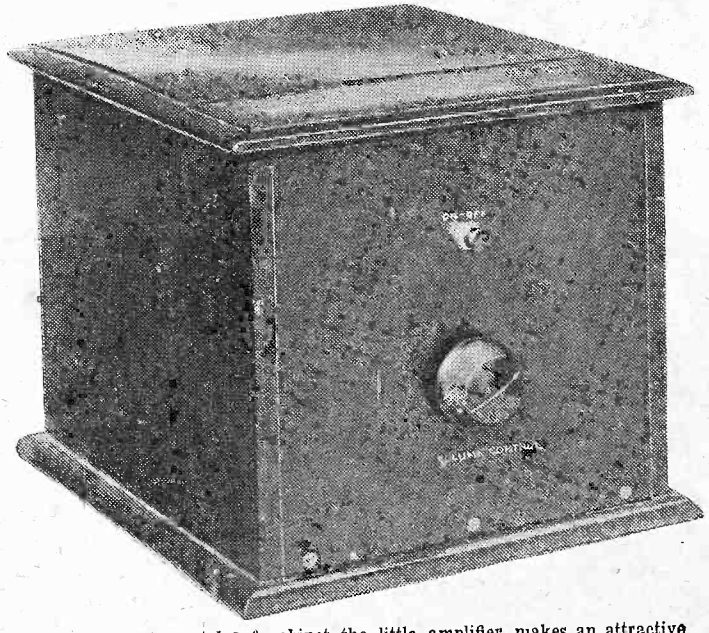
To enable them to film outdoor scenes in which many actors are concerned, the Paramount Famous-Lasky Corporation has been licensed to operate a portable radio telephony transmitter in California. By this means the director of the picture will be able to communicate with actors beyond the range of his megaphone.

* * *

Unlike most modern broadcasting stations the new Copenhagen transmitter has not been placed in a country site, but is erected in the centre of the city.

* * *

Microphones are being installed in the Danish Houses of Parliament so that the speeches can be broadcast.



In its American style of cabinet the little amplifier makes an attractive addition to any modern receiving set equipment.

RECEPTION OF KALUNDBORG.

The Editor, POPULAR WIRELESS.

Dear Sir,—I see in this week's issue of POPULAR WIRELESS that you have not received many reports of reception of Kalundborg in this country, and am therefore sending you the following in the hope that it may be of some interest to you.

I can receive the above station any evening at sufficient strength (loud speaker) for a medium-sized room, in fact, at certain times I have to detune slightly in order that the volume shall not become uncomfortable.

My set is a straightforward three-valver, Det. and 2 L.F. (transformer coupled), and being now over two years old, would probably cause some of the present-day experts (R.C.C., etc.) to turn up their noses in contempt. However, I have built some, and heard most, of the up-to-date receivers and cannot yet find anything to touch the above for either volume, range, or purity of tone.

I can get from 28 to 30 stations on the loud speaker, including, on the long waves, Hilversum, Radio-Paris, Daventry, Kalundborg, Zeesen, and Motala, and on the broadcast band such distant ones as Vienna, Prague, Breslau, San Sebastian and Barcelona. Not so bad for an old-fashioned set. Also, on the only occasion on which I sat up for America, I received Schenectady, New York, at splendid headphone strength.

My aerial is quite an ordinary one, single wire, 60 ft. long, 31 ft. high at free end and 24 ft. at lead-in end, while the valves are all Mullard, 2-volts.

May I also say how much I have enjoyed your recent sarcasm at the expense of Chamber Music and Symphony Concerts. The programmes contain a disgusting amount of this heavy, depressing, absent-minded sort of stuff.

By the way, what about asking the Technical Staff to give us some more short-wave circuits? I have now got practically all I want on the longer waves, and having built the "Sydney" Two, am looking for some more short-wavers to try my hand on.

Wishing you and "P.W." every success, I am,

Yours faithfully,

HORACE L. CLARKE.

Wolverhampton, Staffs.

The Editor, POPULAR WIRELESS.

Dear Sir,—You ask for reports of reception of Kalundborg.

It is one of my best quality and most reliable stations.

I have two sets of my own design and construction, four- and six-valvers; on the former Kalundborg gives good loud-speaker results after dark, fair in daylight. On the six-valver first-class loud-speaker results all day and requires a "Losser" in A.T. circuit at night.

Hilversum I get better quality than Daventry, which is supposed to be our best station.

I wonder if the B.B.C. realise that a regional station on the lower broadcast band will be utterly useless on the South Coast owing to terrific spark interference? There must be a million inhabitants there bound to the long waves.

Yours faithfully,

WM. A. LUCAS.

Hastings.

CORRESPONDENCE.

RECEPTION OF KALUNDBORG

BOMBAY AT L.S. STRENGTH—THE COLOMBO STATION.

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.

BOMBAY AT L.S. STRENGTH.

The Editor, POPULAR WIRELESS.

Dear Sir,—My attention has been drawn to the Indian note published in your issue of January 7th, 1928, on page 946. It appears that the writer of the note doubts my statement which appeared in the report of my interview by the "Broadcaster" that the Colombo station is received in "Bombay at loud-speaker strength on a five-valve set."

I have to say that my statement is absolutely correct, and it is not my own experience but the experience of several hundreds of other set owners who have received Colombo on loud-speaker strength on five-valve sets, and very often on a four-valve set also. If my statement has been properly read by the writer of the note in your magazine, he would have noticed that it was in reply to a question about the reception conditions in India that I gave this fact as an illustration.

The reception conditions in India are sometimes so favourable that even on a two-valve set very often stations as far away as 1,000 to 1,200 miles have been heard at 'phone strength. That is to say, recently my own experience on a two-valve Bowyer-Lowe Short-Wave receiver which was adapted to receive broadcast band reception on a home-made coil was interesting.

As you know, this set is not designed for medium wave-length reception, and still it received in Bombay Calcutta programmes on two valves. You may be aware that the Calcutta station is of 3 kw. and the distance between Bombay and Calcutta is nearly 1,200 miles. Of course, this is an exceptional instance, but there are several instances on record that on a three-valve set Calcutta and Colombo have been received at 'phone strength.

Hoping the above may be of interest to you.

Yours faithfully,

for Bombay Radio Co., Ltd.,

ABDULLA FAZALBHOY.

Managing Director.

Bombay, India.

THE COLOMBO STATION.

The Editor, POPULAR WIRELESS.

Dear Sir,—With reference to page 946 of your issue of 7th instant, under subheading "Indian Note," the particulars given regarding the Colombo Wireless Broadcasting Station are not quite correct.

The official power of the transmitter is 1·75 kw. and crystal range at least 25 miles round Colombo.

The Colombo Broadcasting service is an excellent one and developing steadily among a people who are entirely unaccustomed even to the idea of broadcasting.

With regard to your surprise at Colombo being heard in Bombay on five valves, it may be interesting to you to know that in Colombo, Bombay can be heard well at strong telephone strength on a single valve set of a certain design, and also on a two-valve (det. and 1 L.F.) short-wave receiver of Simmonds' design with suitable coils. The distance is 900 miles (approx.) from Colombo.

Calcutta, on the other hand (1,200 miles away), is not a success from Colombo on these sets, probably due to hill screening. It is, of course, easily heard on multi-valve sets further inland to the east.

Yours faithfully,

J. S. DINWIDDIE.

Member of Committee,

Ceylon Amateur Radio Society.

Colombo, Ceylon.

APPARATUS TESTED

TWO GECOPHONE ACCESSORIES—RIPAULTS H.T. DRY BATTERY—DIONOID ACCUMULATORS—THE STEWART-WARNER REPRODUCER.

* *

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

TWO GECOPHONE ACCESSORIES.

THE attractive feature of an alliance of the radio-set with the gramophone is that however old-fashioned the latter may be it can be made to give results equal to the most expensive modern instrument. All the gramophone has to do is to provide a turntable which will rotate at certain definite speeds. The rest of the work is left to the radio outfit and to that important link, the "pick-up."

Providing your set has two stages of low-frequency amplification it can be linked to a gramophone. The pick-up replaces the sound box on the tone arm of the gramophone, and the two leads which come away from it are joined across the grid and filament of the detector valve. This, broadly speaking, is all that has to be done, although refinements, such as transformers, pitch controls, and so on, can be introduced by the more advanced amateur if he requires to operate a moving-coil loud speaker with complete faithfulness.

Quite recently the G.E.C. people sent us one of their B.C.1660 new type gramophone pick-ups. It is a neat little piece of gear and with its bright aluminium and steel has a very business-like appearance. It appears to be moderately light on records.

New "Modern Wireless" Feature.

With a moderately heavy needle (half-tone) there is a very little chatter and the damping appears to be thorough. Nevertheless, it gives a very bright reproduction and faithfully follows all variations from the highest to the lowest notes. It feeds into the set an input much better than the average set and loud speaker is capable of handling.

To appreciate its real efficiency one requires to employ a first-class outfit, including a moving-coil loud speaker. Nevertheless, with a device such as this you would be able to operate your set with results equal in every respect, and perhaps even better than, the broadcast reception. And, by the way, if you desire to learn something about "Radio and the Gramophone" and its advantages, and obtain practical hints and tips, we would advise you to read the new section starting in MODERN WIRELESS dealing with this modern and interesting subject.

We have also had a Gecophone cabinet cone loud speaker on test. It is a handsome instrument. A special feature is the deep and rigid cone, and this probably contributes in no small measure to the good results the loud speaker gives. It handles

(*Continued on page* 39.)

All Editorial Communications to be addressed to The Editor, POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

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

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

QUESTIONS AND ANSWERS.

A TUNING "PUZZLE."

A. L. (Westhoughton, nr. Bolton, Lancs.).—"May I join my congratulations to other readers on the capabilities of the 'Sydney' Two? Every night for a month I have been able to listen to K D K A from 11 p.m., sometimes as loud and clear as the local station 15 miles off.

"One thing has puzzled me, and that is the position of the earth clip, and I am sure other users have been likewise at a loss. I have never been able to tune in anything lower than 40 metres, not a whisper of 2 X A D or 2 X A F. Looking at the coil from the front I receive K D K A with A clip on the fifth turn from the left, G clip on last turn, and earth clip on the extreme right. I am sure other users of the 'Sydney' Two would welcome enlightenment on the point.

"I have also a three-valve Unidyne which I would not change for all the super and ultra sets ever issued.

"List of stations I log on any good night on the loud speaker, using one-valve Unidyne and 2 L.F.: Manchester, Dublin, Liverpool, Milan, Prague, Frankfort, Toulouse, Langenberg, Vienna, Brussels, Radio-Paris, Huizen, Hilversum, Koenigwusterhausen, Kalundborg, Breslau, Hamburg, Stuttgart, also Mersey dockboard lightships."

We do not quite understand your difficulty with the "Sydney" Two, A. L., unless it is that you have not read the instructions in the article properly, and you are not varying the positions of all the clips correctly. You say that you have picked up K D K A any old night from 11 p.m. onwards at good strength, but have never received a whisper from 2 X A D or 2 X A F.

As a matter of fact, 2 X A D and 2 X A F have been coming over not only as well as K D K A but considerably better, and it would appear, therefore, that the reason you have not received them is that you are not tuning properly. If the earth clip is placed on the extreme right of the coil the wave-length to which the set will tune is chiefly determined by whether the grid clip G is on the last turn of the coil or is put at some intermediate point between the two.

If you are keeping it on the last turn you will not tune down much below 40 metres, because even with the condenser all out the inductance which you have in circuit is sufficient to cover that wave-length. But move the G clip down towards the earth clip and immediately in effect you have a smaller tuning coil, consequently you tune down lower and the stations previously outside your tuning range will come romping in.

(*Continued on page* 32.)

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 30.)

Remember that the amount of coil in use is the amount between the earth clip and the G clip, so that the nearer these two are together the lower is the wave-length to which the set will tune. (Thanks for your report upon the reception with your Unidyne receiver. It is certainly extremely good, for regular results.)

AN ADAPTABLE CRYSTAL SET.

R. H. W. (Leeds).—"Can I have a crystal set that I can experiment with? I should like to try loose coupling and all sorts of different circuits, but I can't keep building new sets all the time, so I want one I can change over and try different circuits with. (But crystal, not a valve, because here in LS (Leeds), £ s. d. is scarce.")

Just the set for your purpose is described in the March issue of "Modern Wireless." It is called the "Centurion" Crystal Set, because there must be about one hundred ways of connecting it up. Very cheap to build, too!

TUNING THE "PROGRESSIVE" TWO.

W. W. M. (Sunbury, Middlesex).—"Since writing you last I have completed the 'Progressive' Two, and after some little trouble have got it to work fairly well.

"Am using a 60 Lewcos centre-tapped coil, two P.M.5X valves with 40 volts H.T. I find that using the second tapping from the bottom of the coil, as you suggest, I can hear practically nothing; the fourth seems to be best. Have tuned in about 20 stations and they all come in on the top half of the tuning condenser dial (Ormond S.L.F.), e.g.:

Station	Reading
5 G B	177
2 L O	147
Dublin	132
Not identified	92

"Also, the A.T.C. comes down to zero for best signals at about 120 on the tuning condenser, after that it seems to be no further use.

"Should I be satisfied with this, or do you think a change in the aerial coil would improve matters?

"Aerial is a good 100 feet long and about 29 feet high."

Although you have succeeded in tuning in about twenty stations the set is very heavily handicapped because the two tuned circuits are now "out of step." Instead of the A.T.C. being set to zero when the other condenser is set to 120, both dials should read the same, or about the same. At present your two condensers are right out of step, and we should certainly not be satisfied with this state of affairs.

Near the end of your letter you say the "aerial is a good one hundred feet long," and that, W. W. M., is where you have "missed the boat." By having an extra long aerial you have in effect mistuned the circuit and, consequently, you should either shorten your aerial or use a much smaller aerial coil. As a matter of fact, we should be inclined to do both; that is to say, we should first of all shorten the aerial to a maximum of about 70 feet, including the lead-in, and then try also the effect of a smaller aerial coil.

You will find that the tuning of the H.F. circuit will be unaltered, but the aerial-tuning-condenser will now read an approximately equal number of degrees. Consequently, both condensers will be set near the top of their readings for 5 G B, both will be round about 132 for Dublin, and below that the aerial tuning will be just as critical as that of the other condenser. When both circuits are tuned correctly the stations will come tumbling in on the lower half as well as on the upper half of the scale. If it is not convenient to shorten your aerial or reduce the aerial coil as suggested, you can do it electrically by means of a series condenser. Get one of the little ·00025 mfd. variable condensers, as used in the "P.W." Standardised Wave-trap, and set it nearly "all out," after which it will not require readjustment. (You will find the best setting for it very easily in practice.)

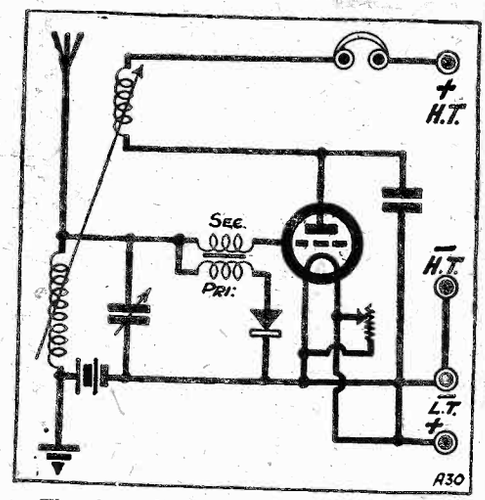
RADIO AND THE GRAMOPHONE.

"COLUMBIA" (Cheltenham, Glos).—"This working a loud speaker by gramophone is just the thing I have been looking for. Where can I get details of a three- or four-valve set on these lines?"

You will find many interesting details about gramophone pick-ups in the March number of "Modern Wireless," now on sale. In this March issue, also, is a full description of "The Radio-Gram" Four, a powerful set suitable for broadcast or gramophone reproduction.

(Continued on page 34.)

WHAT IS WRONG?



The above diagram is supposed to represent the connections of a one-valve Hale receiver. But it is wrong, and would not work properly.

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

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

The "Modern Three"

RIDLEY. RIGHT for RADIO

Everything sold by this House is guaranteed to give entire satisfaction, or money will be refunded in full. This covers you against dissatisfaction. If your requirements are not included below—write giving details.

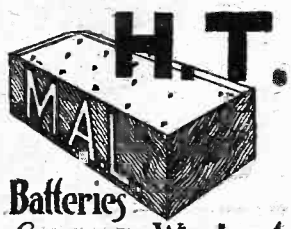
POSTAGE PAID ON PARCELS VALUE 10/- upwards, below that sum add postage.

BUILD THE "MULLARD MASTER THREE" WITH RIDLEY PARTS

	£	s.	d.
2 Terminal Strips, 2½" by 2" by ¼"			Free
4 Terminals		0	4
1 Coil Base, 6-Pin		1	0
1 ·0005 Condenser S.L.F.		3	9
1 ·0003 Condenser S.L.F.		3	6
1 H.F. Choke		4	6
3 Valve-holders		3	0
1 Cabinet	1	0	0
1 Pair Brackets		0	8
1 6-Pin Coil, B.B.C.		7	6
1 2 v. Accumulator D.F.G		8	6
1 P.M. 1 A Valve		10	6
1 P.M. 1 L.F. Valve		10	6
1 P.M. 2 L.F. Valve		12	6
1 100 v. H.T. Battery		8	6
1 Grid Battery		1	0
1 R.C. Unit, Lissen		4	0
1 L.F. Transformer, Lissen		8	6
1 Cond. and Leak, Fixed		2	0
1 Switch, Benjamin		1	0
2 Spade Terminals		0	2
8 Wander Plugs		0	8
1 Panel, 18" by 7" by 4"		2	6
3 Yds. Red and Black Flex		0	5
	£5	15	0

BUILD THE "COSSOR MELODY MAKER" WITH RIDLEY COMPONENTS

	£	s.	d.
2 S.L.F. Variable Condensers, ·0005		8	0
2 Slow Motion Dials		5	6
1 ·0001 Fixed Condenser		1	0
2 ·0003 Fixed Condensers		2	0
1 ·002 Fixed Condenser		1	6
1 ·001 Fixed Condenser		1	0
1 2-microfarad Condenser		2	3
2 Grid Leak Clips (Lissen)		1	0
1 Grid Leak, 4 megohm (Lissen)		1	0
1 Grid Leak, ·25 megohm (Lissen)		1	0
1 Grid Leak, 3 megohm (Lissen)		1	0
3 Valve-holders		3	0
1 Lissen Transformer		8	6
2 Panel Switches		1	6
1 Variable Resistance for B.B. mounting		1	0
9 Terminals		0	9
Connecting wire, insulated		1	3
1 yd. Systoflex Covering		0	3
1 Black Panel, 21 in. by 7 in.		3	6
1 Black Terminal Strip, 21 in. by 1½ in.		1	6
1 Cabinet, 21 in. by 7 in.	1	0	0
1 210D "Cossor" Valve		10	6
1 210RC "Cossor" Valve		10	6
1 210P "Cossor" Valve		12	6
	£5	0	0



Batteries for your Wireless!

RIDLEY'S price 4/11

60 volts

Postage 6d.

I sell more Batteries than every other Wireless Dealer in the district combined I think, simply because the **M.A.L.** stands pre-eminent for long life and good service. 60 volts **4/11**
100 volts **8/6.**

All well-known makers' parts in stock—state requirements.

25/-

DUNDAS LOUD SPEAKER

The finest value obtainable, full size, well finished, gives perfect reproduction, **25/-.** Carriage 1/-.

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

Devicon Variable Condensers, ·001, **2/-** each.

Catwhiskers, 10 a **1d.**

Miniature Ebonite Switches, **9d.** each.

4½-volt Flash-Lamp Batteries, **3/6** per doz.

Neutron Crystals, **11d.** each.

Hertzite Crystals, **6d.** each.

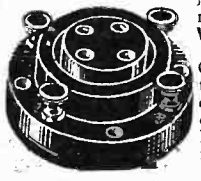
·0002 Devicon Variable Condensers, **3/6.**

4-volt Frelat Valves, **3/-** each.

4-volt Frelat Power Valves, **3/-** each.

Murray Valve-holders, **6d.** each.

Antimicrophonic Valve-holders, **10d.** each.



Ebony Antimicrophonic **VALVE-HOLDER.** Cheapest on the market, considering quality. Base-board mounting. **1/-.**

Leather Accumulator Carriers, **1/3** each.

Single Circuit Plugs and Jacks combined, **3/-.**

H.T. Voltmeters, 0-130, **4/3** each.

Bretwood Var., Grid Leaks, **2/-** each

Cleartron 6-volt Valves, **2/6** each.

30-ohm and 6-ohm Rheostats, **9d.** each.

Mans. Fixed Condensers, ·5, **6d.** each.

" Fixed Condensers, ·25, **6d.** each.

JACKS AND PLUGS

Single Circuit Jack, open, **1/3.**

Double Circuit Jack, closed, **1/6.**

Filament Jack, Single, **1/9.**

Filament Jack, Double, **2/3.**

Plugs, **1/6, 2/-** and **2/9** each.

S.P.D.T. Switches, **6d.**

D.P.D.T. Switches, **9d.**

·0005 S.L.F. Condensers, **3/6.**

Push-pull Switches, **9d.**

Baseboard Rheostats, **11d.**

8-in. Panel Brackets, **6d.**

Bars Solder, **3d.** each.

Fluxite, per tin, **4d.**

Back-of-Panel 2-way Coil-holder, geared, **2/6** each.

Valve Windows, **6d.** each.

Transfers, per packet, **3d.**

Voltmeters, single reading, **2/-.**

Hydrometers, **2/-** each.

Grid Leaks, **6d.** each.

"Sovereign" Coil-holders, **9d.** each.

Brown H2 Loud-speakers, shop-soiled, usually 50/-. Offered at **35/-**

Basket Coil-holders, **9d.** each.

China Valve-holders, **4½d.** each.

·0003 Condenser and Grid Leak, **2/-** each.

Scrap Ebonite, 8 square inches a **1d.** (in 5/- parcels only).

WONDERFUL OFFER OF COSSOR MELODY COILS!

Remarkable value, price **4/6** each.

Insulated Name Terminals, **3d.** each.

2-way Geared Coil-holders, long handle, **2/6.**

Also back-of-panel 2-way Coil-holders, **2/6.**

Croix Transformers, **8/6.**

Dundas Transformers, 5-1, **4/6.**

Crocodile Clips, **2d.** each.

ADDITIONAL OFFERS

Electron Aerial Wire, 100-ft. coils, **1/8** each.

Superial Aerial Wire, 100-ft. coils, **2/6** each.

Edison Bell Fixed Condensers, ·0001, ·0002, ·0003, ·001, **1/-** each.

Benjamin Rheostats, 6 and 30 ohms, **2/9** each. Lissen panel type, 7 and 35 ohms, **2/6** each.

Microstats, baseboard type, **3/-** each.

Resistance Capacity Coupling Units, Ediswan, **7/-**; Lissen, **4/-**; Cosmos (unit only), **8/-**; with Valve-holder, **10/-.**

Coil Plugs, wedge type, nickel connections, per doz., **4/-.**

Coil-holders, Lissen 2-way, **4/6.**

Mansbridge Condensers, 1 mfd., **2/6**; 2 mfd., **3/6.**

Edison Bell Low Loss Coil-holder for baseboard mounting, **1/-.**

Benjamin Filament Switch, **1/-** each.

Colvern 6-pin Bases, **1/6**; Formers, **4/-.**

Basket Coil-holders, **9d.** each.

Neutralising Condensers, Colvern panel type, **3/6**; baseboard, **3/6.**

Grid Leak Holders, **6d.** each.

Panel Brackets, 6 in. and 9 in., per pair, **9d.** and **1/-.**

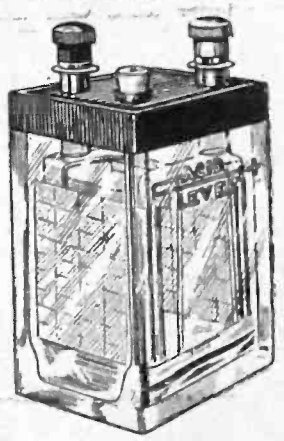
Edison Bell H.F. Chokes, **4/6** each.

CABINETS

10" × 8" Mahogany, **14/6** Oak, **12/6**
16" × 8" Mahogany, **17/6** Oak, **15/-**
21" × 7" Mahogany, **25/-** Oak, **20/-**
18" × 7" Real Oak, **22/6**
Add 1/- carriage.

ASK FOR COMPLETE CATALOGUE

POST FREE.



2-VOLT ACCUMULATORS

In enclosed glass cases, large plates, strongly made. 10 hour actual. Price, each **3/6**
Add 6d. postage.

CECIL RIDLEY

"RADIO HOUSE," MIDDLESBROUGH

'Phone: 1366 M'bro.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 32.)

THE LODGE "N" CIRCUIT.

H. J. (Harold Wood, Essex).—"A friend of mine who lives in Cape Town has written to ask where he can get particulars of the famous 'N' circuit invented by Sir Oliver Lodge. He wants full particulars of how to build a two-valve set which is not capable of causing interference with neighbours. And he tells me that this 'N' is the only set of the kind in the world. Can you let me know where I can get an envelope or a book dealing with the constructional details of a set?"

Full particulars for constructing a two-valve Lodge "N" circuit are given on the "P.W." Blue Print No. 21. This can be obtained from the Technical Query Dept. (price 6d., postage extra).

IMPROVING CRYSTAL-SET RECEPTION.

D. A. J. H. (Finchley, N.).—"My little son has been so delighted with the 'Lo-Cost' Crystal Set which we made from the instructions in your paper that I feel I must write to thank you at once. It gives amazingly good reception from London and has actually received 5 G B, the Daventry Experimental Station. Is there any way of increasing its strength on 5 G B, I wonder?"

Unfortunately the strength of a crystal set is strictly limited. However good and however sensitive it may be—and the "Lo-Cost" is both good and sensitive—there is a definite limit as to the strength of signals it can give in the telephones. Unlike a valve set, in which batteries and other forms of local power are utilised, the energy that works a crystal set is derived directly from the broadcasting station which is being tuned in. In this particular instance there is a great deal of energy developed by the Daventry Station.

THE TWO METHODS.

This enormous electrical energy is radiated outwards and upwards and downwards from 5 G B's aerial in the form of electro-magnetic waves, travelling in all directions with the speed of light. At very short distances from the Daventry aerial these waves are strong, so that, although an aerial within, say, ten miles of 5 G B's aerial would pick up only a tiny proportion of the total energy being sent out, even this fragment would be quite enough to give tremendously strong telephone signals. At distances farther away from the transmitting aerial the area covered by the fast travelling signals becomes so tremendous that only a very small proportion of the energy radiated can be picked up in an aerial. Thus you will readily see that at your own distance from the Daventry station it must be only an incredibly minute fraction of the power passing into space from Daventry's aerial that reaches your own aerial, and works your little "Lo-Cost" receiver. Yet that very small fraction so truly represents the total energy, that the voice which is controlling the latter is reproduced with such fidelity by your set that anyone knowing it would be able to recognise the speaker! Looked at in this way the marvel is not that the signals are rather weak but that there are any signals there at all. Yet it is quite natural to want to make them as loud as possible, and in order to do this you will see from the foregoing that there are only two possible methods in which this can be done. The first method is to increase the amount of energy picked up. Obviously the only way to do this is to have a good aerial so that you pick up as much of the energy that is being radiated as possible.

AVOID LOSSES.

The second way in which you can increase strength is to make sure that there are no losses anywhere. Remember that the little currents of the aerial are travelling through your set to earth, and it is in this journey that they work the receiver. If, therefore, you bring the lead-in near to any earthed object there will be a tendency for the energy to hop away to earth across the intervening space instead of passing to the set. Naturally energy which is bypassed in this way represents so much energy lost, and therefore it behoves you to get the aerial and earth system as efficient as possible in order that all the energy that is being put into the aerial should actually pass through the set, and work the telephones. By taking every care to get the highest possible efficiency you can conserve the energy and thus ensure that your little crystal set is working at its maximum efficiency. If even then there is not sufficient power for your requirements, the only thing to do will be to utilise the latent power that lies in a battery or dry cell, harnessed to that modern miracle—a valve.

THE WAVE-TRAP CRYSTAL SET.

"WIRY" (Friern Barnet, London, N.).—"I see that on page 1231, 'P.W.' 298 (February 18th), it says the wire for the Standard Wave-trap is No. 26, but in the description of the trap in 'Radiotorial' it says 28 wire should be used. Which is right?"

The number of the D.C.C. should have been 28, not 26.

"THE NEARER THE BONE . . ."

S. J. (Bradford, Yorks.).—"We used to live about four miles further out and then I could not hear Bradford at all well. But now we have come closer in I can hear it as plainly as anything. Why is that?"

Although wireless is the newest science, it obeys the old laws of distance. Every yard that you move farther in towards the broadcasting station is a yard towards perfection. And in broadcasting as in carving, "The nearer the bone the sweeter the meat."

POSITIVE AND NEGATIVE LOUDSPEAKER TERMINALS.

G. W. (Beeston, Notts.).—"My loudspeaker terminals are not marked positive or negative. Can you tell me the best means of ascertaining one from the other?"

It is not easy to tell which is the positive and which the negative terminals, although it can be done. The usual method of determining this depends upon the fact that if a small current is run through the loud speaker the magnetism resulting from this current will either assist or oppose the permanent magnetism of the loud speaker, according to whether the battery supplying the current is connected correctly or incorrectly.

In practice the experiment is generally carried out as follows. The horn and its support are removed from the loud speaker and the latter is suspended at a convenient height with the permanent magnet exposed to view. Leads are connected to the loud-speaker terminals and taken to a battery, which can be cut in or out at will by means of a switch. Then the magnet is magnetically "loaded" by pins or other small objects, the idea being to attach a load to it as heavy as it can magnetically bear. When the magnet is fully loaded, the battery should be switched in and the effect upon the load should be noted. If the switching-in appears to have no effect upon the load reverse the battery terminals and switch in again. Should the load fall off when the battery connections have been reversed, this will indicate that the battery connections are now the wrong way round, and that its magnetism is opposing instead of assisting the permanent magnet. By careful manipulation it is possible so to load the magnet that every time the battery is reversed the load falls off. When the correct position for holding the load has been definitely ascertained in this way, mark the loud-speaker terminal which is connected to the positive of the battery with a plus and that which is connected to the negative of the battery with a minus mark. This will ensure that the plate current of the valve which flows from the H.T. positive will be connected to enter the loud speaker at its positive terminal and leave at its negative.

WHAT IS RE-RADIATION?

D. W. (Chatham).—"I picked up Hamburg quite clearly on the crystal set, but when I told my neighbour (who has a three-valve set) he said he was tuned to Hamburg at the time, and I was only getting 're-radiation.' What does that mean?"

Re-radiation from a valve set often occurs when reaction is used. What happens in such cases is that the valve set picks up some of the weak signals from Hamburg, and by means of reaction it *strengthens its own input*. Consequently the originally-weak signals are magnified till they are quite strong, and if this process is carried far enough the valve-set receiving aerial may actually commence to transmit some of Hamburg's signals to neighbouring aerials! This is called re-radiation. If your aerial is close to the other one it is probable that you were picking up Hamburg via next door by re-radiation.

IS NEUTRALISING WORTH WHILE?

T. W. A. (Dundee).—"I find neutralising is a difficult and troublesome job, and as the set seems to work O.K. without being adjusted exactly I am wondering if it is really necessary?"

It is a shame not to neutralise a set which is supposed to be neutralised, for it means losing several distinct advantages. For one thing the correct adjustments and handling of the set is easier when once it has been neutralised, and it does not then cause interference with neighbouring sets.

Quite as important is the effect upon sensitivity—a long-distance set that is badly neutralised will not bring in half the stations which it is capable of getting when the neutralising adjustment has been made properly.

SHORT-WAVE NOTES.

APPARENTLY the transatlantic telephone has at last forsaken its old pitch and started up on short waves. On about 19 metres, one half of it may be heard, the other half being on about 20 metres, although sometimes I have heard them both in the neighbourhood of 16 metres. Since the British station and the American are almost the same strength, it appears that the only reliable way of telling which is which is by the strong accent generally noticeable on one "half"!

A really sensitive short-wave receiver has a most disturbing habit of picking up all sorts of "transmissions" other than those for the reception of which it is intended. A few days ago I had been carrying out some tests with a new microphone, and left it lying loose on the bench, with its long flex leads simply trailing along and then dropping on to the floor.

Judge my astonishment when, on running my fingers along the edge of the table, very loud rustling noises, obviously due to the microphone, were heard in the headphones. When someone spoke quite a foot away from this microphone (which was lying *face down* on the bench) very clear and intelligible speech in the 'phones resulted.

Peculiar "Strays."

Annoying sounds in a short-wave set may often be traced to such improbable causes as tools rubbing together on the table, or even bits of wire making intermittent contact at quite a considerable distance from the set. A friend informed me once, in all seriousness, that he had to keep his box of "stray" wires of all shapes and sizes outside the room. If it were brought anywhere near the set, a lorry passing down the road caused all the wires to shake, and produced quite a severe storm of atmospherics in the receiver!

It is well worth the little time spent to try the effect of supporting your receiver on boxes or small ebonite legs, not with any motive of insulation, but simply to ensure that the coils are really well above the level of the table.

I always prescribe this simple alteration in cases where the owner of a short-wave set is having difficulty in getting his receiver to oscillate right down in the lower ranges, and it generally has a beneficial effect. On my own, which is always supported by three valve boxes, the action of removing them and lowering the whole thing to the table level has the effect of raising the minimum wave-length of a given coil and condenser from 14 metres to nearly 16 metres!

A long, low aerial is very often found to give really excellent reception, particularly in cases in which the main aerial is somewhere near a source of artificial interference, such as electric trains or trams.

I sometimes use my transmitting counterpoise as a receiving aerial, and interference certainly is considerably lessened. The one trouble that I have not yet succeeded in overcoming is the persistent trouble on 20 metres, or thereabouts, from L.G.O.C. 'bus magnetos, which are more or less selectively tuned to that wave!

NEWS FROM SAVOY HILL.

(*Continued from page* 12.)

Miss Cable on Tibet.

Even in these twentieth-century days, when explorers are discovering hitherto unknown tribes and unearthing buried cities of the past, comparatively little is yet known of Tibet, the "Forbidden Land" as it is called, beyond the vastnesses of the snow-capped Himalayas. There will thus be something unique in the missionary talk which Miss Mildred Cable is giving at 5.30 p.m. on Sunday, March 4th, in the London studio entitled "The Dancing Rituals of the Tibetan Lamas."

Miss Cable, with the Misses Eva and Francesca French, has had considerable experience in China with the China Inland Mission, and a few years ago lived for some time in the far North-West of the isolated province of Kanzu, making preparations to undertake the dangerous and wonderful trek across Central Asia to Siberia. The privilege they had of entering Tibet, the country closed to travellers, except to the few who can approach it from the Chinese border, was almost unprecedented and their experiences, which listeners will hear this afternoon, are certain to be of the greatest interest.

Belfast News.

A running commentary on the ceremony of the reopening of the Parliament of Northern Ireland will be broadcast at 11.45 a.m. from the Belfast Station on Tuesday, March 6th. During the same evening the Ulster Station is paying a tribute to its neighbours across the water by giving an all-Scots programme, the chief feature of which will be a one-act play entitled "The Lost Piper," which deals with an old Scots legend of the eighteenth century. The play is founded on a tradition that a subterranean passage extends from Musselburgh Sands to Edinburgh, through which many years ago a certain piper wagered he would walk playing his pipes the while.

A Newcastle Event.

Songs and choruses, some of them devoted entirely to the North Country, are included among the contributions of the Wallsend Male Voice Choir, in a programme they are giving under the direction of Mr. George W. Danskin, in the Newcastle studio on Monday evening, March 5th. Two short sketches entitled respectively "All Square" and "The Healing Herb," which Mr. E. A. Bryan, of Gateshead, has specially written for broadcasting, will be performed during the same evening, the cast being drawn from the Repertory Company.

Talks—A New Departure at Cardiff.

Dr. Olive Wheeler, Professor of Education at the University College, Cardiff, who is to give a talk on "Psychology for Parents—Early Developments" on Tuesday, March 6th, has lectured in many parts of Great Britain on educational psychology. She is the author of various books and papers on this subject, on which she is a great authority.

APPARATUS TESTED.

(Continued from page 28.)

both the high and the low notes successfully, and although it is probably more than usually sensitive it can deal with heavy inputs. It is the kind of speaker that looks well in any room, whatever its furnishing, and will give pleasing results with practically any type of receiver.

RIPAULTS H.T. DRY BATTERY.

It will probably be remembered that a few weeks ago we mentioned that we had received a "self-regenerative" type H.T. dry battery from Messrs. Ripaults for test. It is claimed for this type of battery that internal resistance has been entirely overcome and that the capacity output and life has been increased to a considerable degree. The actual battery we have had under test is the triple-capacity type, model H.M., a 90-volter which sells at 29s. 6d. The maximum discharge advised for this battery is 18 milliamps. The approximate life in hours is stated to be 335 hours at a 20-milliamp discharge rate. At 100 hours per month aggregate use this gives a life of three and a third months approximately.

The sort of modern set with which it could be used is a five-valve receiver employing power valves. On the test we gave it we exceeded the maximum discharge advised and after delivering a current of 21 milliamps for well over 300 hours the battery is still capable of doing somewhat lighter work probably for some time. It will be seen that Messrs. Ripaults have not overrated their battery and have, in fact, given a conservative estimate of its life.

We have also carefully tested one of the smaller types and find this similarly satisfactory. The term "self-regenerative" as applied to these Ripault H.T. batteries does not mean that they are capable of living for ever and ever, but that they quickly depolarise and give consistent and long service.

DIONOID ACCUMULATORS.

We have recently had the opportunity of examining and testing an accumulator manufactured by the Dionoid Battery Co., Ltd., of Prince of Wales' Road, Darnall, Sheffield. The accumulator is of special construction and has many points of interest.

It has, for instance, a removable metal carrying handle, while the glass container is enclosed in a thick, protective casing, a window being provided to enable the acid level to be checked. Very strong precautions against the effects of acid attacks on the various parts have been taken by the use of a special enamel. This appeared to us to be a particularly sound battery, and one that should give long and reliable service.

THE STEWART-WARNER REPRODUCER.

We have had on test a loud speaker due to the Cooper-Stewart Engineering Co., Ltd. It is a very heavy instrument, and its main construction is an imposing metal casing. But it is very nicely finished in antique bronze-green, ornamented with attractive tracery in a kind of Grecian style. If the projection is somewhat restrained, speech is clear and the speaker's register is wide. The price of this accessory is £6 15s.

TECHNICAL NOTES.

(*Continued from page 12.*)

L.F. Amplifiers.

A low-frequency or audio amplifier may be considered satisfactory if it amplifies the signals impressed upon it sufficiently to operate a loud speaker with adequate volume, and if it does so without distorting the signals to an extent sufficient to become noticeable in the output from the speaker. Proper performance in this respect can only be obtained when the amplifier has been correctly designed and, what is perhaps even more important in practice, when it is properly operated.

The overall characteristic of an amplifier is often quite different from the characteristic of any individual stage, and this is particularly true of transformer-coupled or impedance-coupled amplifiers. It is probably due, in some cases, to coupling in the plate-supply, whereby regenerative effects are produced which induce changes in the overall frequency characteristic of the audio system. Effects of this kind are also present sometimes in resistance-coupled amplifiers, and give rise to the effect which is referred to as "motor-boating."

Peculiarities.

The solution of difficulties of this kind is to design the amplifier so that it has a flat characteristic, or else to design two units to have a flat characteristic, and then to arrange the circuit carefully so that regenerative effects shall not be present to any appreciable extent. This usually necessitates feeding of the grid and plate circuits through resistances or choke coils, and by-passing the circuits with suitable condensers.

Limits of Transmission.

In some modern transformers the design is such as to cut out audio frequencies much above 5,000 cycles per second. This has the effect of excluding various extraneous valve noises, high-frequency heterodyne whistles and so on, which are usually above the figure mentioned. In any case, it is known that frequencies much above about 5,000 do not add appreciably to the quality of the reproduction and can, therefore, be eliminated without loss. It is doubtful, indeed, whether the majority of broadcasting stations really transmit notes of more than about 5,000 cycles.

Many amplifiers have a tendency to oscillate at high audio and supersonic frequencies, but if the amplifier is designed to give little or no amplification to frequencies of this order, the tendency of the amplifier to oscillate will be counteracted.

Sound Characteristics.

The characteristics of the human ear in relation to atmospheric sound-waves have become increasingly important with the advent of broadcast receivers and many other modern acoustical devices and have, therefore, received much greater attention than formerly from scientific investigators during the past few years. Some very interesting and remarkable facts have been discovered. It is evident that there is a minimum intensity below which the average ear ceases to be conscious of any sound and there is, in the same way, a maximum intensity, but in the latter case, if the intensity exceeds a certain value, the ear becomes conscious of a sensation of pain rather than of sound.

The upper and lower limits of pitch of sounds are well-known, the lower pitch being about 30 cycles per second, and the upper limit varying with the individual between about 15,000 and 40,000 cycles.

The number of separate types or sensations of sound which the ear can appreciate and distinguish is large; it has been found to be upwards of 300,000.

Pressure-Changes.

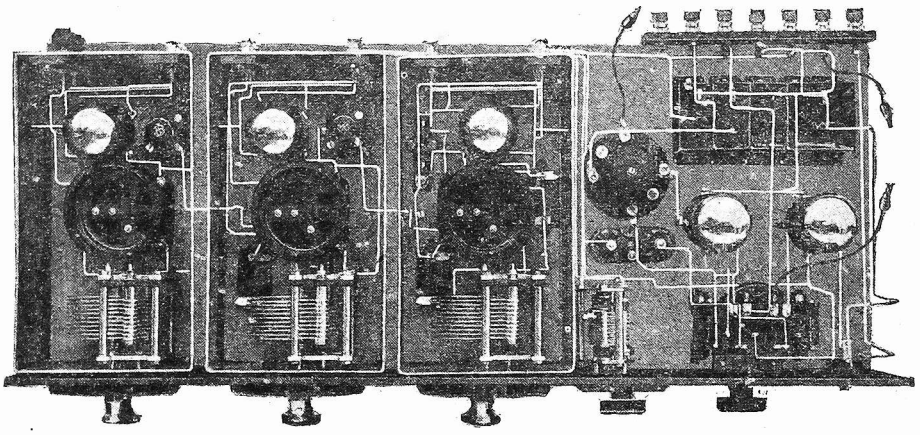
One of the most striking observations relates to the great difference in pressure-change which can be appreciated by the ear. If we take the minimum pressure-change which occurs in a sound only just audible and the pressure-change in a sound which is becoming unbearably loud, we find that the latter is about 100 million times greater than the former. The energy-ratio of these two quantities is actually ten million million.

The sensitivity of the ear to variations in loudness is, on the other hand, very poor. With weak sounds, a change of about 25 per cent in loudness is necessary to be properly distinguishable, whilst with louder sounds a change of about 10 per cent is detectable.

The appreciation of slight differences in pitch varies considerably with the individual, but generally it is found that at medium and high frequencies a change in frequency of about 0·2 to 0·3 per cent can be detected, whilst at low frequencies a change in frequency of about 1 per cent is necessary.

Distance . . . . . to the very edge
Volume . . . . . to fill the house
Purity . . . to give radio the breath of life

The Free Blueprint simplifies building to a degree that everyone may duplicate the original set wire for wire without the least difficulty.



The instructions for building this master receiver have been divided to cover six enjoyable evenings, making success certain.

THE great set for you is the Raleigh P.M. You will be amazed at the remarkable power which its five valves have at their command.

Imagine how much greater one's radio enjoyment would become if possessed of the Raleigh P.M. Once and for all radio from the Continent would find a welcome with all the members of your family. Their prejudice against "foreign stations" which you have almost despaired of ever breaking down, would vanish during your first half-an-hour's test. Think of the untold pleasures to which you will be able to treat them and your friends.

It is hardly creditable that two high-frequency stages are able to reach out to any part of Europe as one feels inclined to direct them.

Yet it is definitely the case, as hearing is believing. On the long waves one journey round the dials brought in eight stations; most other sets satisfy themselves with four.

If your radio set is to provide your family with a variety of distant programmes at a volume as intensive as the local, it should embody not less than two high-frequency valves.

It must not be assumed that a large set is difficult to handle because it employs a large number of valves. The true state of affairs is rather to the contrary. A group of stations may be tuned-in on the Raleigh P.M. which by comparison almost place a slightly lower-powered valve receiver into the category of the crystal set.

It is scarcely believable that the simple addition of two or three valves may completely transform a radio receiver so that it will always provide its owner with more programmes than will ever be called upon to deliver their entertainment. Such an overwhelming supply of music from opera to jazz, from musical comedy to the concert-hall, is at the call of any reader who owns a Raleigh P.M.

Fill in the coupon to-day.

STATION.	Aerial	1st H.F.	2nd H.F.
Unidentified	76·5	75	76
Radio Paris	71	68·5	65·5
Daventry	64	59	58
Berlin	44	44·5	44
Unidentified	34·5	35	36·5
Unidentified	31	32	33
Unidentified	26·5	29	28
Hilversum	25	24·75	25
Budapest	94·5	92	93
Munich	88	89	89
Vienna	85	86·25	86
Brussels	83·5	85	85
Daventry (5G3)	81	82	83
Langenberg	77	78·5	78·5
Oslo	75·5	77	77
Rome	73.25	75	75
Breslau	71·5	73·5	73·5
Frankfurt-on-Main ...	69	71·25	71
Cracow	68	70	70
Berne	65	68	67·5
Glasgow	63	67·5	67
Plymouth	62·5	66	66
Hamburg	62	65	65
Toulouse	60·75	64	64
Manchester...	58·5	62·5	62·5
Stuttgart	58	62	62
London	56	59	57
Koenigsburg	45·5	50	50
Bournemouth	44·5	49	49
Paris...	44	48	47
Dublin	43·5	47·5	46·5
Breslau	42	47	45·5
Newcastle	41	45	45
Belfast	38	44	42
Nuremburg...	37	43·5	40·5
Liverpool and Hanover ...	36	41	41
Innsbruck	34·5	40	39
Edinburgh	34	37·5	38
Sheffield and Cassel ...	31·5	33·5	32
Lille	28	31	29·5
Toulouse	27·5	28·5	27·5
Bremen	26	27·5	25
Gleiwitz	25	26	25
Muensten	23	23	20
Orebro	22·5	20·5	19
Halmstad	19	8	8

THE MULLARD RALEIGH P.M.

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

NAME.....

.....

ADDRESS.....

.....

..... P.W.7.

Mullard
MASTER · RADIO

Printed and published every Thursday by the Proprietors, The Amalgamated Press, Ltd., The Fleetway House, Farringdon Street, London, E.C.4. Advertisement Offices: Messrs. John H. Lile, Ltd., 4, Ludgate Circus, London, E.C.4. Registered as a newspaper for transmission by Canadian Magazine Post. Subscription rates: Inland, 17/4 per annum; 8/8 for six months. Abroad, 19/6 per annum; 9/9 for six months. Sole agents for South Africa: Central News Agency, Ltd. Sole agents for Australia and New Zealand: Messrs. Gordon & Gotch, Ltd.; and for Canada: The Imperial News Co. (Canada), Ltd. Saturday, March 3rd, 1928.
R/R