

HOW TO MAKE THE "ECONOMIST" H.T. UNIT. (See Page 259.)

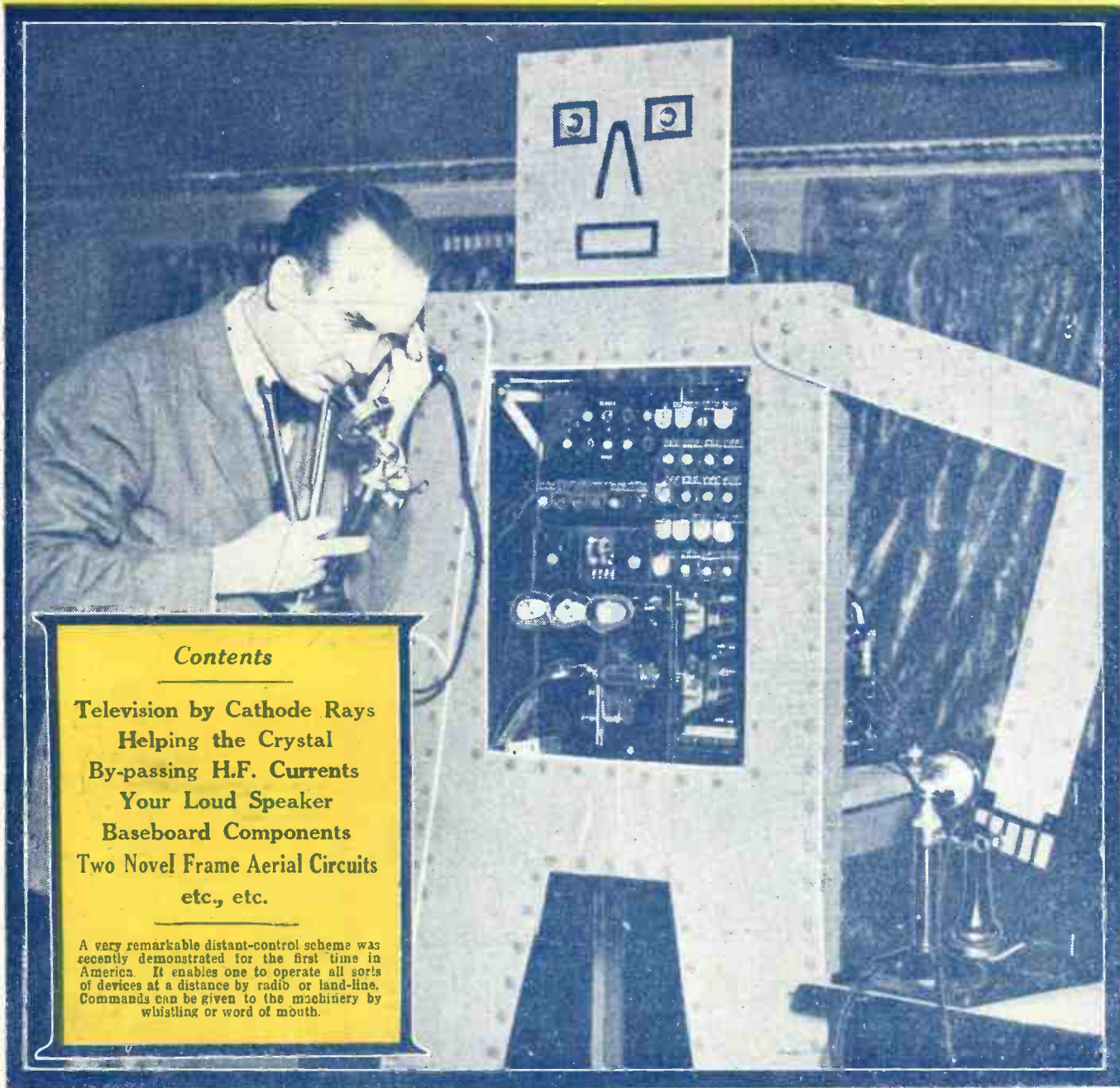
Popular Wireless

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No. 306. Vol. XIII.

INCORPORATING "WIRELESS"

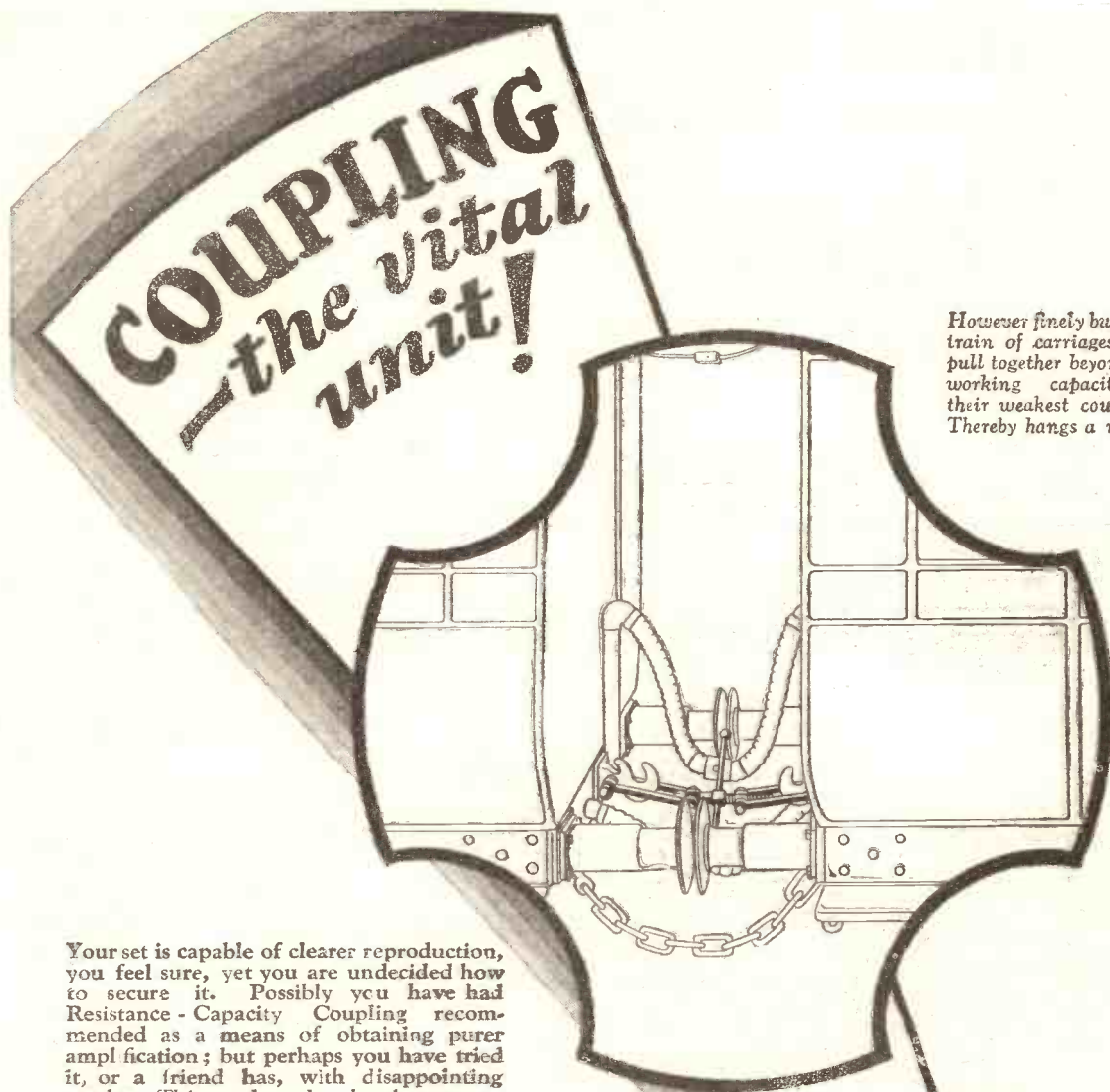
April 14th, 1928.



Contents

- Television by Cathode Rays
- Helping the Crystal
- By-passing H.F. Currents
- Your Loud Speaker
- Baseboard Components
- Two Novel Frame Aerial Circuits
- etc., etc.

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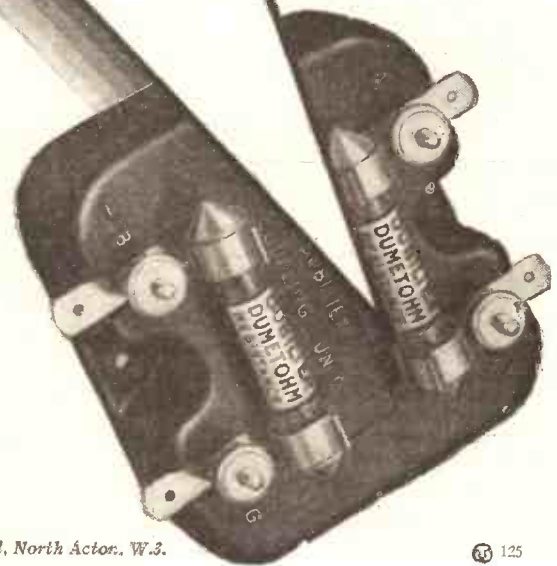
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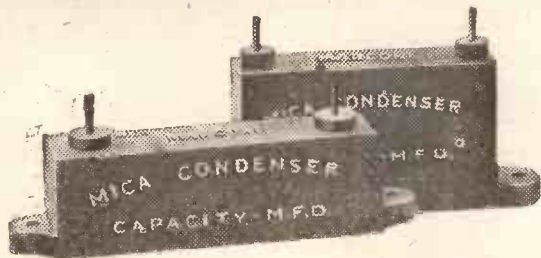


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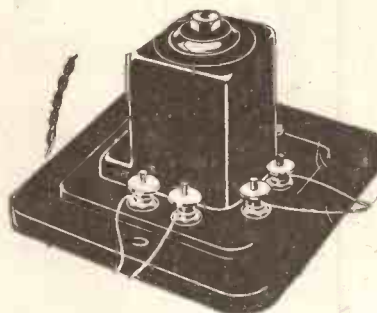
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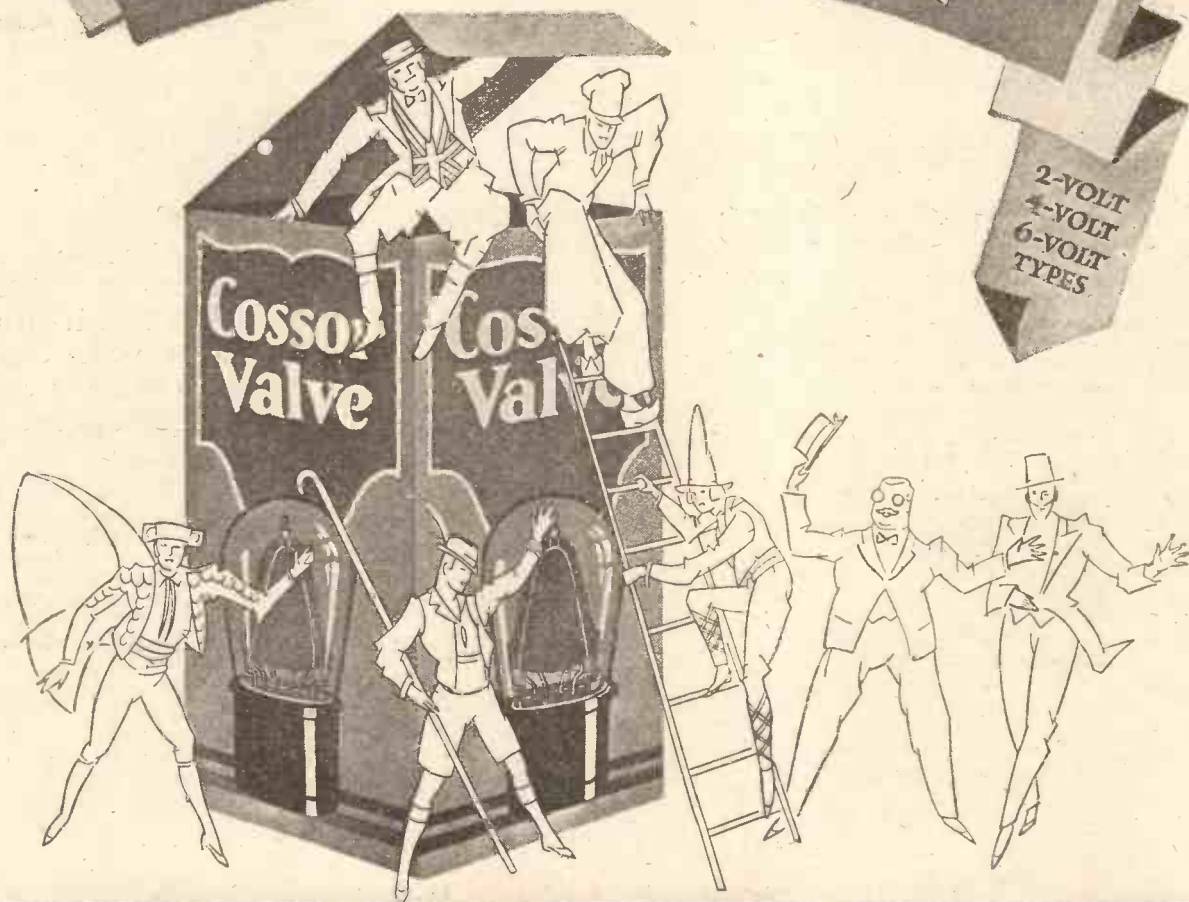
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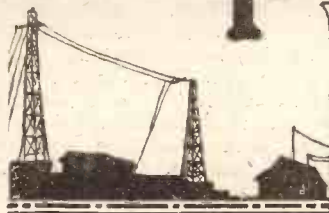
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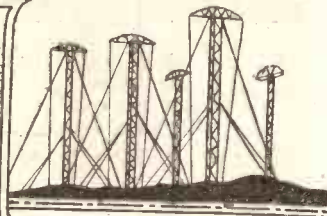
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RADIO NOTES AND NEWS.

The 1928 Chitos—Radio in Tiger-Land—The Great Discovery—A Few Bill-Toppers—
 Modern Wizards—The Sceptic Speaks—Radio Friendship.

Lighter Portables.

NOW that "out-of-doors" weather is here, or is due here, people are beginning to wonder whether they will make or buy portable sets. Most of last season's portables struck me as being on the large and heavy side; there were many valves and consequently heavy batteries. It occurs to me that a "regional scheme" under which the whole country is evenly served by high-power stations will cause a modification in the design of portables, tending to lower valve power and reduce weight and size.

Trade and Progress.

"FLAT, stale and unprofitable" as is the journalists' trade, nevertheless I am sometimes moved to pity the manufacturer of radio sets. Not only has he to design his goods from six to nine months before the "season" opens, but he has to foresee public taste, foresee the development of the B.B.C.'s system of stations, foresee—or chance—any new inventions, especially in valves, he must introduce something new in the way of control or cabinet or lay-out, and he must try to reduce his prices. So far as I know no radio manufacturer has successfully introduced real "mass production" in Britain. When shall we see the Morris of radio?

Court Circular.

SOME weeks ago, on one of his "off" days, the King of Afghanistan paid a surprise-visit to a certain well-known maker of wireless sets. I should greatly like to know what came of it, because Oriental potentates generally do not buy by the couple; rather do they "acquire" in right royal fashion. I heard of an Indian ruler who took a fancy to a "grand" piano—and ordered a hundred. One can only suppose that some scores of his officials were instructed to play Beethoven on the instant.

Amanullah and the Ether.

I LEARNED from one of the party that I conducted King Amanullah and his Queen over the Marconi Beam station at Dorchester what happened there. It is correct that this King who rules, and up

to a few months ago had remained in, that far-off country, showed that he understood the basic principles of radio

"P.W.'s" NEW ADDRESS.

Will our readers and correspondents please note that in future all communications to the Editor should be addressed to—

"POPULAR WIRELESS,"
 Tallis House, Tallis Street,
 London, E.C.4.

and that his questions were surprisingly pertinent. How do these kings do it all? Before leaving their Majesties obliged with their autographs—on a sheet of typing paper, which I have seen. Her Majesty signed, I believe, in Persian; but that accomplished King's signature would do justice to any English copybook.

A Sample of Criticism.

THE Chief Engineer of the Newcastle Station, in a recent speech, told an amusing story of a Sunderland listener who wrote to the B.B.C., saying: "Your transmitter has been broken down for a week; you ought to know about it." Of course, "P.P. Eck." does not allow his stations to have such long holidays, but the lesson I draw from this is that the B.B.C. could make excellent capital out of a short reading from the letters of such candid and kindly critics.

A Typical Programme.

ONE can conceive, for example, a report as follows: "I don't think your programme of the 22nd inst. was very entertaining. After half a time-signal I heard fourteen bars of 1812 by Mister Chike-offsky, followed by twelve minutes' dead silence—presumably representative of six years' Nov. 11th 'silences'—after which there was a Morse fight between the coast station at Ushant and a liner 300 miles south of Santander. Then came a break of seven minutes, followed by a duet between the N. Foreland station and a cat three doors away who seemed to be *in extremis*. But I much appreciated the carrier-wave of some station unknown."

ENABLING THE DEAF TO HEAR.



Students of a New York deaf and dumb institute were enabled to hear broadcasting through the device illustrated above. It consists of hard rubber, rather like a pipe stem, which is attached to the drive pin of a loud-speaker unit.

(Continued on next page.)

NOTES AND NEWS.

(Continued from previous page.)

The 1928 "Chitos."

OUR up-to-date edition of this famous circuit is maintaining the reputation of its predecessors, and happy letters about it are arriving in bulk. T. G. (Dublin), on an aerial 14 feet high, gets Warsaw, Langenberg, Berlin, Frankfurt, Zeesen, 5 G B, and Manchester at strong 'phone strength on one valve. In building his set he omitted the oscillation control, and his grid leak is 2 megohms.

"Chitos" Amongst Other Gems.

P.W." gets all over the world and like to hear from overseas amateurs, Britons or otherwise. Here is a note from a constant reader of Bombay, Mr. Shrikishandass, on letter paper bearing the romantic legend, "Pearls and Precious Stones." Our Indian friend is satisfied with the 1928 "Chitos" and proposes to add an H.F. stage with one of the new screened, grid valves. Good! I hope S. of Bombay will give me further news and let me know whether he gets Europe (Belaiti). And if any pearls stick to the paper I shall be glad to send a receipt. I remember my Bombay days with pleasure, though I was badly diddled near the Taj Mahal Hotel.

Radio in Tiger-Land.

BEFORE leaving India permit me to blow a toot of welcome to No. 6 of "Radio Jottings," the journal of the Radio Club of Bengal. Hurray for the enterprise of "Calcutta side"—as we Anglo-Indians say! To one who remembers amateur radio in its leaner years it is amazing to see this healthy young journal from Calcutta, with its diagrams, positively genuine ads., and pen-and-ink sketch, entitled "Photographical Illustration of Complete Eliminator." The letterpress is full of sound advice, and the price is annas two. Good luck to the young 'un, from "P.W."

Stamps and Radio.

IT is conceivable—such is human frailty—that a man can find room in his life for two loves. It is even possible, in this rummiest of all worlds, that a man can be a radio fan and a philatelist simultaneously. If there is anything madder than a real radio enthusiast, it is a stamp-collector. A combination of both must be terrific. I have before me a stamp journal full of thrilling references to "new issues" and "hitherto undetected fly-spots on French Colonials," etc., and it urges the B.B.C. to introduce talks on stamps. Well, on April 19th, 7.25 p.m. to 7.45 p.m., there will be such a "talk" from 2 L O.

The Great Discovery.

I THINK that I have at last discovered the fundamental error of those musical experts who turn up their noses at radio and talk of "distortion" and "lack of balance," etc. Where they run off the rails is at the point where they imagine that we think the radio reproduction is the same or as good as the original. Of course, we don't think anything of the sort, but we know that a good copy is better than nothing—in fact, half a bottle is better than no ginger ale. And without

radio, what chance would tens of thousands have to hear good music?

A Few Bill Toppers.

FOR instance, such music as we shall hear from 2 L O and 5 X X on April 14th, from the Kingsway Hall. And, on the day before that the same stations will relay a National Concert from the People's Palace. From 5 G B on April 12th comes the opening concert of the National Orchestra of Wales, which is bound to be good. Cardiff, on April 14th, gives a popular orchestral concert, and on the same date Newcastle is to put on the Brancopeth Colliery Prize Band.

Modern Wizards.

IN more than one book of fiction the hero has got out of a tight place by pretending to shut out the sun or moon, eclipses of those orbs occurring just at the critical time. I recall the sun eclipse in Mark Twain's "A Yankee at the Court of King Arthur," and the moon

SHORT WAVES.

A correspondence course in wireless has been started. It is said to be as simple as B.B.C.—"Humorist."

Superior Person: I can read a modern novel and listen to radio music at the same time.

She: Really?

Superior Person: Oh, yes; I find that each takes my mind off the other most effectively.—"Everybody's Weekly."

It is reported that a certain enthusiast walks about and listens-in by means of a miniature wireless set concealed in his hat. We know many people who talk through theirs.

Every dull emitter has a silver lining.

Bones: What does your radio bring in?
Fones: The instalment collector.—"Radio News."

SAFETY FIRST.

A leading Paris hotel has installed a loud speaker in each of the bathrooms.

Apart from hearing the broadcasting when indulging in a bath, it is highly appreciated when a key or a latch of the door is missing.

A cynic suggests that it is an attempt to educate the bathroom tenor.—"Popular Radio Weekly."

His voice was full of static.

"Oh, can't you learn to care?"

Her answer was emphatic:

Said she, "Get off the air!"

eclipse in Rider Haggard's "King Solomon's Mines." And now we have Ferranti's producing lightning flashes at will. So thorough are they in testing out their protective devices that they have gone to the length of making arcs of a million volts. Nasty toys these transformer people play with! But as they put the same zeal into the tests of radio transformers home-constructors may be complacent.

Lilliput at 3 L O

THE only independent country in the Pacific islands, and probably the world's smallest kingdom, has produced a choir of thirty voices, including that of its Prince. I speak of Tonga. These Tongans have been broadcasting from 3 L O (Melbourne), and are said to sing in English with perfect balance, expression, and tonal quality. They render

"Hail, Smiling Morn" and bits from "The Messiah." As the dear old lady said when she saw a giraffe, "Bless me! What will they think of next?"

Wireless Classes.

MR. G. E. BUDGE, Secretary, Holloway Literary Evening Institute, County Secondary School, Hilldrop Road, Camden Road, N.7, begs to remind Holloway (and district) readers that a wireless class under the control of Captain Jack Frost (late B.B.C.) is held each Monday evening at that institute, from 7.30 p.m. to 9.30 p.m. Talk by Captain J. Frost, demonstration, discussion. Fee, 2s. Classes continue till Whitsun.

The Sceptic Speaks.

MR. B. ELSTON, the well-known radio sceptic and anti-valve-Bart., in a very jolly letter denies that he is a sceptic. Rather, he says, does he speak merely the truth that is in him, which is that he has not himself succeeded in accomplishing the feats recorded of my Valve Barts. and Barons. That's more like it! Despite his generous letter, I am inclined to think that he doubts; for he hints that wireless fans are competing with fishermen. Ah! he has evidently neglected the "Sydney" Two.

Let him try that and give "Ariel" news of it, the unbelieving dog of a—something-or-other.

Radio Friendship.

MR. CHARLES D. MACLURCAN, the President of the Wireless Institute of Australia, has been over here, staying with his friend Mr. E. J. Simmonds, a name many of you dwell upon with gratitude. The interesting side of this visit is that the two "friends" had never met before MacLurcan arrived here, and their friendship had seeded and blossomed out of their radio talks with each other over a distance of about 12,000 miles.

Correction.

IN our issue of March 24th, I mentioned that Mr. R. L. Rowland, BRS 131, transmits on C.W. and telephony. He says he does not, having no transmitting licence. I was misinformed, but hope R. L. R. will continue to read "P.W."

Prison Notes.

AT Rheinbach, Prussia, on Sundays and holidays, the inmates of the prison are subjected to the process of broadcasting. It is to be presumed that they look forward with pleasure to these contacts with the life beyond the walls. I cannot say offhand what a German Sunday programme is like, but I hope it is not such as to provide the prisoners with the mental equivalent of "forcible feeding."

What of 5 S W?

THIS station has by now been in regular operation long enough for reports to have been received from all places that matter. Is not an interim announcement due from the B.B.C.? The public is more or less interested in Empire broadcasting, and, though I don't want to rub it in, I suppose 5 S W is run at the public expense.

ARIEL.

A COIL PLUG SWITCH.

By H. J. B. C.

FREQUENTLY during the course of experimental work on receivers one is called upon to make and break the L.T. circuit a great number of times, sometimes through the medium of a filament switch, and also by actually disconnecting the leads from the accumulator to the terminals of the set.

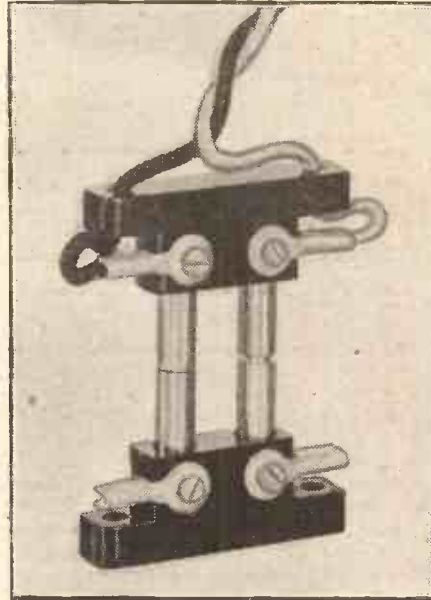
In the case of the last-named, unless one is careful, the two leads may short, with dire consequences to the accumulator; or, again, unless the leads terminate in spade tags, the wire ends become frayed and are likely to cause damage.

Ensures Correct Connections.

In situations such as these it is better to resort to some form of plug-and-socket arrangement which permits a rapid make and break of the circuit, and yet keeps the leads intact, and, furthermore, ensures the connections being made correctly, i.e. positive to positive and negative to negative. The following simple arrangement meets the case very well, and has served the writer many times.

Obtain two ordinary single-coil holders—or, alternatively, a coil holder and coil plug—and mount one holder on the back of the set just above the L.T. terminals; or, if desired, it can replace the L.T. terminals. Join the positive and negative filament terminals or leads from the set to the plug and socket terminals of the holder.

The other holder (or plug, if preferred) should have the ends of the twin red and black flex joined to the socket and plug terminals so that the positive socket fits into the positive plug or vice versa, as desired, and as is shown in the photograph. To break the L.T. current, it is now only necessary to withdraw one plug from the other, and we have a most efficient, neat, and inexpensive switch; and, in addition, the leads joined to the accumulator are kept apart, and hence cannot short or cause trouble.



Two single-way coil holders can be used to fashion the simple switch device described in the accompanying article.

RADIO ITEMS OF INTEREST.

The Hungarians are contemplating the erection of a station at Budapest with a power far greater than that of any of the British stations.

A high-power broadcasting station similar to the German giant at Zeesen is to be erected in Finland this year.

One or other of the German stations is generally on the air before breakfast, and daylight programmes, often of excellent quality, are a strong feature of the German stations.

Unless high-frequency amplifying stages are used, the distance over which a simple set will receive is chiefly dependent upon the skill of the operator.

As a matter of fact, "cheap" H.T. batteries are not necessarily cheap H.T. batteries!

The capacity of the average aerial used for receiving broadcasting is between .0002 and .0003 mfd.

Riviera residents are agitating for the erection of a powerful broadcasting station at Nice.

The Johannesburg Station, J B, is now broadcasting on an additional wave-length of 32 metres.

CALCULATING H.T. VOLTAGES.

MANY amateurs must be considerably puzzled at times to determine the actual H.T. voltage applied across their valves, especially in L.F. circuits, where it is necessary to know at least an approximate figure, in order not only to apply the maximum recommended by the makers, but also to arrange the correct value of grid bias.

A simple method, giving a result near enough for all practical purposes, is as follows:—

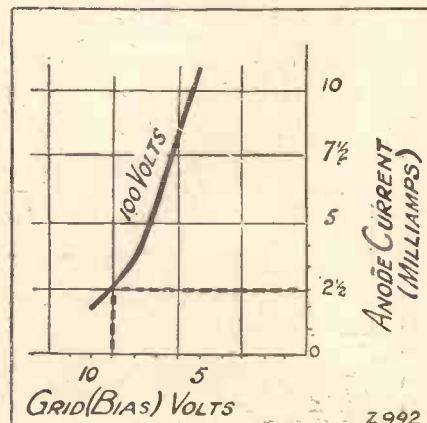
Presuming we wish to apply the maximum permissible H.T., but no more, we look up the "curve" diagram supplied with the valve, and select that curve representing the maximum H.T., which will be the last one on the left. Now we add a permissible $1\frac{1}{2}$ volts or so to the grid bias recommended with this H.T. voltage, and where the vertical line from the G.B. voltage intersects our curve, we read across on to the anode current.

Simple Arithmetic.

If we now multiply this figure by the D.C. resistance of the loud speaker, 'phones, choke, transformer primary or anode resistance (obtainable from the makers),

which may be in the anode circuit, and divide the result by 1,000, we obtain the voltage across them. It only remains to add this amount to the H.T. voltage desired on the valve, and to arrange our H.T. battery tapplings accordingly. To give a practical example: The D.E.P.610 has a recommended maximum of 100 volts. Using a G.B. of 9 volts the anode current at this voltage is about $2\frac{1}{2}$ milliamps. If we have a loud speaker of 2,000 ohms resistance in the circuit, 5 volts will be dropped across the windings, and 105 volts will be the H.T. required.

In the case of some valves, particularly those used in R.C.C. circuits, the discrepancy will be much greater.



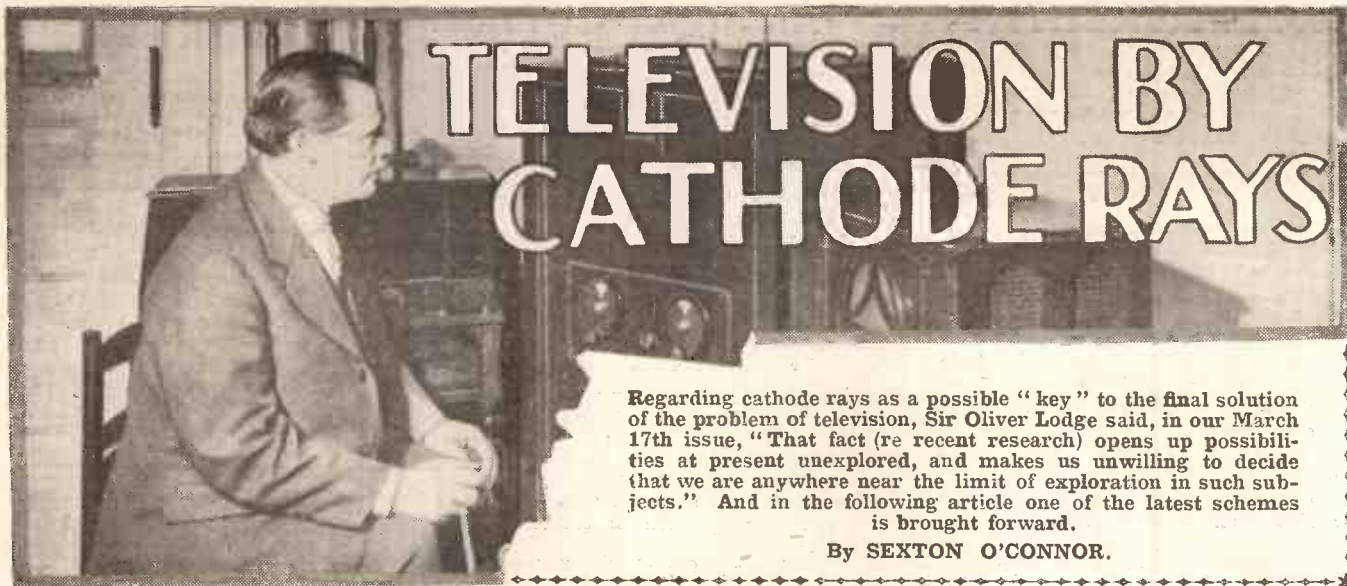
A UNIVERSAL CLEANER.

By C. A. J. MEADOWS.

AFTER a time, the best of cabinets and panels are apt to take on a dingy appearance, and so far no absolutely satisfactory means of restoring them to their pristine freshness has been discovered. A polished ebonite panel looks particularly "grubby" very soon after it is put into constant use in a set, and simply rubbing it over with a duster will not keep it free from smudges and finger marks.

While overhauling a set recently with a polished panel in such a condition, various means of cleaning it were tried, none of which gave satisfactory results, as a cloudy effect remained, which detracted from the appearance of the set. As a matter of interest, every kind of polishing material was employed which happened to be available, and among them was the preparation for cleaning and polishing car paintwork known as Karpol. This restored the polish of the panel, and it was found that finger marks and smears were less noticeable after it had been applied.

It also gave equally satisfactory results when used on the cabinet.



Regarding cathode rays as a possible "key" to the final solution of the problem of television, Sir Oliver Lodge said, in our March 17th issue, "That fact (re recent research) opens up possibilities at present unexplored, and makes us unwilling to decide that we are anywhere near the limit of exploration in such subjects." And in the following article one of the latest schemes is brought forward.

By SEXTON O'CONNOR.

THE outstanding difficulty in every scheme for securing television or moving-picture results, whether over a connecting wire or through the ether, is that of transmitting the picture with sufficient rapidity to secure the necessary "kinematographic" effect. An associated problem is that of keeping the transmitter and receiver in step with each other.

The latter problem does not arise in ordinary broadcast or telephony transmission, where the transmitted sounds only vary in quality—or in wave-form outline—and in sequence of time. But in transmitting a picture, each small element has first to be converted by a scelenium cell or its equivalent into an electric current, and the resulting signal impulses, after passing through the ether or over a connecting wire, must finally each be assembled in proper position, so that each occupies its proper rank and file, so to speak, upon the viewing-screen.

15,000 Times Too Slow.

"Not so difficult," one might perhaps say, at first sight, "considering the resources of modern science." The comment is quite true within certain limits. For instance, it was solved quite satisfactorily more than twenty years ago in the case of telephotography, or the transmission over wires of still-life pictures. More recently it has been successfully adapted to the wireless transmission of newspaper and similar photographs between this country and the United States.

But in such cases it takes approximately fifteen minutes to transmit each completed picture; whereas for television the same picture must be repeated sixteen times per second. In other words, everything has to be speeded up nearly 15,000 per cent.

Now when it comes to arranging thousands of different signal impulses—say a minimum of 3,500 per square inch—accurately in rank and file on the reception screen, at this extraordinary speed, then the resources of modern science are strained to their utmost.

The task was actually accomplished in America early last year, but it evolved the use of apparatus costing thousands of pounds and the services of hundreds of men to reproduce by wireless a picture 2 by 3 inches over a distance of 22 miles.

Various inventors have from time to time devised different ingenious schemes for breaking up the picture into small elements at enormous speed and re-assembling them in proper order at the receiving end.

Keeping In Step.

Mr. Baird, for instance, uses rotating discs carrying spiral lenses which sweep over the picture and "explore" it in spiral lines as the discs rotate. Others have suggested the use of rotating cylinders, while Mr. Jenkins in America employs a somewhat similar apparatus in the form of a rotating prismatic ring. Mihaly and others use a small mirror which is rotated very rapidly around one axis, and less rapidly around another axis, so that the light is swiftly swept from top to bottom of the picture in strips, each

strip being slightly displaced laterally from the preceding one. In this way the whole of the surface is successively explored.

Whatever method of exploration is utilised at the transmitting end, a similar apparatus is required to build up or re-assemble the picture at the receiving end. In addition both sets of apparatus must be kept accurately in step with each other.

The Speed Limit.

It is well known that there is a limit to the speed of any mechanically-moving part. It may be perfectly safe, for instance, to drive a fly-wheel at 1,000 revolutions per minute. This corresponds, say, to the conditions for transmitting the still-life or ordinary photographs previously referred to.

The same fly-wheel cannot, however, (Continued on next page.)

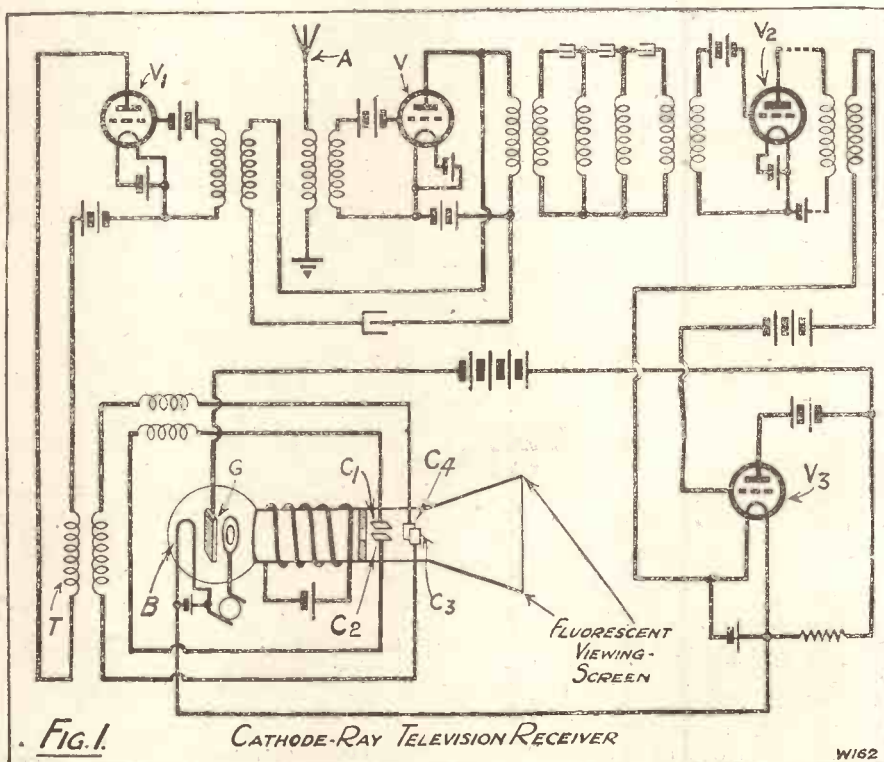


FIG. 1. CATHODE-RAY TELEVISION RECEIVER

TELEVISION BY CATHODE RAYS.

(Continued from previous page.)

safely be driven 15,000 times faster; yet this is what is involved, as explained above, in television apparatus. Centrifugal force, in the case of the fly-wheel, would break it into fragments long before it could attain the speed mentioned.

The same natural limitation applies in every case where inventors seek to use purely mechanical devices, such as rotating discs and mirrors, in order to "explore" a picture at the enormous speed necessary to obtain clear television results.

In other words, by confining themselves to such methods they are working in a blind alley, the blank wall of which is fixed—not by their own ingenuity—but by the natural properties of matter.

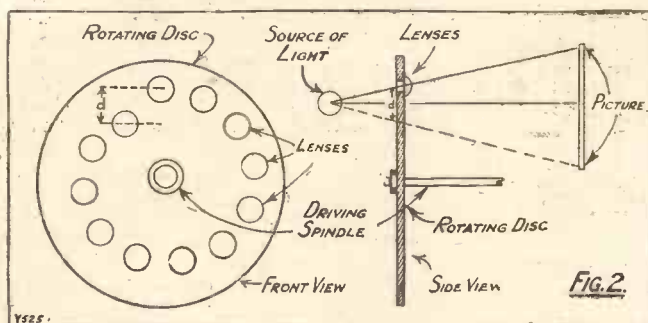
It is not to be denied that a certain degree of success has already been achieved by such methods, but indications point to the fact that further progress is barred by practically insuperable obstacles. Or to put it in another way, further improvement can only be secured—if at all—at a cost which would place television apparatus definitely out of the reach of the ordinary man in the street.

Cathode-Ray Possibilities.

As we have seen, the difficulties resolve themselves into:

(a) That of obtaining a sufficiently high speed of exploration at the transmitting end, and of the building-up operation at the receiving end; and (b) that of keeping both sets of apparatus accurately in step.

The first of these difficulties can be largely eliminated by using the discharge ray from a cathode tube, as a substitute for rotating discs or vibrating mirrors, in analysing and reassembling the picture to be transmitted.



This suggestion was advanced some years ago by Boris Rosing, then of the Russian University in St. Petersburg, and also by Professor Campbell Swinton, who has recently elaborated such a system in a paper read before the Radio Society at the Institute of Electrical Engineers. Fig. 1, for instance, shows the circuit arrangements at the receiving end of a cathode-ray television system developed along the same lines by the engineers of the Western Electric Co.

The peculiar advantage of this method lies in the fact that all the mechanically-moving parts are replaced by a stream or

pencil of cathode rays generated by means of a Brauns tube. The rays have no weight and no inertia, and can, therefore, be made to sweep over the picture or viewing-screen at practically infinite speed—certainly at speeds that are of the order required in television.

The Influence of Light.

In the arrangement illustrated in Fig. 1, the speed-control signals are applied from the aerial A to the two sets of condenser plates C_1 , C_2 and C_3 , C_4 placed at right-angles across the cathode-ray stream in the Brauns tube B. These are derived from a shunt circuit across the output of the first amplifier V, through a second amplifier V_1 , and the transformer T.

The picture-building signals pass separately through amplifiers V_2 , V_3 , to the grid G of the Brauns tube, and serve to control the intensity to which each spot on the fluorescent viewing-screen is successively illuminated.

In Professor Campbell Swinton's apparatus the cathode rays at the transmitting end are used in conjunction with the so-called Hallwachs effect, according to which certain bodies lose electrons and, therefore, become positively charged under the influence of a light ray.

A number of small rubidium cubes form a screen on the front face of which light from the image is thrown. Simultaneously the cathode ray, under the control of two pairs of condenser plates fed with alternating current, is caused to sweep rapidly over the back of the screen.

The Viewing-Screen.

The rubidium cubes, under the combined influence of the light from the image and the stream of cathode rays, send signal impulses corresponding to the various light-and-shade effects to an amplifier, from which they are either transmitted to line or are caused to modulate a radiated carrier-wave.

At the receiving end, the cathode ray from a second Brauns tube is controlled by A.C. currents of the same frequency as those used at the transmitter, so that the ray is traversed over a fluorescent viewing-screen at exactly the same speed and in accurate step. At the same time, the incoming picture signals are separately applied to the control grid of the same tube.

In this way the viewing-screen is rendered luminous to the same degree of intensity, and at the identical positions corresponding to the original light and shade effects of the transmitted picture, which is accordingly reproduced in accurate detail.

Make sure of your copy of the APRIL DOUBLE NUMBER of MODERN WIRELESS

This fine issue contains many attractive and exclusive features, including a

SPECIAL SOLODYNE SUPPLEMENT MODERN WIRELESS Now on Sale APRIL Double Number PRICE 1/6

IS REACTION DOOMED?

FROM A SPECIAL CORRESPONDENT.

REACTION or regeneration which, not so many years ago, was regarded as one of the most important discoveries in connection with wireless reception, has now fallen very much from public favour. The main reason for this, as everyone knows, is that, although it has the advantage of boosting up enormously the strength of the received signals, it is very liable to give rise to oscillation in the set, with the pro-

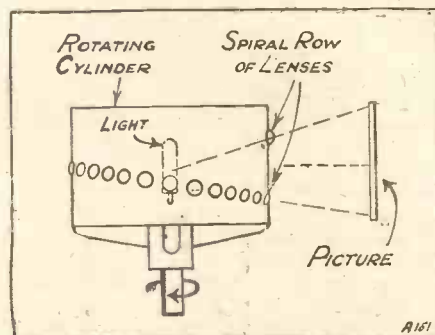


Fig. 3. As the cylinder rotates the effect is to move the spot of light up and down as shown in section.

duction of distortion and also of very great annoyance to the owners of sets in the neighbourhood.

In fact, it may be said that reaction, and its attendant oscillation or "howling," have constituted the greatest bugbears in wireless reception during the past three years. Various other methods of high-frequency amplification have been introduced, notably the screened-grid valve. The basis of this valve is the neutralisation of the inter-electrode capacity.

The virtual elimination of the plate-grid capacity in screened-grid valves opens the way for a very great increase in the amplification practically obtainable per stage. Under ordinary conditions the impedance of the valve may be between 150,000 and 200,000 ohms, whilst the amplification factor is as high as 110.

Actual Amplification.

Of course, the actual amplification which is obtainable in practice varies with the frequency, and is greater upon the lower frequencies (longer wave-lengths) than upon the higher frequencies (short waves). A higher degree of amplification per stage is, therefore, obtainable when tuning-in, say, Daventry, than with the stations on the ordinary broadcast band. Even in the latter case, however, a high-frequency amplification per stage of as much as 40 is obtainable, whilst on the longer waves it is stated that the amplification may reach 100. In the broadcast band, using two of these screened valves, an amplification of 1,000 is said to have been obtained.

It is very interesting to reflect that although reaction was hailed as almost the salvation of the receiving circuit, from the point of view of sensitivity, it may shortly be superseded to a large extent by the extremely simple modification in valve design described above.

THE bulk of the crystals used nowadays comprise galena in one form or another. Galena is the material which we shall consider here, and a good detecting contact point on galena has not a very high resistance. To get good results with this sort of detector, therefore, we must design circuits which will suit a low-resistance detector.

How can we achieve this? Let us start at the beginning. The only energy available in the circuit is that which comes in by way of the aerial. That is our power supply. What we want to do is to apply as much as possible of that power to the telephones, in a suitable form to actuate them. Some of the power is inevitably going to be wasted in the circuit in overcoming resistance. To begin with, then, we can improve our circuit by keeping its resistance down to a low value. We must also endeavour to reduce dielectric losses.



HELPING THE CRYSTAL

How to get good results with simple sets. Explained by A. V. D. HORT, B.A.

set's aerial circuit. Also, the trouble may be due to some peculiarity of the electric mains running outside the house and perhaps in the neighbourhood of the earth plate of the receiver.

An Efficient Cure.

Quite an efficient little method of dealing with such a trouble consists in placing a moistened finger-tip on the earth terminal of the set. In the large majority of cases this will result in the disappearance of the annoying hum—the hum, of course, returning after the finger-tip has been removed from the earth terminal.

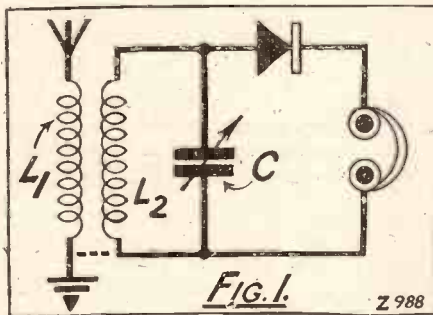
In such cases, however, the same desirable effect will be obtained by attaching a 4- or 5-ft. length of bare wire to the earth terminal of the set and by allowing it to dangle loosely on the floor. Alternatively, the free end of the wire may be connected

sensitive to minute currents as those with a larger number of turns on their pole-pieces, and a consequently higher resistance. We might put in a telephone transformer, as in Fig. 3, to reduce the effective resistance of the high-resistance 'phones. But such a course would lead to the loss of some useful energy in the transformer. The carpieces of a pair of headphones are normally connected in series. Try connecting them in parallel. This will, of course, lower the ohmic resistance of the 'phones as a whole, and the improvement in some cases will be marked.

Auto-coupling.

This gives us the circuit of Fig. 4. Here we have the crystal circuit auto-coupled to the aerial. On the tuning coil are tapping points, so that the best position for any particular crystal can be located. The 'phones are shown with the earpieces connected in parallel. Each ear-piece has a resistance of 1000 ohms, so that the resulting ohmic resistance of the pair is 500.

If you try experiments along the lines indicated in this article, do not make the mistake of expecting too much when you make the first alteration in your existing

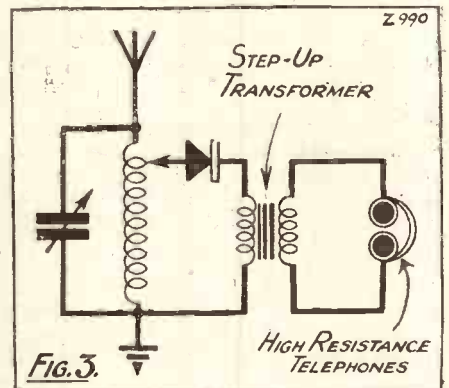
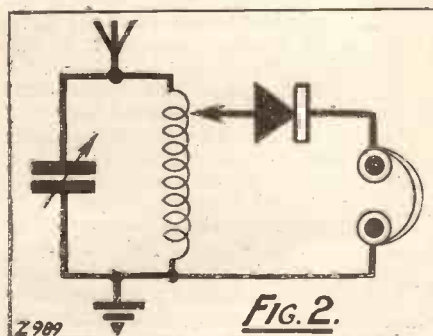


A good aerial, clear of walls and other bad dielectric materials, will help us. Low-resistance coils and components of sound construction will carry us a step further in the right direction. These precautions concern only the construction of the set. We have yet to consider the circuit itself.

The circuit comprises three main parts, the aerial, the crystal, and the telephones. Our aim is to make the apparent resistances of these three as nearly equal as possible. The resistance of the crystal we cannot alter, so we have to design the remainder of the circuit to suit the crystal.

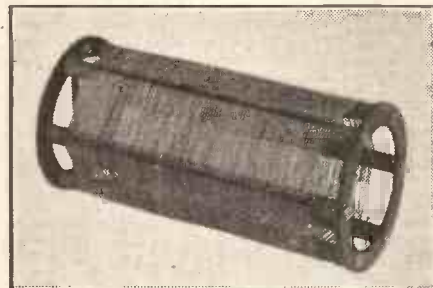
We can use loose coupling, as in Fig. 1, or, as in Fig. 2, we can use an auto-transformer, tapping the crystal across part only of the aerial inductance. Most of the crystal circuits which are recommended at the present day employ modifications of one or other of these two methods.

Low-resistance telephones are not so



to a metal plate laid on the floor; or, again, the wire end may be attached to some extensive metal object in the room, such as, for example, a kitchen range, a fender, a gilt-framed picture of large size, and so on and so forth.

This extra loose earth connection, acting as it does owing to the setting up of a capacity leakage, has the effect of allowing the oscillations responsible for the annoying hum to leak away to earth. Very little of the actual transmitted oscillations leak away, however, because the set is tuned accurately to respond to them. Consequently this method will, in a large majority of cases, overcome the trouble due to the hum, and will have practically no effect on the signal strength of the set.



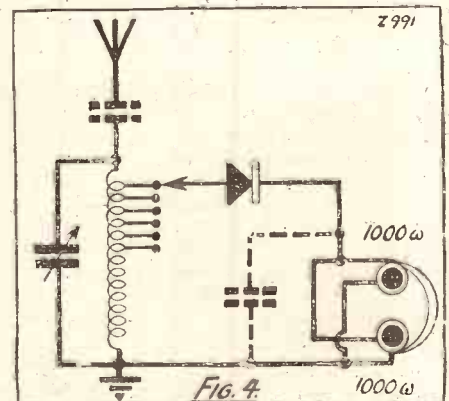
A form of "low-loss" coil which is admirable for experiments with crystal circuits, as tapings can be taken from adjacent turns.

set. The improvement will probably be too small to be noticeable.

A Peculiar Fault.

Wind a good coil, use good quality components, and follow out the suggestions given above, and you will find when the set is finished that you will get vastly better signal strength than you did with the old circuit which you were content to think "good enough" for a crystal.

Sometimes, however, crystal-set enthusiasts suffer continually from a most annoying hum in the 'phones of their instruments. Such a disturbance is, of course, generally due to the proximity of a generating station or to the nearness of the electric wiring of the house, which may be running closely parallel with some portion of the



TECHNICAL NOTES.

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

LOUD-SPEAKER DESIGN

VALVES IN PARALLEL—AN INTERESTING POINT—VOLUME CONTROL.

Loud-speaker Design.

SINCE the introduction of cone loud speakers there has been a tendency to go on increasing and increasing the size of the cone with the idea of making it more responsive to lower frequencies. Cones of gigantic size are now by no means uncommon. Whether these large cones really are more faithfully responsive to the lower frequencies is a matter of opinion. And it is interesting, in this connection, to note that Mr. P. K. Turner, the well-known engineer of the Amplion Company, who has exceptional facilities for experiments in this direction, gave it as his opinion recently in a lecture that the idea that large cones were necessary to reproduce low notes in their proper relation was a fallacy. At the same time, he demonstrated the fact that a small conical diaphragm was capable of giving excellent results, provided it were correctly operated and supplied from a receiving set of proper design.

An Interesting Point.

Incidentally, Mr. Turner touched on a point which is of considerable psychological interest, and that is the question as to whether amplified sounds—amplified beyond their natural volume—can ever seem really natural. For example, would it ever be possible to make an enormously magnified voice seem truly realistic?

Apparently Mr. Turner's idea is that magnification beyond the natural volume of any sound—no matter how faithful in the technical sense—detracts from its apparent naturalness, and in this I am entirely in agreement with him. Probably a simple analogy would be the case of a statue or other sculpture: I think most people would agree that an enormous statue of a human figure, however truly proportional, could never, owing to its exaggerated size, appear really lifelike.

Valves in Parallel.

The question of running two valves in parallel still crops up from time to time in the letters which I receive from readers. I mentioned this subject a considerable time ago in these "Notes," but there are one or two simple points with regard to paralleling valves which, in view of the questions asked, I think it may be useful to give.

The idea of running two valves in parallel arises particularly in connection with the low-frequency output stage of a receiver, and is not nearly so important nowadays as it was some two or three years ago, before such great improvements had been made in L.F. power valves of low impedance.

Undoubtedly it is better to use a single power valve of the appropriate characteristics, but sometimes the experimenter does not wish to do this, either on account of the cost of the valve, or, more usually, on account of the extra filament-current consumption which may perhaps not be convenient with his particular L.T. supply

arrangements. In the case of a valve such as the LS.5A., for instance, the filament current consumption is an appreciable item.

If we suppose a valve such as the D.E.5A. is being used in the output stage, this may be paralleled with a second valve of the



Frederick Lamond, the famous pianist, whose recitals from 2 LO will long be remembered by listeners as being amongst the most enjoyable musical events ever broadcast.

same kind—in most cases with quite satisfactory results.

Connecting Up.

When running two valves in parallel it is only necessary to run the two filaments from the same source—and, of course, with the same current—and to connect the two grids together to form a common grid and the two anodes together to form a common anode.

It is very desirable, though not absolutely essential, that valves which are run together in parallel should be of the same type, or, at any rate, should have substantially the same characteristics.

When valves are run in parallel in this way, the voltage amplification factor—assuming the two valves are virtually identical—does not change, but is the same as that of either valve. The A.C. resistance, however, is halved and for a given H.T. voltage and grid bias the anode current will be doubled. The filament consumption is obviously doubled.

Paralleling valves in this way is often useful as a temporary measure where extra power is required from the loud speaker for some special purpose.

But although the effect of paralleling valves would appear easily calculable, very often the results obtained are different from those expected, because of the many variable factors. Ideal conditions are not easily obtained outside the experimental laboratory.

Volume Control Pointers.

Volume control is one of those apparently simple things which can be done in quite a variety of ways, but most of the ways are unsound, because they bring with them other disadvantages. The simplest way, for instance, of controlling volume is by the H.F. tuning, but this method may often be ruled out owing to the immediate loss of selectivity, especially in sets employing reaction.

(Continued on page 276.)

NEWS FROM SAVOY HILL.

FROM OUR OWN CORRESPONDENTS.

ANOTHER FRACAS IMMINENT?

THE BAN ON CONTROVERSY—SINGULAR RETICENCE.

Another Fracas Imminent?

THERE has been an unusually long lull between rows on the B.B.C. Board.

But, perhaps, appearances are deceptive. One thing is certain anyway, and that is that, for the time being at all events, the Executive side is in the ascendancy, and the closure on Governors expressing their opinions in public is effective. But there is ground for the rumour that the pressure is increasing, and will be in the danger zone in the last week of this month. The coming explosion promises to be more spectacular and "meaty" than the mild squabbles that have already crept into the light of day.

Controversy—Singular Reticence.

Nearly a month went by before the B.B.C. said anything about the effect of

the removal of the ban on controversy. That Savoy Hill declined to exaggerate the importance of the event was all to the good; but the public rightly expected a prompt and definite statement of policy, however negative it might be. It is very unusual for the B.B.C. to shirk an issue. But apparently here is an exception.

Having let things slide for a month, Savoy Hill has used the columns of a Sunday newspaper to make an announcement which literally means nothing. There is the usual cautionary note, accompanied by qualified indications of "debates" and "discussions" on some threadbare subjects which have exhausted the patience of generations of literary societies. How much better it would have been for the B.B.C. to have faced the issue squarely, and

(Continued on page 275.)

WHEN a receiver is being built to a published specification, questions of lay-out rarely concern the constructor, for diagrams are usually given showing the exact relative positions of panel and baseboard components. On the other hand, if the set is being built to your own designs, the importance of lay-out cannot be over-emphasised.

A receiver in which components have been set out with proper regard to the minimisation of magnetic and capacity stray couplings is certain to give results infinitely superior to another set using the same circuit and components, wherein these precautions have not been observed.

Balancing the Panel.

The panel lay-out should be one giving the most symmetrical and balanced appearance when the knobs and dials are mounted. Often symmetry has to be sacrificed in the interests of efficiency. For instance, the tuning condensers should be mounted as near as possible to the coils they tune, and this will nearly always bring them near to the left-hand side of the panel, this being usually the input side where the H.F. circuits are situated.

The remaining panel components, such as a volume control and L.F. switches, will tend towards the right; while L.T. switches and rheostats can be placed practically anywhere necessary to effect the desired balanced appearance. The increasing use of fixed or semi-fixed baseboard-mounting filament resistances tends to eliminate rheostat knobs from the panel, giving the latter a less crowded appearance. In modern sets you will rarely find more than the condenser dials, the L.T. on-off switch, and perhaps a volume control on the panel.

Note these Dimensions.

When deciding upon general dimensions of panel and baseboard, a good working plan is to allow 6 in. of panel length for each variable condenser, a further 6 in. giving ample baseboard space for 2 L. F. stages. The height of the panel is decided by the overall height of coils, valves, etc., above the baseboard, and usually need not exceed 8 in. The depth of the baseboard will vary according to the number of baseboard components, but it should not be less than 8 in. even for a small set.

It is a good idea to draw on paper a plan of panel and baseboard to scale. Then sketch in the positions of the variable condensers, allowing a clearance for the moving vanes and the tuning coils, the latter being disposed so that stray couplings between them shall be a minimum, with their axes as far as possible from condensers and metal shields. Provision should also be made on your diagram for metal screens, if shielding between each H.F. stage is to be used. Try to visualise at the same time the H.F. wiring, in order to get this as short as possible, and the panel lay-out in order to make this as symmetrical as possible. Symmetrical positions can now be found for the remaining panel components.

BASEBOARD COMPONENTS

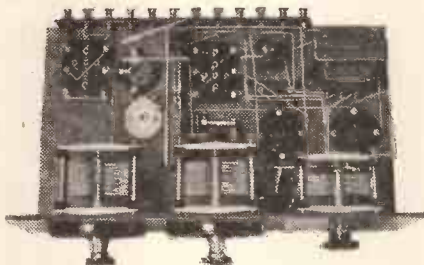


Where receiver design is concerned the importance of baseboard lay-out cannot be over-emphasised.

By A. SAXON.

Distribution of baseboard components is greatly facilitated if they are grouped together according to their functions. Thus the L.F. stage components can usually be grouped together on the right hand of the baseboard in quite a compact space. Further grouping can take place in each H.F. stage.

The positions of the H.F. and detector



When included in a receiver, exceptional care must be taken over the lay-out of the components.

valve holders should now be marked in, great care being taken to set these out so that all grid leads shall be short and direct, and anode leads well spaced. The positions of the grid and anode valve-holder terminals are most important, as it is easy enough to run the filament leads to any position underneath the baseboard. The remaining components, such as fixed condensers, H.F. chokes and grid leaks, will now fall almost automatically into position, provided the lay-out so far has not been too cramped.

Some Wiring Hints.

The remaining space on the baseboard, which should be from a third to one half of the whole, is available for the L.F. side. As careful spacing of wiring here is not so important as with the H.F. end, all components can be accommodated into a compact lay-out. Two points only are of importance. Endeavour to keep the grid leads short and arrange the couplings so that the H.T. positive leads do not have to stray all over the baseboard before reaching their respective terminals.

The rough diagram which you now have should be re-drawn in its final form, and after serving its purpose in the mounting of components, it can be used as a basis for the wiring diagram.

The panel components should be mounted first of all, commencing with the tuning condensers. If a metal panel or a wood-cum-metal shield is used, see that the earthed portion of the condenser, usually the rotor, makes sound contact with the metal sheet. In the case where a metal panel is used and one condenser must be insulated

from it (a somewhat rare case), a larger hole should be drilled in the panel, and the condenser mounted on a small square of ebonite. This is then bolted to the panel so that the condenser is insulated from the panel, while there is a good clearance between the metal panel and condenser spindle. This is a better method than using ebonite bushes in the panel.

Where the condensers are fitted with slow-motion dials, a little extra care expended in obtaining a true and easy motion will be well repaid when operating the set. Often careless mounting and fitting of such devices results in a stiff movement at some settings of the tuning dial.

Spacing the Terminals.

The mounting of baseboard components is obviously quite simple, amounting chiefly to the screwing of them down in the proper positions. Brass screws and not iron or steel should always be used. All components should be firmly screwed down, especially coil holders and other types of coil mountings.

It is a good plan, especially with a multi-valve set, not to mount all the terminals on one ebonite strip at the rear of the baseboard, but to split them up into groups. A small ebonite strip can be mounted on the left-hand side for A. and E. terminals and another small strip on the right for 'phone or L.S. terminals. The battery connections can either be a row of terminals on another ebonite strip or, better still, double tags bolted to a narrow ebonite strip which can be screwed on top or beneath the baseboard. The latter position is very convenient if L.T. and H.T. wiring is to be carried out under the baseboard. The set wiring is soldered to one side of these double tags and, to the other, lengths of flex for connection to the batteries.

TWO USEFUL NOTES.

When humming occurs in a set which employs a low-frequency transformer it sometimes happens that the reversal of either the primary or secondary leads of this will eliminate the trouble.

Have you examined your lead-in lately? If not, it is possible that you would improve reception by giving attention to the cleanliness of contact at this point.

FOR THE CONSTRUCTOR.

Lettering Panels—A Good Earth Tube—A Tantalum Tip—
Screwdriver Efficiency.

Lettering Panels.

IT is quite simple to letter panels without the use of transfers, or ingraining, or embossing tools. Little skill is required with an ordinary water-colour brush. This should be of good red sable of suitable size.

Some Chinese white, or similar pigment, is used for lettering purposes, and applied with the brush. When dry, a thin coat of pure shellac varnish or gum should be applied to fix the paint. When this is done the result is pleasing in appearance and permanent in nature.

A Good Earth Tube.

I have found recently when using a short earth tube, 2 ft. 6 in. long, in gravel soil, that results were not particularly good. As the problem of reaching clay soil was not to be thought of, the depth being too great, it was decided to try a longer tube. Looking round for suitable material for this purpose a curtain rod, some 5 ft. in length, was chosen.

One end of the rod was hammered down to form a spike, and the other end was drilled to take a terminal for purposes of connection to the earth lead. The difference in results obtained was beyond all expectations and thus the problem of getting a reasonably good earth in the neighbourhood of gravel soil was solved.

A Tantalum Tip.

One of the difficulties with chemical rectifier electrodes, especially tantalum, is the trouble in making an effective joint between the electrode and the outer circuit. A piece of stout gauge flexible wire is generally soldered into a small hole previously drilled at one end of the rod. It is then necessary to arrange some means of protecting the soldered joint from action by the acid. As tantalum is normally handled in strips rarely exceeding $\frac{1}{4}$ in. the solution is simple. A piece of glass tubing, slightly larger in diameter than the width of the joint and $1\frac{1}{2}$ in. long is procured, and the electrode is then arranged as follows: The joint is placed so as to come quite close to the top of the tube, so that the maximum amount of electrode is exposed. The space above and below the joint is then filled with Chatterton's Compound, which serves the useful purpose of protecting the joint from the acid. The glass tube in turn protects the Chatterton's from the layer of paraffin oil which is usually placed on the top of the electrolyte to prevent evaporation, etc.

Screwdriver Efficiency.

Nobody is more aware than the busy constructor of the manner in which a well-constructed panel or other piece of radio apparatus can be spoiled in appearance by the presence of one or more damaged screw-heads. Yet, at the same time, there is many a lesser-experienced amateur who will persist in employing a screwdriver which is more or less totally unsuitable for the work in hand.

A screwdriver must, of necessity, fit well the screw upon which it is used. That is to say, the blade of the driver should go right down to the bottom of the slot in the screw head, and it should make a close fit with the sides of the slot. It is not advisable to employ a screwdriver blade, the extreme end of which is tapered, for, under these conditions, the act of forcing the blade down to the bottom of the screw slot would result in the upper edges of the slot being damaged.

A screwdriver the blade of which is rather too thick for the screw used can be filed down and afterwards smoothed over with sandpaper very successfully. If, owing to wear, the corners of the screwdriver blade become rounded, they should immediately be made square by the aid of a little judicious filing, otherwise the rounded edges of the driver blade will probably cause the implement to slip while in use, and thus damage the screw slot.

that the eliminator is still imperfect, although the B. C. L. set does not show up the trouble.

I am at present using two 32-henry chokes in the filter which follows my transformer, with 4 mfd. across the H.T. on the transformer side, and a further 6 mfd. on the "set" side. This effectively cures any trace of hum. The rectifier is, of course, a full-wave arrangement, which is practically essential for this work.

If you have one of the very high-magnification types of valves, and have not tried it as a detector in the short-wave set it is well worth your while to do so. They are not quite uniformly good in their performance, but several that I have tried as detectors have been superior to most general-purpose valves. A fairly high value of H.T. is, of course, desirable, and if they are followed by a resistance-coupled stage a double benefit may be derived from the use of these valves.

Improved Selectivity.

The high grid-to-filament impedance reduces the amount of damping introduced into the grid circuit, with the usual result of improved selectivity, and the use of resistance coupling on short waves often proves beneficial in reducing the amount



The main radio transmitting-room at London's Air Port, Croydon. There are four Marconi 3 kw. transmitters, which can handle C.W., "Tonic Train," or Telephony on any wave-length between 800 and 2,000 metres.

SHORT-WAVE NOTES.

By W. L. S.

THE efficient operation of a short-wave set from A.C. mains seems to present unnecessary problems to many readers. Having never had any trouble in this direction myself I naturally find it a little difficult to fall in with their points of view; but I would strongly emphasise the fact that the presence of hum in a short-wave set is bound to be due to some inherent defect in the eliminator used, and cannot justly be put down to uncontrollable circumstances, as many seem to think. Admittedly, it is more difficult to cure trouble of this kind in a short-waver than in a "B. C. L." set, but this only means

of "mush" received. This mush is often connected with long-wave stations, which are received on the primaries of L.F. transformers at surprising strength unless one takes all manner of precautions in screening the set.

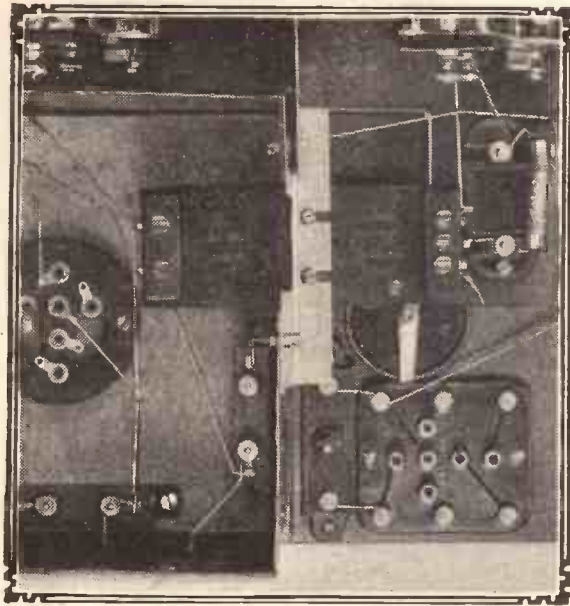
I was very interested a few days back, on seeing an aeroplane cruising round near my garden, and at a very low altitude, to find that the "spark transmission" from its magneto was plainly audible on about thirty metres. This was quite a low-power record for the plane, for car magnetos on 20 metres can seldom be heard when the car is more than a few hundred yards away, and the plane must have been half a mile or more distant before the noise faded out!

This goes to show that the lot of the short-wave enthusiast is liable to become more and more unhappy as different types of electrical apparatus are perfected and put on the market.

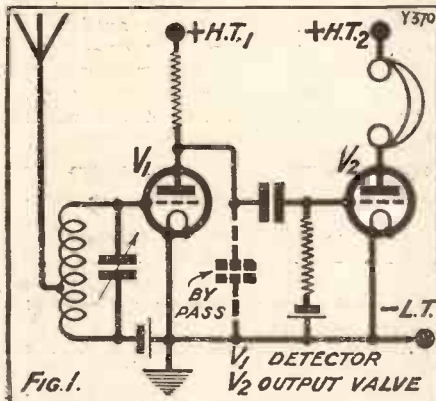
BY-PASSING H.F. CURRENTS

The real work and importance of by-pass condensers in preserving faithfulness of reproduction is discussed

By W. JAMES.



EVERYBODY knows that in the output circuit of the detector we have high-frequency and low-frequency currents, and that the high-frequency currents are not wanted in the low-frequency circuits. We have, in fact, to provide a means for preventing the high-frequency currents from passing into the low-frequency amplifier, and it is for this reason that two



distinct circuits are connected to a detector. Naturally one will, to a certain extent, influence the other, so that we shall find there is a tendency for some of the high-frequency currents to pass through the low-frequency apparatus, while the effect of the high-frequency apparatus may be to by-pass some of the low-frequency currents from the low-frequency coupling proper.

Effect on L.F. Component

This is quite an undesirable state of affairs, as it leads to distortion and other troubles, and, as the matter is one of some considerable importance, it will be worth while spending a few minutes in considering how best to arrange the two circuits which we have referred to.

First of all, we will suppose the detector to be resistance coupled to the first low-frequency stage (Fig. 1). If the circuit were arranged just as shown in Fig. 1, we should have high-frequency as well as the low-frequency currents influencing the grid of the first low-frequency stage. We have therefore to provide a means for cut-

ting down the amount of high frequency which reaches the first low-frequency stage without in any way, if at all possible, weakening the low-frequency currents.

One obvious way is to connect a condenser between the anode of the detector and its filament. The impedance of a condenser such as .0005 mfd. to high-frequency currents of, say, 750 kilocycles (400 metres) is of the order of 400 ohms. This is such a low value as compared with the impedance of the other possible paths for the high-frequency currents that one would think that this condenser would effectively short circuit high-frequency currents so that none would pass to the low-frequency amplifier.

In practice this is very nearly true, but now we have to consider what effect this condenser has on the low-frequency currents, which, as we have said before, we wish to pass to the grid of the first low-frequency valve without distortion. Obviously, the condenser will have some effect, particularly on the higher audio-frequency currents,

Condenser Impedance.

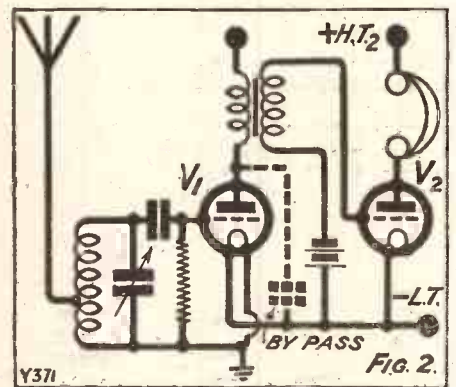
The impedance of the .0005 mfd. condenser to a 5,000-cycle note, for instance, is only 60,000 ohms; from which it would appear at first sight as though a good deal of the high audio-frequency currents will pass through this condenser. In practice, this all depends on the value of the anode resistance of the valve and that of the anode-coupling resistance.

A valve working as an anode rectifier will very often have an impedance of 200,000 ohms or more, while coupling resistances of 1 or 2 megohms are frequently advised. We therefore see that if we were to use a .0005 mfd. by-pass condenser with such high values of valve

impedance and coupling resistance that a good deal of the higher audio frequencies would be lost.

Lower Anode Resistances.

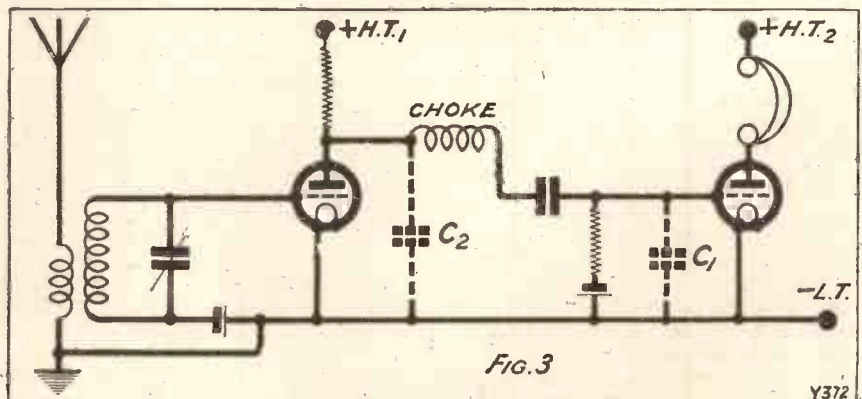
But we are not forced to use such a high value of resistance. There is nothing to prevent us using a lower value, provided we can put up with the loss of overall amplification occasioned by the use of such a lower value. If this is 250,000 ohms, the .0005 mfd. coupling condenser will not have too bad an effect for the majority of



loud speakers. In fact, the diminution of the higher audio frequencies may make the reproduction appear more pleasing. This, then, is one method of preventing the major portion of the high-frequency currents entering the low-frequency amplifier

The method is not a perfect one by any means, for to preserve the quality it is necessary to use a fairly low value of coupling resistance, though the amplification of the audio frequencies as a whole is more uniform. The method is often used, however, and

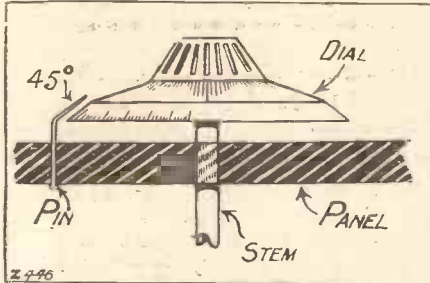
(Continued on next page.)



Y372

A SIMPLE DIAL INDICATOR.

AN easily arranged condenser dial indicator can be made from a long pin of the ordinary variety (see Fig.). A small hole is drilled in the panel close to the edge of the dial and the pin is pushed through so that its head is driven slightly



into the hole on the reverse side of the panel. Bending the pin through an angle of about 45° completes the indicator. It is essential, of course, that the hole should be small enough to keep the pin firmly in position.

BY-PASSING H.F. CURRENTS.

(Continued from previous page.)

has the advantages of simplicity and cheapness, and reliability.

When a transformer coupling is used between the detector and first low-frequency valve (Fig. 2), a by-pass condenser of .0005 mfd. will normally not have anything like so serious an effect. In fact, one famous transformer has a built-in condenser. For, when a transformer is used, the detector valve will almost certainly be worked as a leaky grid rectifier. The valve will, therefore, have a much lower anode impedance than when it is used as an anode-bend rectifier, and probably a valve of a different type, having a lower impedance, would be used.

Use of R.F. Choke.

The result is that we are dealing with a circuit having much lower working impedances, so that we can safely shunt the circuit with a fairly large condenser without damaging the quality. A .0005 mfd. condenser can, therefore, be used with perfect safety when a transformer coupling is employed, but here one has to remember that the condenser is relatively not such a good short circuit to the high-frequency currents because of the lower impedances with which it is associated.

Owing to the self-capacity of the windings of the low-frequency transformer, there may be a tendency for high-frequency currents to reach the grid of the low-frequency valve. But if the shunting condenser has a sufficiently large capacity the effect will not be serious. General experience indicates that there is very little

chance of a material amount of high-frequency current entering the low-frequency amplifier when a transformer coupling with a fairly large by-pass condenser, such as .0005 mfd., is used.

In an endeavour further to preserve the higher audio-frequency currents, other schemes have been suggested, and are coming more and more into use as their advantages become known. A favourite consists of the high-frequency choke coil connected between the anode and the grid condenser and leak, as shown in Fig. 3.

A Further Refinement.

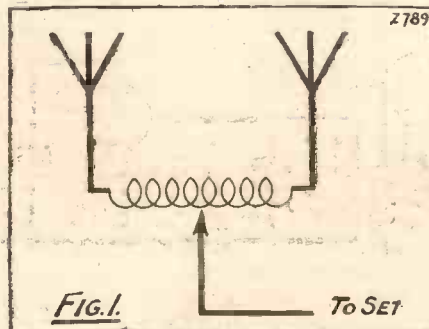
Here we rely upon the choking effect of the high-frequency choke coil, and the results obtained naturally depend upon the impedance of the choke as compared with the impedance of the remainder of the grid circuit. If, for instance, the impedance of the choke happened to equal that of the grid circuit of the first low-frequency stage, which includes the coupling condenser, grid leak, valve, and their associated self-capacities, there would probably be an appreciable high-frequency voltage on the grid of the first low-frequency stage.

The effectiveness of the choke coil depends a good deal on the self-capacity of the circuit, and we can improve this effectiveness by adding a small condenser, marked C_2 in the diagram, for this condenser will have a fairly low impedance to high-frequency currents. At all events, its impedance will be low compared with that of the choke coil, so that a much smaller proportion of the high-frequency voltage will be developed across the grid filament of the first low-frequency valve. The condenser can be connected before the choke or after it, as shown—two condensers are not required, and a suitable value would be .0001 mfd. Sometimes it is better to connect it at C_1 .

The resistance type of high-frequency stopper cannot be discussed here, as we are merely concerned with the effects of by-pass condensers for getting rid of the unwanted high-frequency impulses.

DUAL AERIALS.

“WHY is it that we cannot increase our signal strength by using more than one aerial?” asks every beginner. The trouble chiefly is, of course, that the respective aerials are unequal in natural wave-length, there is greater capacity, and the extra energy is damped out by losses. In some cases, however, the two

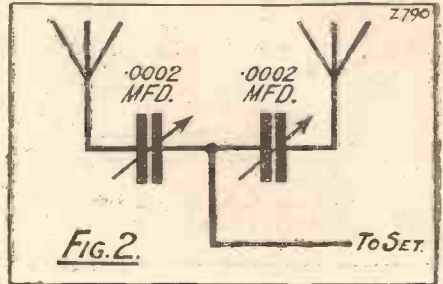


aerials are an advantage, whilst in others they are a decided disadvantage—depending on whether the difference is large or small as regards resonance.

The solution to the problem is a balancing arrangement. The first method that occurs to one is shown in Fig. 1.

This method, however, is not efficient because of increased capacity. It may lead to an improvement in reception on the higher broadcast band, but is not likely to do so on the lower; indeed, the reverse is more probable.

In Fig. 2 an arrangement is shown



whereby the aerials provide the additional receptive surface without an undue increase in capacity and, incidentally, in natural wave-length, and, providing that the two aerials are quite distinct and not just the two halves of a twin aerial, an increase in signal strength quite frequently results. The adjustment of the two condensers must, however, be such that the respective aerials exactly balance.

The same principle may be applied to earths except where too lively a valve set is used. But the idea is mainly for getting the last ounce out of a crystal receiver, and experimenters will find it well worth trying.

A BATTERY TIP.

ALWAYS see that the terminals of your accumulators are clearly marked. Unfortunately, the terminal indications on some batteries are of rather a flimsy nature and tend to wear off. You might be able to locate the positive terminal by a remaining speck of red, but there is always a possibility that a careless charging station hand will not do so. It would be no new thing for a charging station of even fairly high repute to connect an accumulator to the charging board the wrong way round. This is not good for the battery and may, indeed, cause considerable damage.

Small pots of what is known as anti-sulphuric paint can be obtained at any oil-mongers for quite a small sum. Copious use of this material will prevent any such accidents as have been indicated. And it is well worth noting that this anti-sulphuric paint has other useful applications. As its name suggests, it entirely resists the action of sulphuric acid.

If your accumulator is provided with a wooden carrying crate, this can usefully be coated with anti-sulphuric paint in order to extend its life. Also, the leather carrying handle, which is a vulnerable point of attack for the acid, could be coated in a similar manner.



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| 1 | H.F. Choke Climax |
| 1 | Aluminium Panel (18 x 7 ins.) Collinson |
| 3 | Anti-Vibratory Valve Holders (with terminals) Pye |
| 1 | Pair Panel Brackets Magnum |
| 1 | Broadcast Wave Master Three Coil Colvern |
| 1 | Long Wave Master Three Coil Colvern |
| 1 | On and Off Switch Bulgin |
| 1 | R.C.C. Unit (Type A) R.I. Varley |
| 1 | L.F. Transformer (G.P.) R.I. Varley |
| 1 | Combined Grid Leak (2 megohms) and Condenser (0.003 mfd.) Mullard |
| 4 | Terminals (A.E., E. L. S.—L.S.—) Belling-Lee |
| 1 | Set A.B.C. Connecting Links Junit |
| 2 | Spade Terminals (1 red, 1 black) Eclax |
| 8 | Wander Plugs (4 red, 4 black) Eclax |
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Of course, the "Marconiphone T.2 Circuit" is famous for the splendid results obtained with it. This 5-Valve Receiver incorporates two of the wonderful Screened Grid Valves, and under normal conditions at least 30 stations can be received. The cash price is £14/2/11, but the complete set of components will be delivered to you after the first of 12 monthly payments of 2/4/8. Carriage paid in British Isles.

COMPONENTS FOR THE "MARCONIPHONE T.2 CIRCUIT."

No. Req.	Components	Price each.
3	Sterling .00025 mfd. Miniloss Condensers	14 0
	Astatic Coil Holders	6 6
3	Astatic Aerial Coil (B.B.C.)	7 6
1	Astatic Aerial Coil (5 X X)	7 6
2	Astatic Anode Coils (B.B.C.)	7 0
2	Astatic Anode Coils (5 X X)	7 6
2	S.625 Valve Holders	5 6
3	Antiphonic Valve Holders	2 9
1	Ideal Transformer 4/1 ratio	25 0
1	Resistance Capacity Coupling unit	8 0
1	.0005 mfd. Condenser	2 0
1	.001 mfd. Condenser	2 6
1	.0001 mfd. Condenser	2 0
1	Sterling Mansbridge Condenser 2 mfd.	3 10
1	Sterling Mansbridge Condenser 25 mfd.	2 3
1	Marconiphone 30-ohm Rheo.	4 6
1	H.T. and L.T. Switch	3 6
2	Grid Battery Clips	0 4
1	Ten-way Terminal Strip	9 6
1	Baseboard Screen	12 6
1	Panel Screen	set 7 6
1	Partition Screens	
4	Angle Brackets for S.625 Holders	6 6
2	S.625 Valves	22 6
1	D.E.L. 616 Valve	10 6
1	D.E.P. 610 Valve	12 6

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You would not suddenly put Jack Hobbs, excellent cricketer though he be, into the Cambridge boat and expect him to pull stroke.

Why then buy an assortment of valves of different makes for your set and expect them to give balanced reproduction?

It is balance first and balance every time that you require amongst your valves, that is why you should fit a set of SIX-SIXTY Valves to your receiver without delay.

Ask your Dealer for SIX-SIXTY Valves by name and accept no other.

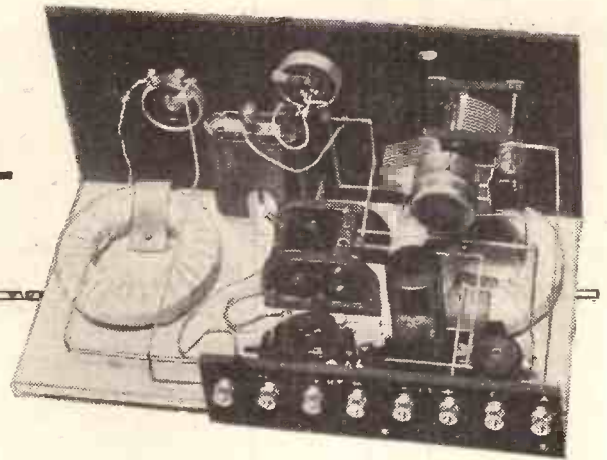
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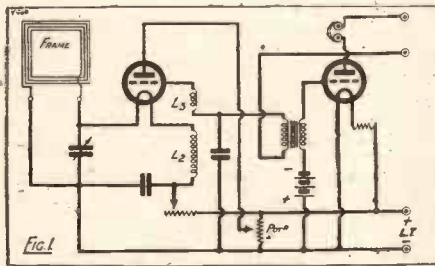
TWO NOVEL FRAME AERIAL CIRCUITS

Some interesting details concerning portable receivers employing the famous Filadyne circuits.
By J. ENGLISH.



WHILE experimenting recently with various frame aerial receivers I was tempted to try the effect of adapting the Filadyne circuit to this form of reception. The actual circuit which I found to be most suitable was the well-known offspring of Mr. Dowding's original and stimulating circuit, wherein two tuned coils are inserted in the filament leads.

There are one or two possible ways of connecting a frame aerial to this circuit, but obviously the most efficient way is to make the frame aerial actually one of the two tuned coils. Any existing Filadyne



receiver can thus be adapted in a most simple manner by removing one of the filament coils, and connecting the frame aerial in its place.

The reaction coil is, of course, coupled to the other filament coil, L_2 , as in the diagram of Fig. 1. Using the frame in this way, the whole of the signal energy collected is available for detection. Also a very smooth reaction control, as given by the Filadyne scheme, is secured without such complications as a tapped frame aerial which is necessary with the ordinary regenerative detector.

Continental Stations Received.

When a receiver was put together on these lines, I was surprised to find that the inductance of the frame aerial had decreased considerably. Normally, it tuned from approximately 200 to 550 metres with the same condenser in parallel as used in this experimental receiver. No less than 85 turns (on a 3-in. former) were necessary for L_2 in order to bring up the wave-length range sufficiently to tune in 5 G.B. The frame aerial consisted of 14 turns of stranded wire spaced $\frac{1}{4}$ -in. wound on a former having diagonals 4 feet long. This makes quite an efficient frame.

The coil L_2 , as already mentioned, consisted of 85 turns of 22 D.C.C. on a 3-in. former, the reaction winding L_3 being 30

turns of 30 D.C.C. spaced $\frac{1}{4}$ -in. from the filament end of L_2 . With a .0003 mfd. variable tuning condenser, the receiver tuned well beyond 5 G.B. and down to about 275 metres. For convenience in tuning, a slow motion dial was fitted, together with a smooth-running potentiometer for silky reaction control.

Not more than 36 volts H.T. was applied to the Filadyne detector, and with 60 to 80 on the L.F. amplifier (see Fig. 1) loud 'phone signals were obtained from 2 L.O. (15 miles) and 5 G.B. (70 miles), together with strong and clear 'phone reception from a number of other stations, British and Continental. Without troubling too much about setting the frame for maximum directional reception, it was surprising the number of distant stations which could be heard clearly on the 'phones.

Tapped Frame Winding.

Having found that the Filadyne as a frame aerial receiver worked quite as well, if not better, than the ordinary regenerative detector, I began to consider the project of replacing the second filament coil, L_2 , by another frame of inductance equal

If all the programmes sent out by 5 X X during the year 1927 were repeated in one long programme, it would take well over six months to transmit, working day and night.

to the first. I was interested to see whether the two frames would result in a double "pick up," and what would be the result of their inter-action, if any. Before a second frame could be used, however, arrangements had to be made for obtaining reaction, as it would obviously unduly complicate matters to use a third small frame for L_3 .

Accordingly, resort was made to the well-known tapped frame aerial with capacity-reaction feed, as shown in Fig. 2. Here the second frame is shown as a simple coil, to make things more clear, and you will not have any difficulty in following the changes which have been made in order to obtain the desired reaction effects. Reaction is still controlled by the potentiometer, the .0003 mfd. condenser being fixed. If it is variable, then an additional, though somewhat unnecessary, fine control of reaction is at hand.

Both frame aerials would, in the ordinary way, cover approximately 200 to 550 metres with a .0003 mfd. condenser in parallel. However, when used in this way,

a wave-length of barely 400 metres was reached with the tuning condenser all in.

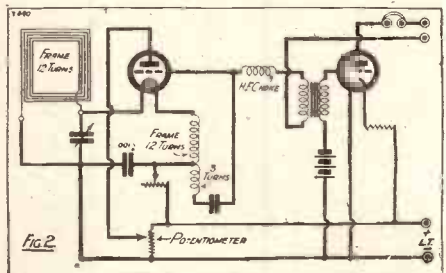
It was noticed that signals were certainly stronger when two frames were used, placed fairly close together and in opposition, but it was difficult to ascertain the exact increase in pick-up without making very accurate measurements. However there was plenty of "punch" in the set and numbers of distant stations were tuned in at good strength. On one occasion over 14 distant stations, all clearly audible, were picked up in a few minutes, and this with the frames in one position. The local station and 5 G.B. were received at fair loud-speaker strength.

On the whole the two-valve frame aerial Filadyne was quite the equal of the ordinary one-valve regenerative receiver used in conjunction with an average outdoor aerial.

Now, if any of you are thinking of experimenting with portable Filadyne receivers, I can recommend the circuit of Fig. 2, which is most suitable for a built-in frame aerial. This would consist of two windings, close together, and wound in opposite directions, the inner leads going to the filament of the valve. The reaction winding would, of course, be wound on the same former, close alongside either of the two windings.

Useful, Efficient Set.

For a small self-contained portable you could use a box-like frame having sides, say 14 in. by 8 in., when L_1 and L_2 would consist of 24 turns and L_3 10 turns of 26 D.C.C.



With a single stage of L.F. amplification following the Filadyne detector, you should obtain quite loud 'phone signals anywhere within 10 to 15 miles from a main B.B.C. station. Anyone who cares to go to the trouble of putting together such a simple set as this would have a very useful and efficient little portable with which much pleasure and information could be acquired.

SHORT-WAVE RECEPTION.

The Editor, POPULAR WIRELESS.

Dear Sir,—On reading the reports of "Short-Wave Reception" from your various readers, I feel I should like to contribute a short letter, which may prove to be of some value to those interested.

For the last two years the Central Provinces of India have, in my opinion, claimed a good "Zone of Reception," and in consequence it has not been difficult in spite of occasional adverse conditions, to tune in 5 SW, PCJJ, 2 XAD, 3 LO, 2 FC, ANH, ANE, and several others at varying strength, which are certainly well worth listening to.

The Eindhoven Station, PCJJ, certainly held the supremacy of the ether, both for well selected programmes and constant strength, until the B.B.C. inaugurated the Chelmsford Station, 5 SW, which at first penetrated the Central Provinces wonderfully well, but began to fall off in strength during December, strength again increasing at the end of January until the present date.

One evening during early November I was swinging the dials rather viciously. In consequence of never being able to receive "Bandong" clearly, when suddenly I passed a very penetrating carrier (greatly amplified by my three super-power valve, transformer coupled L.F. amplifier), followed by the "Ethovox" and "Etho-cone" loud speakers. On tuning out the carrier, and standing well away from the "Threshold," the first and most wonderful voice came through announcing: "Chelmsford Station, 5 SW, testing. We are using some old records. Stand by, please."

I might mention here that if new records had been used it would have been exceedingly hard to differentiate between the old and the new, as the reception was exceptionally clear and of good loud-speaker strength. Only occasionally was high speed fading noticeable.

The Armistice transmission came through very well, but at Christmas the tuning was rather difficult to maintain at audible strength. At present the reception of the second transmission from 18.30 hrs. G.M.T. onwards is very near perfect, high speed fading seldom falling to zero. So now, with expectant eagerness, we await the sequence of the programmes.

I must say that when one can repose comfortably in the drawing-room, which has two loud speakers installed, and listen to very interesting and amusing conversations between the B.B.C. and 2 XAD, which of late has preceded the second transmissions, it is evident that the vagaries of the short waves are not so obscure and mysterious as one is led to believe, and I consider it only fair to say that during the exalted fame of PCJJ the B.B.C. engineers were certainly not idle.

It is good to hear the B.B.C. say that "The sun has only just receded beyond the horizon; it has been fine for a week; RATHER!" And then a good hearty laugh at the expense of 2 XAD, enquiring of him whether the American or the English accent affected articulation, etc.

The conversation of the B.B.C. with 2 XAD on Tuesday evening, February 28th, was received as if a megaphone was being used in the room. Common-place conversation was carried on at first, dealing with weather and times for future transmissions.

SOME USEFUL TIPS.

When a filter circuit is used in the output of a valve receiver it does not matter whether or no the loud speaker is connected the right way round.

An accumulator that needs recharging should not be allowed to stand aside indefinitely, but should be taken as soon as possible to the charging station.

In the ordinary plug-in coil, the inner end of the winding is connected to the plug of the coil, and its outer end to the socket.

The Wave-length of 300 metres represents a Frequency of one million per second.

For some reason it is easier to receive wireless signals over long distances north and south than when the direction is east and west.

One metre equals 39.37 inches.

CORRESPONDENCE.

SHORT-WAVE RECEPTION

THE "ANTIPODES-ADAPTOR" ONE-VALVE RESULTS.

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.

Afterwards the Postmaster of Washington was introduced, who said: "This time next year I shall also be able to see you as well as speak to you." The finish was occupied by the two stations exchanging their reports on previous transmissions.

The programme from 5 SW for the evening in question came through remarkably well, it being chiefly from provincial stations, such as Daventry and Liverpool. It was first announced that 5 GB would for the remainder of the evening transmit on half power. The talk on the organisation of the St. John's Ambulance Association was splendid, and not a word was missed.

So in consequence of such reception, it is obvious that whilst repeated appeals were being published in the various wireless periodicals asking for a British Empire Broadcasting Station, and whilst adverse criticism was continually being hurled at the heads of Captain Eckersley and his subordinates, based upon the success of PCJJ, the B.B.C. were perfecting their short-wave plans behind a cloak of silence, and for their success I wish to tender them my heartiest congratulations.

P.S.—Receiver—Modified Reinhart, O-v-1, three-valve amplifier.

Jubbulpore, C.P. India.

R. N. FOX.

THE "ANTIPODES ADAPTOR."

The Editor, POPULAR WIRELESS.

Dear Sir,—In a recent issue of "P.W." you published a circuit of a short-wave set called the "Antipodes Adaptor," by G. T. Kelsey.

During a week-end I roughly constructed a set from this circuit, and although I did not strictly keep to the value of components, I am delighted with the results.

On Saturday night I tried the set out at about 11.45 p.m., and within fifteen minutes I had tuned in WGY at fair loud-speaker strength. (Condenser readings: Grid, 30; reaction, 60.) Sunday night, at 6.30 p.m., I again tried the set, and within half an hour got a carrier-wave which eventually turned out to be 3 LO, Melbourne. I heard the announcer on three occasions say "This is 3 LO, Melbourne, Australia, broadcasting on 32 metres, the time is now—," etc. I could not distinguish the tunes played, as they were too distorted. (Condenser reading: Grid, 25; reaction, 45. H.T. voltage, 18.)

I am so delighted with the results that I am going to reconstruct the set to the published details, and I must thank Mr. Kelsey for the simplicity of construction.

Have been a reader of "P.W." for five years, and in my estimation this is one of the best things you have given to us.

Warrington.

Yours faithfully,

B. SPRUCE.

The Editor, POPULAR WIRELESS.

Dear Sir,—Many thanks for your "Antipodes Adaptor." I may say I had a short-wave set before, but as my L.F. stages in my broadcast set were much better than in my short-wave set, I stripped same on Thursday, after my POPULAR WIRELESS arrived, and in the afternoon I was listening to Morse and French amateurs on telephony. In the evening I was unable to tune in 2 XAF owing to a too large coil, but succeeded in picking up a station giving out several letters and saying it was the experimental station of some university. This afternoon (Saturday) I have been listening to PCJJ, which came in with a roar on three valves, also another station calling itself Phillips of Copenhagen, on 42 metres, both on loud speaker. I found that a six-turn grid coil was too large in my case, so I used four and I can get down well below PCJJ's 30 metres now, and hope to hear 2 XAF to-night. I may add that this is just the thing I've been looking for, as it saves me all the bother of unhooking one set to put on another, besides having the advantage of using much better L.F. stages than in my old short-wave set.

Yours faithfully,

S. E. PRIOR.

P.S.—I withheld this letter till I received 2 XAF on loud speaker last night. He could be heard all over the house, and have just received 3 LO, Melbourne, on 'phones at good strength; King's Lynn, Norfolk.

ONE-VALVE RESULTS.

The Editor, POPULAR WIRELESS.

Dear Sir,—This letter, about "A One-Valve Portable," by Mr. Bird, "P.W." No. 259, is written rather a long while after the set appeared. However, on account of this I have all the more time to thoroughly test the set.

I am surprised that more reports about this wonderful set have not appeared in your paper; incidentally, my results may interest Mr. Elston.

The set was built to be taken to Shanklin, I.O.W., for a fortnight in the summer of last year. Building the set was a gamble, as I did not possess one of the valves specified.

The lay-out was completely rearranged on the baseboard-and-panel system so that an ordinary variable condenser could be used. A larger attaché case was also used, so that there was room for a pair of 'phones, making the set self-contained.

None of my British valves would work in the set, but a Radio Micro 2-volt valve gave good results. The H.T. was 24 volts (flash-lamp batteries), bias 41 volts, and L.T. six large dry batteries (as used in super capacity H.T. batteries) in series-parallel, giving 3 volts.

The set was rigged up about half-way up the downs at Shanklin. The aerial, 40 ft. of D.C.C. wire, was slung between two trees about 20 ft. up, and the earth was a length of D.C.C. wire soldered to a metal meat skewer. The stations received in broad daylight, about 6.30 p.m., were Daventry (5 GB), London and Bournemouth.

The set was also used on the second floor of a house at the same place, the aerial being taken from one side of the room to the other; the earth was taken to a wire mattress. Stations received as above and at same time.

During the winter this set was used in London (W. Norwood) on an outdoor aerial 70 ft. long and 30 ft. high (half the length running 9 ft. above a roof), and on a buried earth, lead 6 ft., clay soil. Stations received:

Vienna, Brussels, Daventry (5 GB), Berlin (Witzleben), Langenberg, Rome, Bruenn, Frankfurt-on-Main, Berne, Glasgow, Hamburg, Toulouse, Stuttgart, Leipzig, London, Prague, Barcelona, Bournemouth, Breslau, Dublin, Milan, Newcastle, Belfast, Nurnberg, Innsbruck.

All except Prague, Barcelona, and Leipzig were received with London working.

A few others were also received, but unidentified.

Yours truly,

N. H. BLUNDELL.

W. Norwood, S.E.

[Ed. NOTE.—The circuit incorporated in this little set is a version of Mr. Dowding's now well-known Filadylne.]

FROM FAR AND NEAR.

Several European stations employ a ticking clock or metronome as a means of identification. The Vienna metronome, for instance, ticks 44 times in ten seconds.

The Frankfort metronome clicks at the rate of 32 per ten seconds, whilst at Breslau the rate of ticking is 40 times in ten seconds.

So successful has been the picking up and relaying the signals of 5 SW in South Africa, that quite a boom in broadcasting has resulted in the Cape Town district.

There are four broadcasting stations in Toronto, three each in Vancouver and Montreal, and two stations in Winnipeg.

Fifty wireless manufacturers exhibited at the British Industries Fair at White City, Shepherd's Bush, the number easily constituting a record.

The Faraday medal, a coveted scientific distinction, has this year been awarded to Prof. J. A. Fleming, F.R.S., the inventor of the thermionic valve.



The "ECONOMIST" H.T. UNIT

Constructional details of an extremely simple and cheap H.T. unit, which, however, is capable of providing a reliable anode current supply from any A.C. Mains.

By L. H. THOMAS.

THIS article might well have been entitled "In Search of the Cheapest Eliminator," for it was a search of this kind that led to its construction. It is comparatively easy to cheapen the aver-

former was a "Suprecision" Type 703, obtainable from F. C. Heyberd & Co.

It should be mentioned, however, that before the D.U.2 valve was decided on, quite interesting results were obtained by

"burning up" some very ancient bright emitters as half-wave rectifiers. Some of the oldest "R" valves gave really excellent results, and for the benefit of the reader who is of an experimental turn of mind and has a plentiful supply of these valves reference is made to this, and Fig. 1 shows the circuit. The filament winding of the transformer must, of course, be chosen to suit the valves used, which must be similar.

Fig. 2 shows the final circuit diagram, in which it is seen in the photographs. If we begin at the right-hand side of the

diagram the various points may be explained. Firstly, the switch in series with the primary winding of the transformer. This, of course, finally cuts off all power from the eliminator.

Switching Off.

It does not, however, discharge the condensers. Therefore, if one wishes to escape an occasional shock when making adjustments inside the cabinet—which,

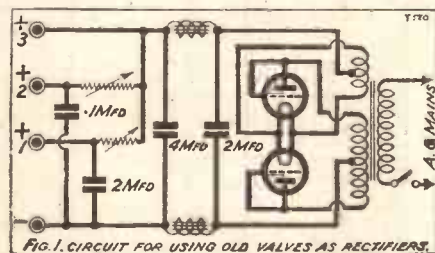
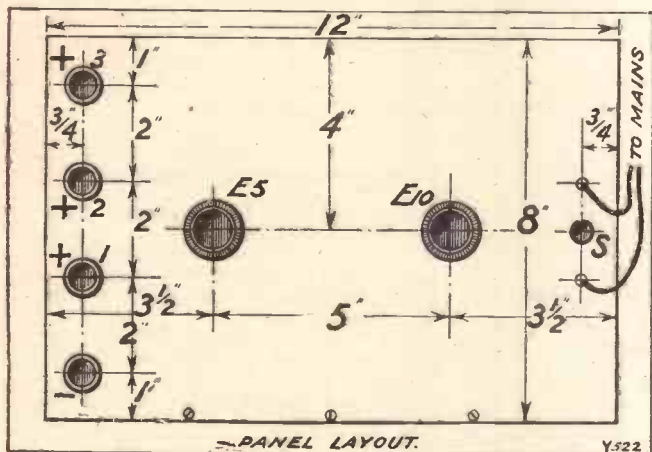


FIG. 1. CIRCUIT FOR USING OLD VALVES AS RECTIFIERS.

incidentally, should never be done with the power switched on—it is advisable to switch off the eliminator switch before switching off the broadcast set with which it is used. The condensers will then discharge slowly and the set may be switched off.

(Continued on next page.)

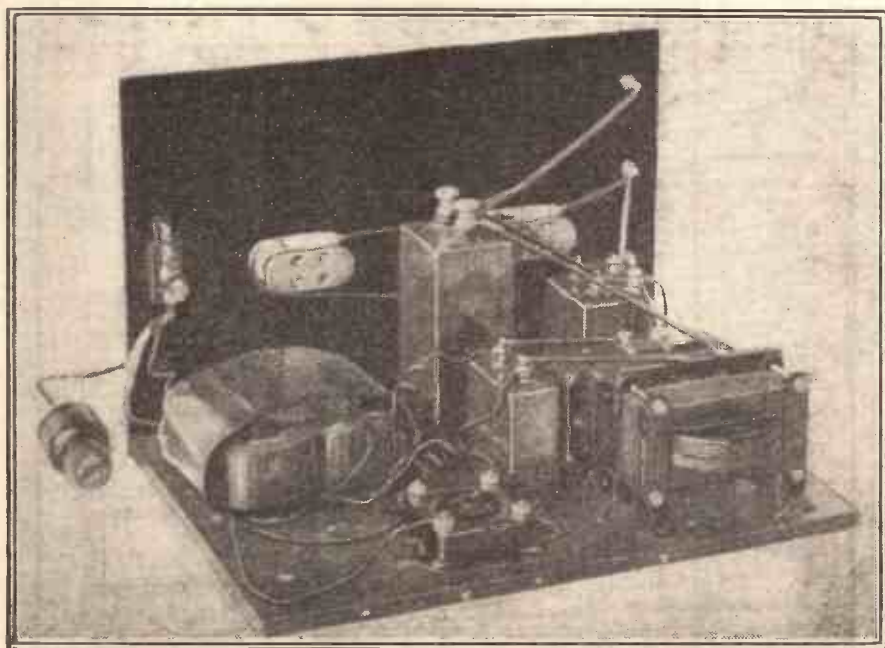
age broadcast receiver without noticeably affecting the results obtained. When one comes to such a piece of apparatus as an H.T. battery eliminator, however, there comes a point at which any further cheapening will have the disastrous effect of producing appalling noises and hums which are entirely undesirable. In view of this, therefore, the chief point about the cheapening process is to know just where to stop.

A Compact Unit.

The writer required a small compact eliminator that would give a D.C. output of about 20-30 milliamperes at 160 or 180 volts, for the purpose of operating a power amplifier, the input to be supplied by A.C. mains. Two other terminals, at "controllable" potentials, had also to be provided for supplying the H.T. to the H.F. stage and the detector of a broadcast receiver. The full voltage was, of course, to be applied to the amplifier.

It was soon decided that the only practicable way of building this in a compact form was to use a transformer with two windings, the filament winding being utilised to heat the filament of a full-wave rectifying valve—i.e. one of the double-plate type.

The transformer eventually decided upon was one with a filament winding giving 2 + 2 volts at 1.6 amperes and 200 + 200 volts at 20 milliamperes, which could conveniently be used in conjunction with a Mullard D.U.2 rectifying valve. The actual trans-



The unit takes up very little space, and the components can be compactly arranged without hindering the process of wiring in any way.

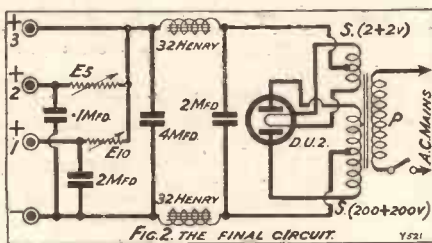
**THE "ECONOMIST"
H.T. UNIT.**
(Continued from previous page.)

This particular switch, incidentally, has been chosen because the knob and spindle which protrude through the panel are insulated from the "business end" and are, therefore, never at high potential. Note also that no terminals are provided for the input, a twin flex lead being taken through two holes in the panel to an adaptor which is simply inserted in the nearest lighting socket.

The Eliminator Connection.

The transformer, which has been already described, has no terminals, but flex leads are again used, and are taken to the necessary points in the set. As will be seen, the perfectly conventional full-wave rectifying circuit is employed, and the extremes of the H.T. winding are taken to the two plates of the valve.

The two extremes of the filament winding are taken to the two ends of the filament, and the centre tap of this winding then makes the positive H.T. terminal, while the centre tap of the other winding makes the negative. This is mentioned because a worthy gentleman of the writer's acquaintance recently refused to believe that



it was the filament winding that became positive. A few seconds thought on the manner in which a valve acts as a rectifier would have shown him that this was so.

These two leads—positive and negative H.T.—are now taken through two 32-henry chokes for smoothing purposes, and a 2 mfd. condenser is connected across the "in-

put" end, and a 4 mfd. condenser across the "output" of the filter. The method of arranging these condensers on the base-board to provide the shortest possible wiring will be seen in the photographs and diagram, and should not be altered seriously when the set is finally made up.

A few words with regard to the chokes will probably not prove amiss, since considerably cheaper chokes—in the form of Ford coils—were tried out at first, and proved to be quite unsatisfactory. In addition to taking up much valuable space, these Ford coils have such high-resistance secondary windings that they cut down the output voltage to a figure far below that required.

Voltage Control.

It will be seen that the "series-resistance" method of reducing the output voltage for the detector and H.F. valves has been employed in preference to the more universally employed potential divider. With the particular components used it certainly gave greater freedom from hum, and wider variation of voltage was possible, and this variation was so smooth and pleasant that it could be utilised to great advantage for such purposes as reaction control and volume control.

LIST OF COMPONENTS USED.

- 1 "Suprecision" transformer, Type 703 (F. C. Heayberd).
- 2 32-henry chokes (W. G. Pye & Co.).
- 1 4-mfd. and two 2-mfd. condensers, 200 working v. type (T.C.C. or any standard make).
- 1 .1 mfd. mica condenser (Dubilier).
- 1 Non-microphonic valve holder.
- 1 on-off switch (L. & P.).
- 1 E.5 and one E.10 Bradleyohm (Rothermel Corporation).
- 1 D.U.2 full-wave rectifying valve (Mullard' or similar type).
- 1 Panel, 12 in. x 8 in. (Radion).
- 1 Cabinet for same, with baseboard, 9 in. deep.
- Flex and adaptor for light socket.
- 4 terminals, of an insulated type.
- Tinned copper wire and Systoflex for wiring.
- Wood screws, etc.

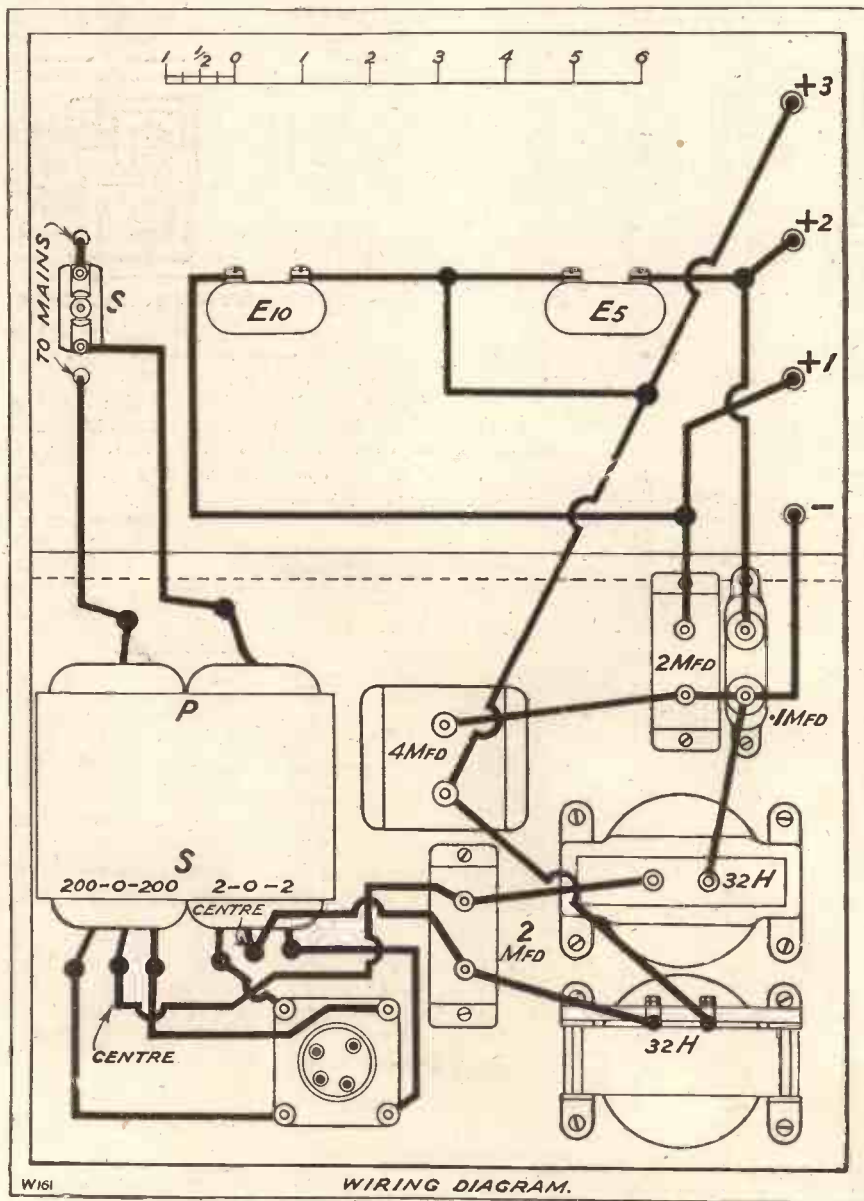
"Bradleyohms" were employed, an E.10 being connected in series with the H.T. + 1 lead and an E.5 in the H.T. + 2 lead. The former has a range of 10,000 to 500,000 ohms, and the latter from 1,000 to 50,000 ohms. A 2 mfd. Mansbridge condenser is connected from H.T. + 1 to H.T. -, and a .1 mfd. mica condenser from H.T. + 2 to H.T. -. As measured with a high-resistance voltmeter, the voltages at the output terminals with a load of about 10 milliamps are roughly as follow:

- H.T. + 3, 165 volts (fixed).
- H.T. + 2, 50-150 volts.
- H.T. + 1, 35-95 volts.

Plenty of H.T.

Thus it will be seen that the H.T. + 2 terminal is suitable for providing the necessary potential for a first-stage note-magnifier or an H.F. amplifier, while the H.T. + 1 terminal gives a suitable range of voltages for use on the anode of the detector. H.T. + 3 should not, of course, be used except on the anode of a final power or

(Continued on page 262)



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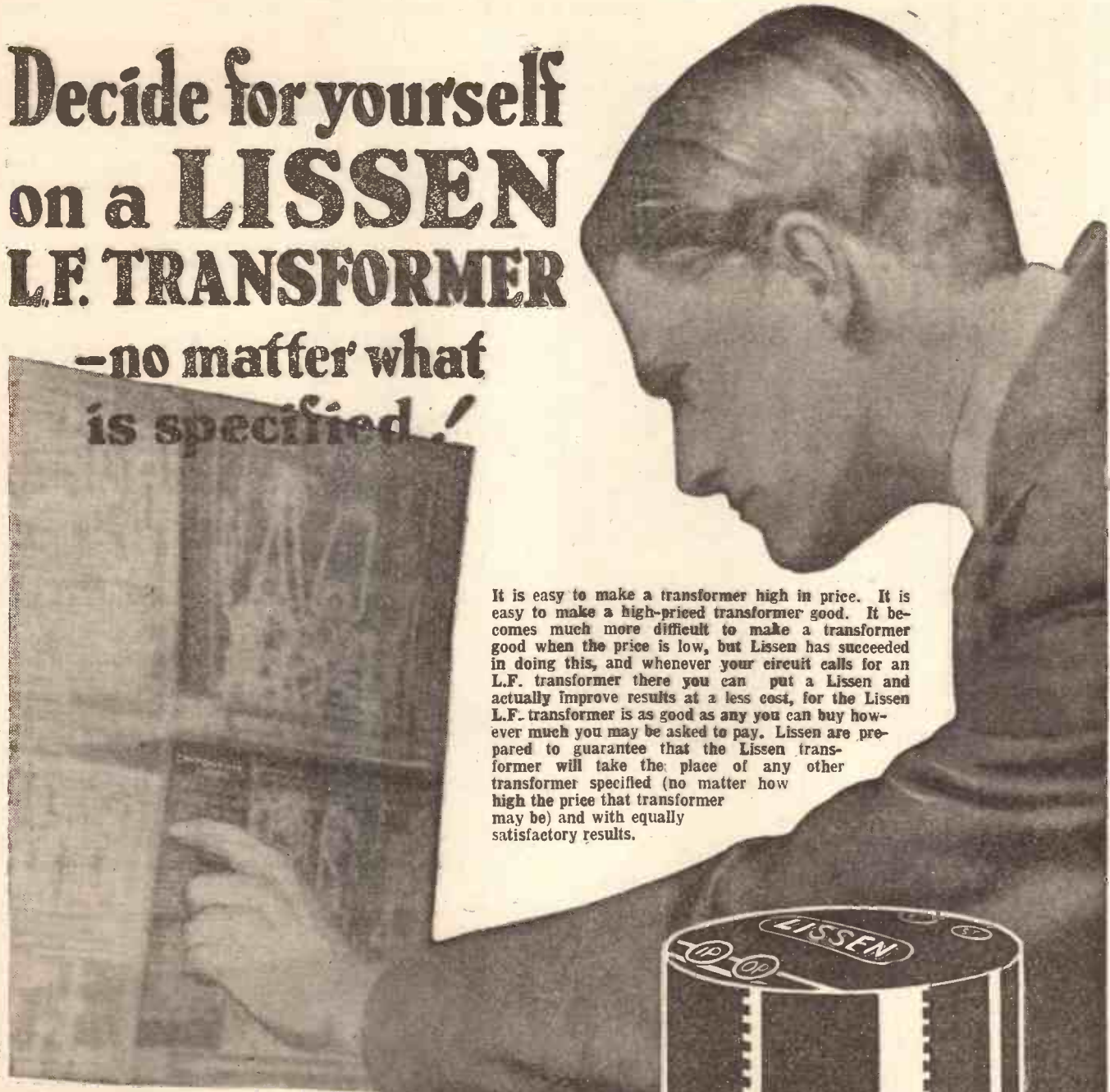
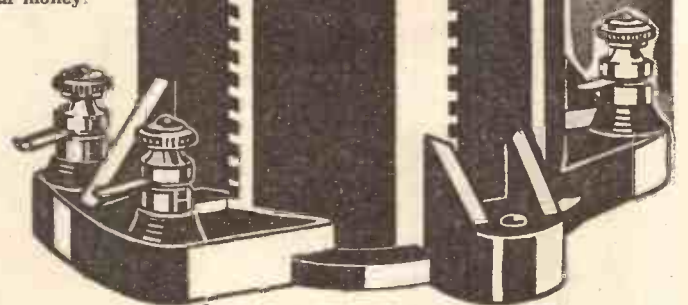
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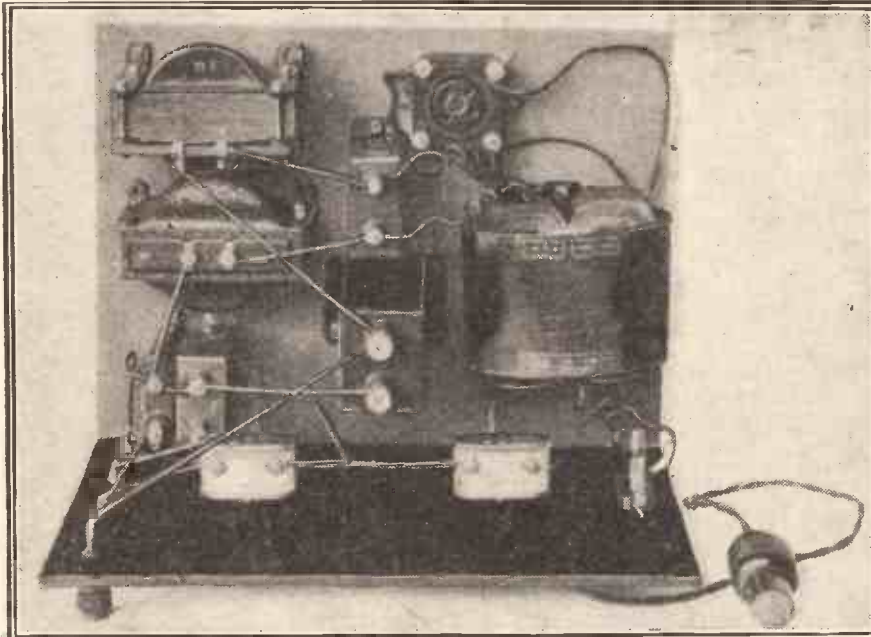


THE "ECONOMIST" H.T. UNIT.

(Continued from page 260.)

super-power valve provided with an adequate amount of negative grid bias.

Referring to the details of actual construction, there is very little that need be said. The panel used was 12 in. × 8 in.



Little more than a dozen wires have to be used in the connections of this unit—a remarkably small number.

in size, with a baseboard 12 in. × 9 in. The components could really have been arranged in a considerably smaller space; but cramping is not desirable in any case, and as an eliminator of this type will probably remain unaltered for a considerable time, on account of its general utility, it is as well to make a good job of it from the first.

Probably the average eliminator made by the home constructor will outlast three or four broadcast receivers, since there is so little to go wrong that one is less liable to become dissatisfied with it.

No panel brackets have been used, and it might be an advantage to incorporate these if the eliminator is frequently to be moved from its cabinet.

Suitable for R.C.

This eliminator is suitable for use with resistance-capacity coupled amplifiers, and has been thoroughly tested out in conjunction with a three-stage amplifier and moving-coil type loud speaker. Needless to say, the highest load that should be taken from it is of the order of 20 milliamps, which is hardly high enough to give "lecture-hall" strength. It is, however, a very useful power output for ordinary purposes.

As a matter of fact, the chief reason for the adoption of the "series-resistance" scheme for voltage reduction and control was this very fact that the eliminator was to be used with R.C. amplifiers. Other

methods often lead to trouble, the filter circuits behaving as tuned circuits oscillating at audible frequencies, and also being common to the anode circuits of the amplifier valves. "Motor-boating" and other undesirable effects are set up unless one either takes special precautions or happens to be very fortunate.

Avoiding Trouble.

In addition to this, the voltage control is very flexible indeed, and the degree of smoothing at full load appears to be greater.

It is, of course, assumed that the set is

necessary to do this. No portion of the eliminator should, however, be connected to earth.

All wiring has been carried out with insulated covering to the wire, as a precautionary measure. The reader should remember that voltages rather higher than those normally encountered by battery users are available across certain points of the wiring, and, although no real danger exists, the use of insulated wire will probably save several unpleasant shocks.

Returning to the point of charged condensers, it is, of course, obvious that if the receiver is switched off first and then the primary circuit of the eliminator broken by means of the switch, the condensers will all hold their charge until it has found some means of leaking away.

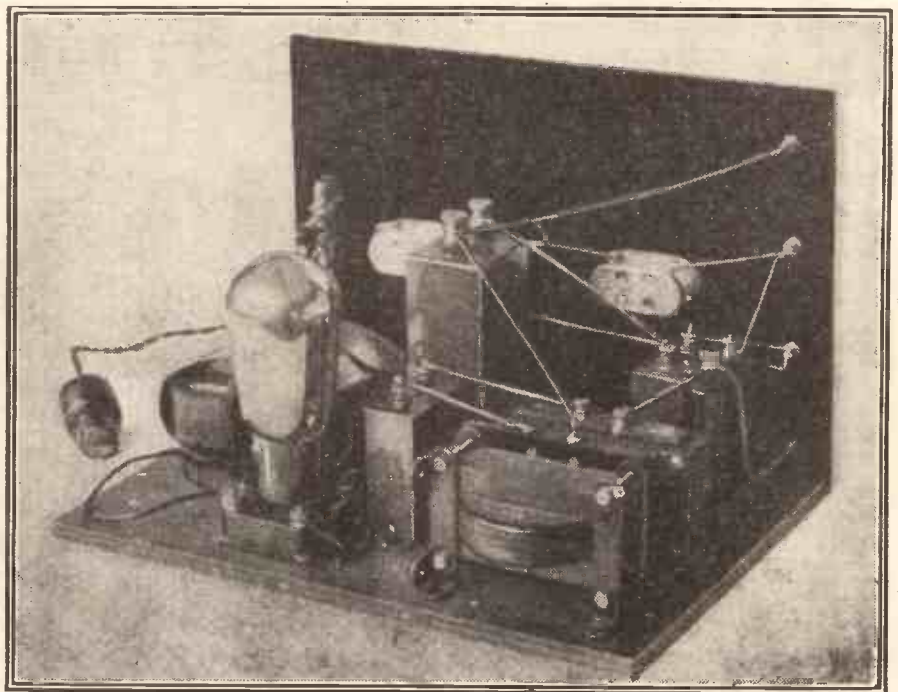
Good Condensers Essential.

If the condensers are good it will generally be found that they still have quite a considerable charge after some hours. It is undesirable to go round with a screw-driver "shorting" condensers, and obviously the common-sense plan is to switch off the eliminator first.

The H.T. will then be heard to fall away gradually as the condensers discharge through their normal paths, i.e. the anode circuits of the valves in the receiver, and the receiver itself may then be switched off.

The condensers used should be of the same type as those mentioned in the list of components; nothing but trouble will probably arise from the use of ancient ex-Government condensers such as may be picked up very cheaply occasionally. The "200 working volt (D.C.)" type should be used.

The transformer may be obtained for any voltage input. When ordering it from the manufacturers the voltage and frequency of the mains should be definitely stated. That used in the unit shown in the photographs was for 100-volt 50-cycle mains.



With valve in position. The H.T. unit ready for use, showing the adaptor for plugging into the electric-light mains.

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

QUESTIONS AND ANSWERS.

CUTTING OUT MORSE INTERFERENCE.

J. P. (Isle of Wight).—"I have a crystal set I made myself, and I can receive Hilversum, Langenberg, Eiffel Tower, Radio-Paris, Bournemouth, 5 G B and 5 X X. I get splendid reception working through a system of mica fixed condensers rating from '01 to '003 mfd. My aerial is an outdoor one, and I am greatly interfered with by shipping here. Can

you let me know how I can cut out some of this government Morse? I have tried a good many different things, including height of aerial and set, but what I want to know is the ideal aerial for use in such circumstances? (Sketch enclosed of my present arrangement.)"

We notice from your sketch that the aerial, starting from your window, runs uninterrupted for a distance of about 50 ft., when it is supported by an elm tree, and passes through this to be fixed to another tree at a distance of a further 50 ft. This is a very good arrangement for winter use, but when the elm tree is in full leaf, as it will be shortly, you may find that the tree acts as a very bad screen for your aerial, owing to the moisture it contains.

If the two trees are "in line" with one another it would probably be best to use a shorter aerial, fastened to the very top of the elm tree. If the trees are not in line with one another, it might be as well to forego the height which is obtained by passing through the elm tree, and to use instead a lower and longer aerial formed by the single span between the house and the furthest tree.

To cut out the Morse interference you should use a wave-trap such as the one which was described in these columns a few weeks ago. But as the Morse interference with which you are suffering is on a wave of about 600 metres it will be necessary to use about 20 or 25 extra turns on the coil.

THE CAUSE OF THE CRACKLING NOISE.

H. P. (Bourneville).—"The set is a Det. and 2 L.F., very much like the 'Programme Collector,' and it has been in use since last August without any trouble at all until lately, when it started to give a crackling noise. This got very bad, and then by good luck a friend came round and suggested that it was due to the resistance. He lent me an anode resistance from his set and we tried this in place of mine and it cured the trouble completely. But what I could not understand was that my resistance made better contact in the clips than his did, and therefore I should have thought it was less likely to cause crackling noises, not more likely as proved to be the case. So what actually caused the crackle?"

(Continued on page 266.)

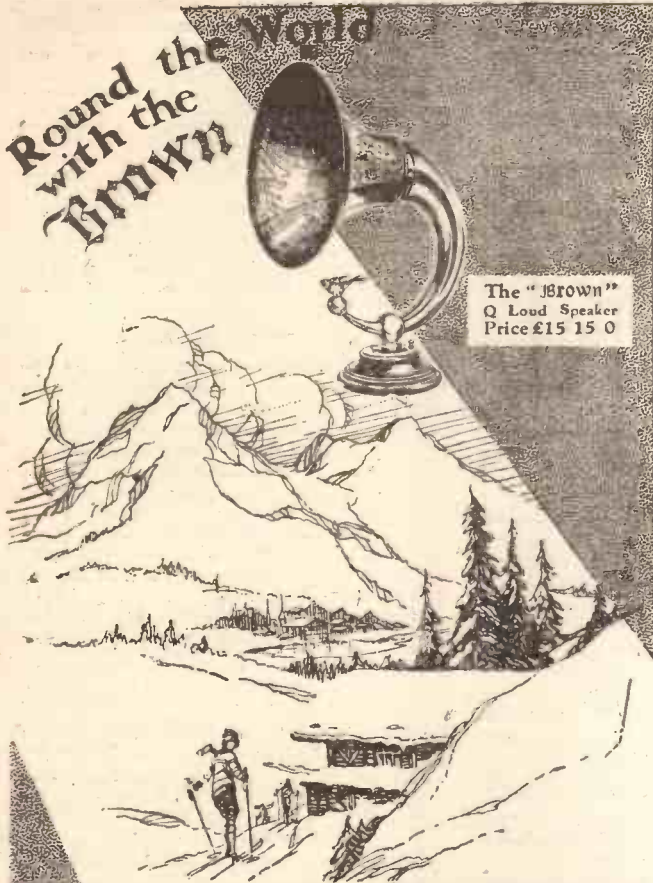
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4 volt. 30 amp. hrs.	1 7 0	1 13 0
4 volt. 40 amp. hrs.	1 12 0	1 18 0
6 volt. 20 amp. hrs.	1 13 9	1 19 3
6 volt. 40 amp. hrs.	2 0 8	2 7 0
6 volt. 40 amp. hrs.	2 8 0	2 14 6

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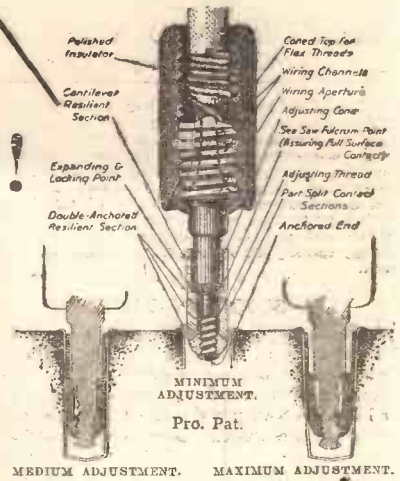
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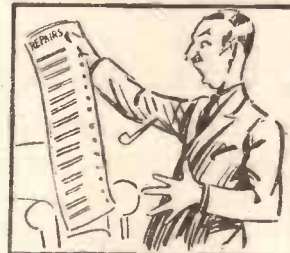
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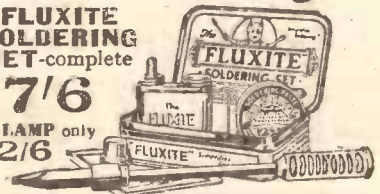
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RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 264.)

Probably bad contact was the cause of the crackle, but this does not necessarily mean bad contact between the resistance and the clips in which it is held. If the anode-resistance was of the paste or composition class the probability is that the material had deteriorated, forming a partial break internally. Such deterioration alters the value of a resistance, which may be high one moment and comparatively low the next, and consequently the current will keep varying, causing the set to give the noises which you hear.

A GOOD TWO-VALVER.

A. R. T. (Merthyr Tydfil).—"I want a good two-valve set of the Reinartz type, using the condenser to control reaction. I have the following components on hand: One cabinet for 16 in. by 8 in. panel: one A.F.3 L.F. transformer; one .0005 mfd. condenser slow motion; one .0003 variable condenser, terminals, rheostat, and a whole big rack of coils (plug-in). Where can I get a circuit for these?"

For your purpose we recommend the "P.W." Blueprint No. 25. This two-valver (Det., 1 L.F.) employs condenser controlled reaction, and is not only a good distance getter, but is capable of working a loud speaker at a moderate distance from a broadcasting station. All your components can be embodied in it.

SIZES OF WIRE FOR COILS.

R. W. P. (Chatham).—"Does the thickness of wire used for coils make a material difference to them? If the instructions say 50 turns of No. 28, and you happen to have No. 26 by you, could this be used instead, or would it be less effective than if the No. 28 were used?"

Small differences in the size of wire are generally comparatively unimportant, but it should not be forgotten that on some sets and with some formers, it is essential to use the exact gauge of wire specified. If, however, this is necessary the fact is generally specifically mentioned in the article describing the set.

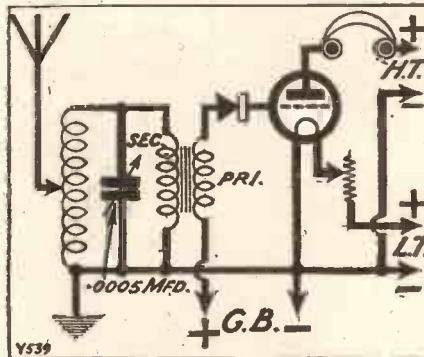
A CRYSTAL-SET PUZZLE.

S. F. (Hoddesdon, Herts).—"I only run a crystal set, but, I must admit that I do not understand that! In it there is a coil with condenser across it) to the respective ends of which the aerial and earth are connected. Across this coil and condenser are the 'phones

and crystal, but, what I can't understand, is that why anything coming from the aerial should choose to go through the crystal and the 'phones (both of high resistance) when there is a direct path for such currents through the coil to earth. Can you throw any light on this, for it is a great puzzle to me?"

As you say, there is a direct path for the current from the aerial to the earth via the coil. But as this coil is tuned by a variable condenser, it constitutes a tuned circuit, and such a circuit offers the tremendously high "resistance" to currents flowing at the frequency at which it is tuned. In a well-designed circuit this high-frequency resistance effect, which is called impedance, is of a far higher value than the resistance of the crystal and 'phones in series. It is because of this high impedance of the coil that voltages are set up at its ends, and current due to the broadcasting station is caused to flow in the crystal and 'phone circuit, thus giving the signals in an audible form.

WHAT IS WRONG?



The above diagram is supposed to represent the connections of a crystal and 1 L.F. 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 "What is Wrong?" diagrams in which mistakes have 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 the reader cannot fail to learn a lot about radio circuits.

CONDENSERS IN SERIES.

C. F. E. (Sudbury, Suffolk).—"Just by way of experiment, I have placed a 2-mfd. Mansbridge condenser in series with the aerial. It distinctly improves the quality of the loud-speaker reproduction without diminishing the volume. A little more reaction, however, is required. I was surprised to find, however, that the wave-length of the aerial tuning condenser was scarcely affected, being about one degree less. Why is this? (A smaller condenser, .0001, changed the reading of A.T.C. about 50 degrees.)"

Every aerial has a certain capacity of its own, the average aerial's capacity being of the order of about .00025 mfd. Therefore, if a condenser is connected in series with the aerial, we should expect the capacity to alter just the same as when one condenser is connected in series with another. Now, if any condenser is connected in series with another one, the total capacity is reduced, and the smaller the condenser which is added, the greater is the reduction in capacity.

Therefore, large capacity condensers connected in series with the aerial will hardly reduce its capacity at all, but a very small capacity condenser, such as

(Continued on page 272.)

MAKE YOUR OWN CONE SPEAKER

As described by the Technical Staff of "The Wireless Magazine"

—Page 21, February, 1928. Using the NEW WONDER

"NIGHTINGALE" CONE UNIT

Price only **15/-**
Complete with full constructional details. Post Free

Guaranteed to give results equal to the most expensive Loud Speakers yet made.



AS FITTED TO OUR CABINET CONE SPEAKER

BULLPHONE DOUBLE PAPER CONE
Postage 3d extra as fitted to our own Speakers. **2/-**

PROFIT BY THE HAPPY EXPERIENCE OF THOUSANDS of listeners who have been astonished with the wonderful results obtained by using the "Nightingale" Cone Unit Speaker with the "Cossor Melody Maker" and the "Mullard Master Three."

The enormous success of the "Nightingale" Cone Unit has been won on merit—because when used with these famous Sets and with other 3, 4, 5, 6, or 7-valve Receivers the results show amazing value for money and demonstrate the superiority of "Bullphone" Loud Speaker Units.

Test the truth of this for yourself. Send for a "Nightingale" Cone Unit to-day—NOW. Our guarantee is your security for ten years of perfect enjoyment. Volume and purity of tone equal anything you have ever heard—and the cost is only 15/-.

SATISFACTION GUARANTEED OR MONEY REFUNDED.

Obtainable from your Local Dealer or direct from:

BULLPHONE LTD.

38, HOLYWELL LANE, LONDON, E.C.2.

BULLPHONE NIGHTINGALE GRAMOPHONE ATTACHMENT
Reduced from 32/6 to 15/- solely as an advertisement for the famous Bullphone Nightingale Loud Speakers. Cobalt magnet guaranteed for all time.

Instantly converts your own Gramophone into a full power Loud Speaker, giving a wealth of pure, undistorted volume which must be heard to be believed.



With 4-inch Diaphragm.

15/-
Post Free.

THE HEIGHT OF PERFECTION



LOEWE

HIGH VACUUM RESISTANCES

AND

HIGH VACUUM BLOCK CONDENSERS

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Ask for Illustrated Leaflet.

THE LOEWE RADIO COMPANY LIMITED,
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Make Sure of YOUR Copy of **The WIRELESS CONSTRUCTOR**

In this issue the Editor

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

describes in detail a fine portable receiver called

The "ROADSIDE" FOUR

Many other constructional articles, covering radio from the handy man's point of view, make this issue a wonderful sixpennyworth.

The WIRELESS CONSTRUCTOR
May Issue Now On Sale - Price 6d.



LET ME BE YOUR FATHER.

I have acted as father and adviser to thousands of others. I give advice free, and when I do so I feel the responsibility of a father, either in advising a career or in guiding our students to success. Having been the self-constituted father and adviser to thousands of others, it is possible I may be able to help you and guide your footsteps so that you

may make a success of your life.

THE MOST SUCCESSFUL AND MOST PROGRESSIVE CORRESPONDENCE COLLEGE IN THE WORLD.

Thousands of people think they are in a rut simply because they cannot see the way to progress. This applies particularly to Clerks, Book-keepers, Engineers, Electricians, Builders, Joiners, etc. They do not realise that in these particular departments the demand for the well trained exceeds the supply, also they do not realise that about 1s. per week will pay for all necessary books and tuition, and that by studying in spare time they can qualify for the higher and better paid positions. In Technical trades and in the professions employers are frequently asking us if we can put them in touch with well trained men. Of course, we never act as an employment agency, but it shows us where the shortage is. In every trade or profession there is some qualifying examination, some hall-mark of efficiency. If you have any desire to make progress, to make a success of your career, my advice is free; simply tell me your age, your employment and what you are interested in, and I will advise you free of charge. If you do not wish to take that advice, you are under no obligation whatever. We teach all the professions and trades by post in all parts of the world, and specialise in preparation for the examinations. Our fees are payable monthly. Write to me privately at this address: The Bennett College, Dept. 106, Sheffield.

J. Bennett

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Fireman's Exam.
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H.M. Inspector
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Mine Surveyor

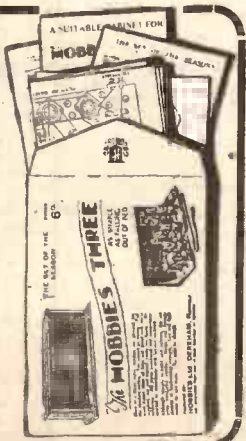
Any Amateur can build SET-CABINET AND SPEAKER

in two or three evenings. Quite simple and quite cheap. Every detail given. A special three-valve set. Cabinet costs 9/- and a handsome cone speaker 23/1. Full design and instructions so that you can't go wrong.

Full Size Plan of HOBBIES THREE
Baseboard plan, full size, with numbered wiring chart and wires supplied ready turned and tabulated. No soldering, no coil changing.

THIS PACKET contains full size design sheet of the Hobbies Three, with illustrated construction leaflet. Also details of Cabinet and Speaker built in mahogany, with prices of suitable polish, wood decorations, etc.
PRICE - 4d.

Ask for it at any Hobbies Branch or Agent, or send 5d. in stamps to HOBBIES, LTD. (Dept. 69), Dereham, Norfolk.





APPARATUS TESTED

A SHORT WAVE SET—
NEW RADIO JACKS.

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

A SHORT-WAVE SET.

THE increasing interest in short-wave reception is being reflected in the production of special receivers for this purpose. Recently a concern known as the Short-Wave Communication Development Co., Ltd., of Wickford, Essex, has entered the field with a representative range of such sets. Mr. Gerald Marcuse, the well-known amateur, is technical adviser to the firm, and he is responsible for the design of the sets.

There is a two-valver, a three-valver, and a four-valve set which, because it employs two paralleled valves in its last L.F. position is known as the 4-5. The price of this last is £22 10s., exclusive of valves and royalties, but including a complete set of coils and grid-bias battery.

The set covers the following wave-bands: 15-100, 100-550, and 1,000-2,000 metres.

The circuit arrangement of the four-five valve set consists of an anode-bend detector

and three resistance-coupled L.F. stages. And, as before mentioned, provision is made for using two valves in parallel in the last stage. An output filter circuit is incorporated.

Plug-in coils are used, and reaction is capacity-controlled. By interchanging the plug-in coils, the set can be made to cover the wave-lengths above mentioned.

The set is fitted with a metal panel, and slow-motion dials are fitted on both the tuning and reaction condensers. Midway on the panel is fixed a volume control, and balancing this on the extreme right of the panel is a small push-pull filament switch.

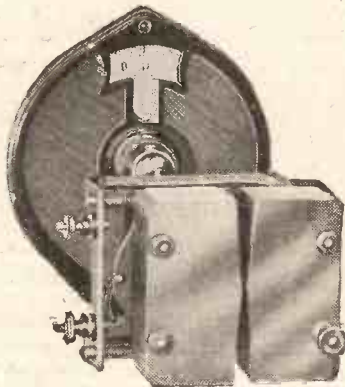
The complete set is contained in a cabinet with folding doors and a lift-up lid. Instead of the conventional terminal strip for battery connections, an ebonite strip is provided with sockets into which the necessary leads can be plugged. This feature was found extremely handy in practice. We received the sample receiver some little while ago, and the aerial tests have extended over a number of weeks. Throughout this time the set has functioned excellently. On the long-waves several stations have been heard, all at loud-speaker strength. Bearing in mind the fact that no H.F. valves are employed, the set is reasonably selective on the broadcast band, and quite a host of stations have been heard on the loud-speaker.

Dropping to waves below 100 metres, for which the set is primarily designed, countless C.W. and telephony stations can be heard at all hours of the day and night.

Places as far distant as Australia have been heard quite regularly at good strength,

(Continued on page 270.)

The "Hartley" One Valver



When building this set, which was specially designed for long-distance work and which was described in "Popular Wireless," March 31st, you will need to use a Ripaults Lateral Action Condenser as specified and used by the designer. Only by so doing can you assure yourself that you will obtain the excellent results of which this set is capable.

PRICE
·0005 . . 10/6

The unique design of Ripaults Lateral Action Condensers gives them definite advantages over all other types. It ensures hair-line tuning, which gives great selectivity; it allows a very minute variation of capacity, which is essential for long-distance work. Ripaults condensers occupy the minimum of space, and, because of their outstanding merits, are being incorporated in sets by many eminent designers.

RIPAULTS SELF-REGENERATIVE H.T. DRY BATTERIES supply the means of obtaining that careful adjustment of H.T. of which the designer makes a strong point. Get a "Standard" 60-volt (Model C.M.), Chocolate Label, price 10/6, which is tapped every $1\frac{1}{2}$ volts up to 9, then by nines up to 60. These tappings give you the necessary minute adjustment. Ripaults Batteries give 50% Longer Life. The battery specified will last you many months with the "Hartley" One Valver.

From all Dealers. If any difficulty, order direct.

RIPAULTSLTD., KING'S RD., LONDON, N.W.1

TAKE NOTE

These L.F. Transformers are made by SPECIALISTS in these particular components and their excellence is due to long experience and concentration in one direction. British Made.

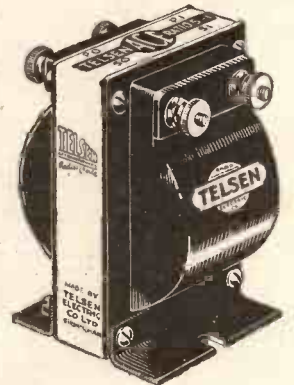
The "RADIOGRAND"

is an instrument which gives results equal to, if not exceeding, the most expensive on the market. A prodigious quantity of these components are turned out weekly in response to the overwhelming demand, and they are incorporated in countless receivers. Their popularity has been gained by wonderful amplifying powers, absence of distortion, and robust construction.

12/6 Ratios 5-1 & 3-1.



If unable to obtain write
TELSSEN ELECTRIC Co., Ltd.,
Head Office & Works: 207, ASTON ROAD, BIRMINGHAM.
Phone: Central 5265. Grams: Escort, Birmingham.



"ACE" 8/6

Ratios 5-1 and 3-1.

This is a smaller instrument built to give first-class results, yet of a size and weight that render it particularly suited for Portable Sets where compactness is an essential feature.

TELSSEN
L.F. TRANSFORMERS

Radio's Choice

Your dealer will supply on 14 days' free trial.

Every instrument guaranteed 12 months.

THE STRONGEST, CHEAPEST AND MOST EFFICIENT
ALL-STEEL WIRELESS MAST
 EVER OFFERED — CAN'T BE BEATEN

15/- AND WORTH
DOUBLE
 THE EASIEST MAST TO ERECT
ROT-PROOF
DAMP-PROOF
FOOL-PROOF

ANYBODY
 CAN PUT
 IT UP

Fullest Instructions given.

NO HOLES
 TO DIG.

'Phone your
 order: City
 3788.

Patents
 Pending.

These Masts are made of British Tubular Steel, are supplied with every conceivable accessory, and fullest directions for erecting. No further outlay is necessary, and the Mast can be easily erected in half an hour, with just the assistance of another.

Read this Specification.

Specification.—All Masts are supplied with Iron Bed Plate, Drilled Steel Ground Pegs, Stay Rings, Galvanized Standard Steel Flexible Wires for Stays, Pulleys, Bolts, etc., and everything down to the last item for erecting. Will stand any gale.

- (1) A High Aerial makes your set louder, and helps you to get away from your neighbours' oscillation.
- (2) A wonderful reception from a Crystal Set can be obtained with a tall Mast.
- (3) A 42 ft. Mast is as good as a valve.
- (4) Takes half an hour to erect.
- (5) A Steel Mast is a direct Earth and saves your set from any electrical disturbances, such as lightning.
- (6) The Mast can be extended by purchasing another section, fullest particulars by request.

26 FT. In 3 sections of 1 1/2 in. Steel HIGH tube tapering to 1 in.

ONLY **15/-** Carriage costs, approximately, London and Suburbs 1/6; Midlands 2/6; other districts 3/6. Net weight 24 lbs., approximately. Two Masts for 28/6.

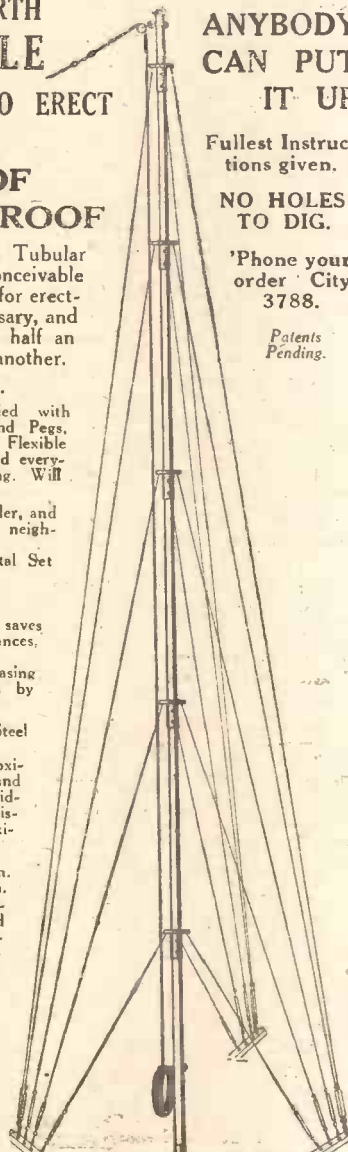
34 FT. In 4 sections of 1 1/2 in. HIGH Steel tube tapering to 1 in.

ONLY **21/6** Carriage costs 2/- London and Suburbs, 3/- Midlands, 4/- elsewhere. Net weight 34 lbs. Two Masts for 40/-.

THE "SUPER" MAST.

42 FT. In 5 sections of heavy HIGH 1 1/2 in. Steel tube tapering to 1 in. A real bargain.

ONLY **29/6** Carriage costs approximately 2/6 for London and Suburbs, 3/6 Midlands, 4/6 elsewhere. Net weight 46 lbs. Two Masts for 55/-.



The Mast sent C.O.D. to London or Suburbs or wherever Messrs. Pickford's or Carter Paterson have an Agency. Fullest guarantee with every Mast as to complete satisfaction, or money instantly returned without question.

COME AND SEE ONE

or

Send Your Order To-day to :

P.R. MASTS

Dept. 39 (Opposite Post Office Tube),

17, PATERNOSTER SQUARE,
 NEWGATE STREET, LONDON, E.C.4

GIGANTIC SUCCESS
 OF THE REDUCED PRICES
P.R. VALVES

THE WORLD'S BEST
FINEST LONDON MADE
 L.F., H.F., R.C. & DETECTOR IN 2 & 4 VOLTS

TRADE
 ENQUIRIES
 INVITED.

NOW ONLY
3/6

OLD PRICE
8/6



P.R. SUPER DULL E-MITTER VALVES challenge comparison with ANY OTHER VALVE ON THE MARKET. Don't imagine for one moment that they are rubbish—

Such as bankrupt stocks or foreign valves. On the contrary, they are the latest product of one of the finest equipped factories in London. Years of experiment and research are behind every P.R. VALVE, and before leaving the Works every valve passes the most exhaustive tests. Experimenters can have every confidence in P.R. VALVES. It was only by the lucky discovery of new elements and new methods of manufacture that the P.R. VALVE at 3/6 became an established fact. Hitherto it had been sold at 8/6. The NEW PRICE BRINGS A GOOD VALUE WITHIN THE REACH OF EVERYBODY.

THE WORLD'S BEST VALVE THE WORLD'S BEST VALUE

Type	Fil. Vts.	Fil. Amp.	Imp. Ohms.	Amp. Fac.	M/C	
PR 1	2	06	35,000	15	4	H.F. Det.
PR 2	2	06	25,000	12	43	L.F.
PR 3	2	06	18,000	8	44	R.C.
PR 4	2	06	120,000	40	33	H.F.
PR 5	2	15	40,000	20	5	Det.
PR 6	2	15	30,000	15	5	L.F.
PR 7	2	15	12,000	6	5	H.F.
PR 8	4	06	23,000	15	65	Det.
PR 9	4	06	19,000	9.5	5	L.F.
PR10	4	06	11,000	6	55	L.F.
PR11	4	06	120,000	40	33	R.C.

3/6

Post and Packing 4d.
 2 VALVES FOR 6/9
 Post and packing 6d.
 3 VALVES FOR 10/-
 Post and packing 6d.
 4 VALVES FOR 13/-
 Post and packing 9d.

P.R. POWER VALVES are superb and challenge comparison with any other, no matter the make or price. Absolutely free of distortion, will take any load.

Power 2V .20 6,000 5 .82 P.
 Valves 4V .15 4,000 4 1.0 P.

THEY CAN'T BE BEATEN

7/6 Each. Post and Packing 4d.

THEY WILL SAVE YOU POUNDS.

NO BETTER-CAN BE BOUGHT ANYWHERE.

OUR GUARANTEE

All valves despatched by return of post under guarantee of Money Back in Full if not satisfied. All valves are carefully packed and breakages replaced.

Sets of Valves made up to any requirements. MATCHED VALVES for intermediate stages specially selected 1/- per set extra.

Tell us what your circuit is. We can help you to select the right valve. Remember that R.C. Valves require at least 110 volts and can take more with advantage.

'Phone your order: CITY 3788. Pay the Postman C.O.D. WRITE, 'PHONE OR CALL.

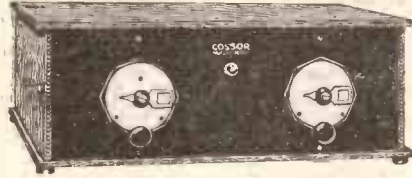
P.R. VALVES

Dept. 38 (Opposite Post Office Tube),

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MULLARD MASTER THREE
HANDSOME OAK CABINET FOR THE MASTER 3 (American Type), with parts,
FREE 12/6 carr. 2/-
With **COMPONENTS** (Blue Print Free) as specified:-
2 Term. Strips 2 1/2 x 2, Lewcos Base, 2 J.B. Condensers, Climax H.P. Choke, Master Three Coil, 3 Pre Valve Holders, Magnum Brackets, 4 Terminals, Spade Terminals, Wander Plugs, Bulgin Switch, R.I. Unit, R.I. L.F. Transformer, Mullard .0005, 2 meg. Leak, Flex. Screws, &c., and Three Mullard P.M. Valves. Above Kit **£6. 17. 6**

The Corsor "Melody Maker"



GENUINE COMPONENTS £4 : 10 : 0 kit.
2 Ormond .0005, 2 Do. S.M. Dials, 6 T.C.C. Condensers, .001, .002, two .0005, .0001, 2 mfd., 2 Grid Lk. Clips, B.B., 1 Var. B.B. Rheostat, 3 Grid Leaks, .25, .5, 4 meg., 3 Lotus V.H., 1 Ferranti A.P. 3, 2 Panel Switches, 1 Corsor Melody Wound Coil, Terminals, Name Tabs, Glazite, 9-v. Grid Bias (all as specified).

Handsome Oak Cabinet 12/6 with parts (as shown above). Also Cabinets at 15/11, 18/11, and Mahogany Polished at 20/- (with parts). Carr. 2/-

EDISWAN NEW THREESOME

COMPONENTS. Three Coupling Units, Tubular Fixed Condenser, Multi-flex Cable and Plug, .0005 Variable with S.M. Dial, 2-way Geared Coil Holder, Connecting Wire, Red and Black Flex. The lot post free **42/-** nett

EBONITE PANEL 5 Ply Baseboard
2/6 The two with kit only.
EDISWAN VALVES.
H.F. 210 .. 10/6
B.C. 2 .. 10/6
P.V. 2 .. 12/6

LISSEN
Valve Holders, 1/-; Fixed Con., 1/-, 1/6; Leaks, 1/-; Switches, 1/6, 2/6; Latest 2-way Cam Vernier, 4/6; Rheostats, 2/6; B.B. 1/6; Lissenols, 13/6; L.F. Transformers, 8/6; 100-v. H.T., 12/11; 60-v. H.T., 7/11; Coils, 60 X, 6/4; 250 X, 9/9.

THREE SOLODYNE SETS

("MODERN WIRELESS," April, 1928.)
SET "A" SET "B" SET "C"
FULL DETAILS FREE.
Kit **110/-** | Kit **95/-** | Kit **75/-**

CALLERS WE ARE OPEN

Please make out your list for orders over 20/- if requiring component parts for any set, and we will give you a fixed inclusive price.

**ALL DAY SATURDAY
ALL DAY THURSDAY
ALL DAY EVERY DAY**
Hours: 9 a.m. to 8 p.m.
Sat.: 9 a.m. to 9 p.m.
Sunday morning: 11-1.

RAYMOND'S for Wireless!

BRITAIN'S "FAVOURITE 2"

Ebonite Panel, 14 x 7, .0005 Ormond S.L.F. and S.M. Dial, Igranic 6 ohms, Lissen 2-way, 2 Lotus Valve Holders, .0003 and series clip, 2 meg. Leak, B.T.H. or R.I. and Varley L.F. Transformer, .0005 Fixed, Strip 4 x 2, 8 marked Terminals. G.B. Clips, 2 Wander Plugs, Square Wire.
THE ABOVE LOT nett cash, post free - **45/-**
With Lissen or Telsen Acc L.F. - **37/6**

Our New 100 page **CATALOGUE 6d.** allowed
Profusely illustrated, Valve Data, etc
Very handy for Reference. **10/-** order

K. RAYMOND

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Come to **LEICESTER SQUARE TUBE**
This address is at the back of Daly's Theatre.
Phone: Gerrard 4937.

APPARATUS TESTED.

(Continued from page 268.)

and American stations literally "pour in" after 11 p.m., all at excellent 'phone strength and in many cases on the loud speaker.

The handling of the set, due no doubt to the metal panel and the slow-motion dials, is very simple, and hand-capacity is almost entirely absent.

Since the set is fitted with three well-designed resistance stages, it is not surprising that the reproduction is very good. Even on the short waves, where it is extremely difficult to obtain respectable quality, the set gave very pleasing results in most cases.

As a general rule, the leaky grid method of rectification is considered more sensitive than anode bend, and it would, perhaps, have been a useful feature to have incorporated both methods with a simple change-over device. With a leaky grid detector unit used in conjunction with the amplifiers of the set in question, louder signals were obtained from 3 L O than with the anode-bend rectifier, and with no noticeable effect upon the quality.

For the man who is interested in distant stations we consider this set to be a very sound proposition, for no technical knowledge is required to operate it successfully. Full details are given with the set with regard to suitable coils and valves, and in the case of the former the approximate wave-length ranges covered are given.

By using special home-made coils, the set will oscillate quite successfully well below 20 metres.

NEW RADIO JACKS.

Practically every radio component is, these days, fitted with screw terminals. This enables a constructor to assemble a set without resorting to soldering, an art which is so simple when experience is acquired, but so difficult for the absolute tyro.

But there has hitherto remained at least one component where soldering was essential—the radio jack. This article invariably had small tags which rendered any screw method of connection practically impossible. However, that progressive firm, Garnett, Whiteley & Co., Ltd., of Liverpool, world-famed for their "Lotus" products, have introduced a range of radio jacks and jack-switches, all equipped with neat and accessible screw terminals.

These terminals are spread out in such a way that connections can readily be made with them in either bare or covered wire. In other respects these new jacks are similar to the original Lotus range and have the same soundness of design and construction. Other special features of these jacks and jack-switches are, of course, that they project only a small distance behind the panel, and have large, solid frames and contact pieces which cannot possibly shift.

This innovation will no doubt meet with the great approval of a large number of constructors. Those who desire still to solder all their connections can use soldering tags.

It is interesting to note that although the above improvements have been made the prices remain the same, the jacks ranging from 2s. to 3s. and the jack-switches from 2s. 9d. to 4s.

YOU CAN BANISH BATTERY TROUBLES—FOREVER.



HIGH TENSION AT EVEN TENSION

HOW 'CONSTANT POWER PRESSURE' MAKES AMAZING IMPROVEMENT IN RECEPTION.

Ask any Standard Wet H.T. Battery user. He will tell you the purity of tone and complete absence of background noise is astonishing. Yet the explanation is simple. The flow of current from this highly efficient battery is absolutely steady, smooth and uniform. Hours of daily service for months on end does not show any violent variation in voltage. The secret is—it recharges itself overnight. **GET YOUR COPY OF THIS FREE BOOK.** Take the first step by sending for free booklet describing every detail for installing and maintaining this super-efficient and money-saving battery.

For 2-Valve Sets. A.4. 90 volts 24/10	For 3-5-Valve Sets. D.6. 108 volts 38/6	For Super-Sets. F.6. 126 volts 69/3
---------------------------------------	---	-------------------------------------

NO DEPOSIT. DEFERRED TERMS. CASH ORDERS. CARRIAGE PAID.

Single units of 1 1/2 volts from 4 1/2d. each. Woolworth's Stores are now distributing No. 2 cell completely assembled at 6d. each. Also "Standard" Electrolyte chemical in 6d. bottles. All types of the battery are also obtainable from Halford's Cycle Stores and Wireless dealers.

(Dept. A.) THE WET, H.T. BATTERY CO. 12, 13 & 14 Brownlow St., High Holborn, W.C.1

STANDARD
PERMANENT
WET
SUPPLY
The Vital Power in Radio!
M.B.

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£500 a year awaits you. Prof. A. M. Low shows HOW in "ENGINEERING OPPORTUNITIES." This 70 pp. book shows the easiest way to pass the A.M.I.Mech.E., A.M.I.A.E., A.M.I.E.E., A.M.I.C.E., etc. Exams. We alone guarantee "NO PASS—NO FEE." Courses in all branches. Write now—state subject or Exam. **BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY, 101, Shakespeare House, Leicester Square, London.**

YYY PEOPLE

buy from us on easy terms. COMPLETE SETS, LOUD SPEAKERS, COMPONENTS, Etc., supplied for all circuits, including the Mullard Master 3, Corsor Melody Maker, also the famous P.D.P. 3 Valve Set, complete with Loud Speaker. £13 15s.

EVERYTHING WIRELESS ON EASY PAYMENT TERMS
Call at our Show-rooms, or send list of requirements. Best monthly terms will be quoted by return.
THE P.D.P. COMPANY, LTD.,
121, Cheapside, London, E.C.2
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RESULTS PROVE!

**OVER-WHELMING
SUPERIORITY OF
NEGROLAC AERIAL**

Unprejudiced reports and experts' tests establish the following results:

25 % increase in volume of reception.
Selectivity improved beyond measure.
Distant stations hitherto unobtainable, brought in at loud speaker strength.
Constant tuning.
Immunity against acid and chemical laden atmosphere.
High insulation and protection against surface leakage.
Easier to handle than 7/22 Aerial Wire.
Will not kink.
From all leading Stores. REFUSE SUBSTITUTES.
PRICES: Coils of 50 ft., 9/-; 80 ft., 15/-; 100 ft., 18/-.

**LIGHTER NIGHTS NECESSITATE
THE USE OF A MORE EFFICIENT AERIAL—THE "NEGROLAC."**

EXTRACTS FROM LETTERS RECEIVED:

Mr. S. H. H.——
Timbrell Street, Trowbridge.
"Really, the results are simply marvellous, and all who have heard my set since putting the Aerial up think it splendid. I shall do all I can to introduce your 'NEGROLAC' Aerial to my friends down here."

Mr. W. R. G.——
Kippax Street, Hulme.
"The results, after replacing the old aerial with your Goltone 'NEGROLAC' Aerial were simply amazing."

Mr. A. H. B.——, New Barnet.
"I found the 'NEGROLAC' Aerial ideal. I think I have tried every kind of aerial marketed, but your 'NEGROLAC' easily beats all the others."


What users say!

Send now for sample, also pamphlet 'P.W.', giving extracts from technical reports and letters received.

"NEGROLAC" INDOOR AERIAL

Extraordinarily efficient.

Prices from..... **3/-**
Full particulars on request.



Ward & Goldstone
PERKLETON MANCHESTER



If you want to get the best out of your **MASTER THREE-**

Try these more selective coils. On the short wave-band they are guaranteed to bring in continental stations previously unheard. Terminal No. 3 has selective tapping on primary winding which considerably sharpens the tuning.

Obtainable through all good radio dealers.
FOREIGN STATIONS GUARANTEED

(Regd. Trade Mark)

LEWCO'S

Six pin Coils

The
LONDON ELECTRIC WIRE CO. & SMITHS, LTD.,
Playhouse Yard, Golden Lane, London, E.C.1

Sooner or later you will build, or want to build

THE SOLODYNE

Descriptions of this famous set, in three-valve form, were given in the APRIL DOUBLE NUMBER of

MODERN WIRELESS

and can still be obtained at any booksellers, price 1/6, including free Blue Print.
Many other special features, including a one-valve "Station-Getter" (H.F. Unit for any set), an A.C. Eliminator, etc., etc., etc.

MAKE SURE OF YOUR COPY NOW



FORMO

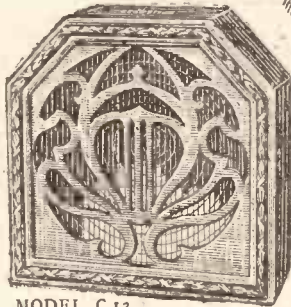
A MONUMENT IN THE MARCH OF PROGRESS.
The Formo Shrouded Transformer is the universal favourite.

10/6

Ratios 1-3 and 1-5

Send for Catalogue.
THE FORMO COMPANY,
CROWN WORKS, CRICKLEWOOD
N.W.2. Phone: Hamo 1787.

Do you know how
really good a
good loud
speaker
can be



MODEL C.12.

- Even response.
- Extreme Sensitivity.
- Adjustment.
Ability to produce weak as well as very heavy signals without readjustment.
- Improves with age.
- Distinctive appearance.

"POPULAR WIRELESS," dated 31/3/28, praises warmly:

"It is some time since we have experienced so much pleasure during a loud-speaker test, as we did when testing 'Celestion' Model C.12, and WE HAVE NO HESITATION IN SAYING THAT WE CONSIDER THIS 'CELESTION' A LONG WAY AHEAD OF ITS CLASS. Those of our readers who have the opportunity should endeavour to hear it in operation. We are sure they will agree with us when we say it is a revelation in what sound design and construction mean to such an instrument."

"P.W." 31.3.28.

Let your dealer convince you that "CELESTION," most excellent of loud-speakers, passes all these tests readily.

Write for illustrated folder and also for new Gramophone Pick-up leaflet.

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The Very Soul of Music

Write to Dept. B,
THE CELESTION RADIO CO.,
Hampton Wick, Kingston-on-Thames.

Showrooms: 33/35, VILLIERS ST., W.C.2. French Agents: CONSTABLE & CO., PARIS.

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 266.)

a .0001 mfd. or a neodyne condenser, will make a very great reduction in the total capacity and, consequently, will have a very much greater effect upon the wave-length setting of the condenser.

Just why condensers should behave like this when added together is too long a story to explain fully, but the effect that you have noticed is just one more proof of the rule that when two capacities are joined in series, the total capacity is less than that of the smaller separate capacity.

THE EFFECT OF H.F. ON QUALITY.

T. G. (Leicester).—"Why is it that the super-heterodyne has a bad reputation for quality when its low-frequency amplifying circuits are just the same as any other receivers?"

Any receiver which can cut out the local station within one or two degrees on the tuning dial is liable to get a bad reputation for quality, because, contrary to a common belief, there is a good deal of distortion in sharply-tuned high-frequency circuits. The effect of a circuit which is very sharply tuned is to gradually

"P.W." TECHNICAL QUERY DEPARTMENT

Is Your Set "Going Good" ?

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

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

Full details, including a revised scale of charges, can be obtained direct from the Technical Query Dept., "Popular Wireless," Fleetway House, Farringdon Street, London, E.C.4.

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

reduce or cut out the higher audible frequencies. This means that many instruments, the characteristic tone of which is due to frequencies of 6,000, 7,000, 8,000 or more, cycles, are not reproduced with fidelity and sound unnatural and distorted. For this reason ultra-sharp tuning is to be deprecated, for a set having such circuits cannot possibly give the same quality of reproduction as a set having circuits which are reasonably flat-tuned.

THE SOLDERING BUGBEAR.

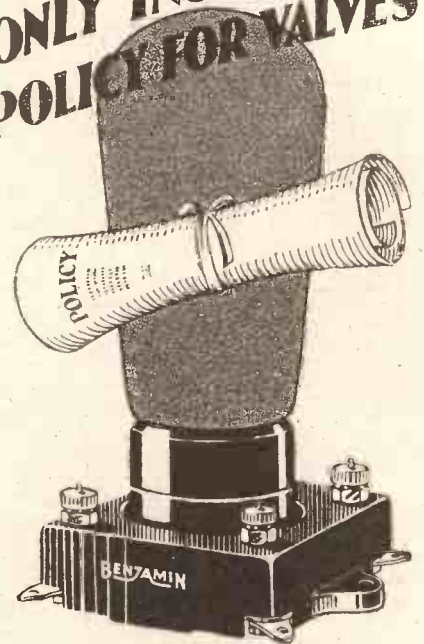
E. G. R. (Eastbourne).—"My trouble is soldering. I do not understand what happens when two metals are soldered together, and I certainly do not know how to do it, for every time I get an iron in my hand, sweat breaks out on my brow, and I have to have the kitchen to myself. What is the proper way to solder?"

The main idea behind soldering is to heat the surfaces which have to be soldered together sufficiently for solder to adhere to them. When they are thus warmed, solder is run across from one surface to another and, upon cooling, it sets as one mass, thereby joining the two surfaces together.

The great art is to keep clean both the iron itself and the working surfaces. First of all, the iron must be "tinned," which is done by heating it in a flame such as a gas jet, till it commences to burn with a green flame, then removing it, and filing it so that it is bright, and dipping it while still very hot into a little flux and a blob of solder in a tin lid. This coats

(Continued on next page.)

THE ONLY INSURANCE POLICY FOR VALVES



The BENJAMIN Valve-Holder!

The valve-holder that floats your valves on four super-sensitive, one-piece springs which effectively absorb every shock, every quiver of vibration. Prolong the life of valves, eliminate microphonic noises, and improve reception all round by fitting Benjamin in every stage. All radio dealers sell

BENJAMIN VALVE-HOLDERS

- (1) Valve sockets and springs are made in one piece with no joints or rivets to work loose and cause faulty connections.
- (2) Valves are free to float in every direction.
- (3) Valves can be inserted and removed easily and safely.
- (4) Valve legs cannot possibly foul the baseboard.
- (5) Both terminals and soldering tags are provided.

2/-



BENJAMIN ELECTRIC LTD.,
Brantwood Wks, Tariff Rd., Tottenham, N.17

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from previous page.)

the surface of the iron with a bright covering of solder, and then the iron is warmed again ready for business.

The two surfaces to be joined can thoroughly be cleaned until the bright metal shows, touched with a little flux, and then rubbed with the heated iron until the soldered coating appears on them also—in other words, until they are "tinned" also.

When both surfaces have been tinned, they are placed close together, the iron is heated until it burns with a green flame again, and then the iron is placed over the two surfaces so that it heats them *simultaneously* and equally. When hot enough, a blob of solder melted on the iron will immediately run on the two tinned surfaces, and these should be held perfectly steady until it solidifies, which it does a moment after the iron has been removed.

At this stage, and before the joint has had a chance to get too cool, wipe it over with a clean cloth so as to remove any traces of superfluous flux. The heat will have liquefied this and it can be removed easily and completely, but if it is left for a little while it will get cool, become greasy, and be exceedingly difficult to remove. If, however, the above hints are borne in mind, soldering will become a very easy and pleasurable occupation.

SET SPOILED BY NEW VALVE.

E. B. W. (Southend-on-Sea).—"My friend had an old three-valve set (H.F., Det., L.F.), built on a sloping panel, as was the fashion a year or so ago. It worked pretty well, but hardly strong enough to be really pleasant, so in the end I persuaded him to get some new valves in place of the old ones which he had been using for years.

"What I cannot understand is this. With the old valves the set is not very strong, but it is moderately clear and worth listening to. As soon as the new valves are plugged in it becomes very much louder, but harsh and distorted—in other words, the new valves seem to spoil the effect completely! Why is that?"

The probability is that with a set of this old-fashioned type the wiring of the grid leads is unnecessarily long and there is a certain amount of feed-back between plate and grid leads—i.e. internal reaction.

In a set using old-fashioned valves, the magnification factor (in the valve itself) is not very high, and such internal reaction evidently was not producing much bad effect. In fact, it was probably making the set a good deal more sensitive than it would otherwise have been, without bringing it too near to the oscillation point. But when more up-to-date and efficient valves were inserted, the feed-back effect of the inter-stage wiring was emphasised. In other words, the internal-reaction effect became excessive, and the results showed the usual distortion, etc., that is associated with too much reaction.

To overcome this and to retain the efficient new valves, you will need to overhaul the wiring and modernise this, too; probably all that is necessary is to respace (and, if possible, to *shorten*) the grid leads, making sure that they do not run close to or parallel with any of the plate-leads.

WATCH YOUR WIRING!

T. L. S. (Twickenham).—"Is the wiring of a set very important? I am often puzzled to account for the great difference in results which friends get even when using the same type of set, and I have come to the conclusion that a great deal of the difference is due to differences in the wiring. Does it actually make much difference, and if so, how?"

Apart from the actual efficiency of the joints a great deal depends upon the spacing of the wiring, especially in valve sets. Wires which run close together and parallel to each other cause instability and oscillation in a valve set, particularly in a high-frequency circuit.

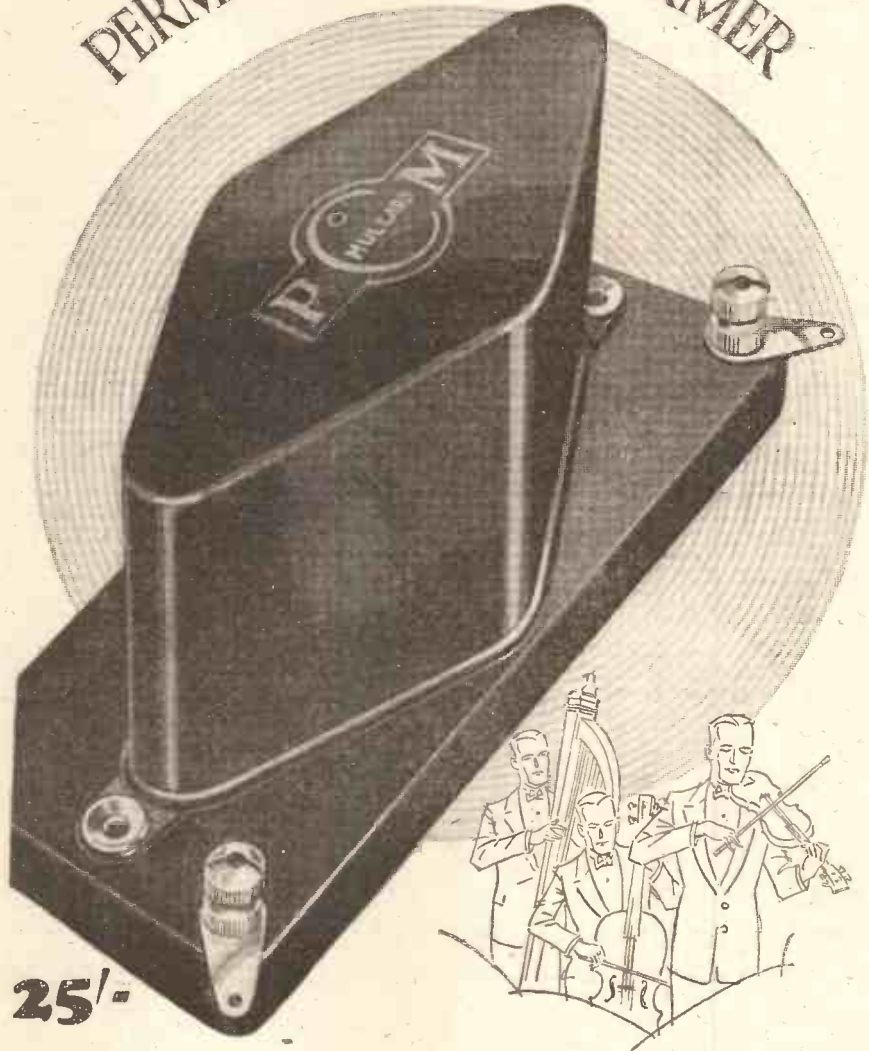
Very often a tendency to howl or a liability to become unstable without apparent cause is due to the fact that the grid wires of a set are placed too near the plate wires, resulting in a feed-back which a loud signal or casual adjustment may spill over into oscillation.

All grid wires, therefore, should be as short as possible and should be well spaced from the rest of the wiring of a set. Even in a crystal set bad wiring is harmful, and loss of strength often results when wires run parallel or too close together.

Apart from actual working efficiency there is yet another reason in favour of well spaced wiring in a valve set, for if insufficient spacing is allowed between

(Continued on next page.)

The MULLARD PERMACORE TRANSFORMER



25/-

No resonant peaks to give unnatural reproduction

The new Mullard "Permacore" Transformer is based upon absolutely revolutionary principles which give these outstanding features.

Small in size; large in amplification. High flux density without saturation.

All shrillness eliminated.

Gives life to every note.

Silver primary, nickel secondary: windings that will not deteriorate.

NO RESONANT PEAK.—The windings of the Mullard Transformer have been so selected that no resonant peak occurs at about 8,000—10,000 cycles as is usually the case. The primary is wound with silver, the secondary with nickel, causing the elimination of resonant peaks.

The iron in the Mullard Permacore allows the use of a high flux density in a circuit of exceedingly small dimensions.

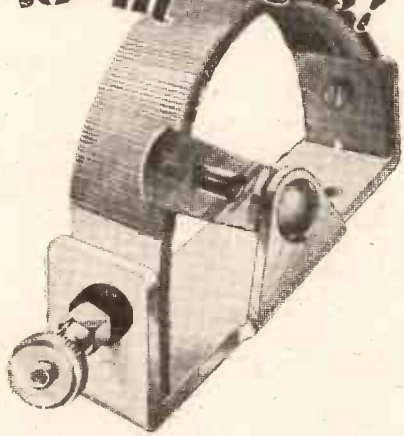
This new wonder Mullard Transformer is the finest L.F. Transformer ever produced.

OBTAINABLE FROM ALL RADIO DEALERS.

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**Standing
room only!**



Your baseboard may be crowded. But there's room for the "Peerless Varistor." It stands up, prominent, easy to get at, but clear of complicated wiring.

Wound with finest quality resistance wire and fitted with a Phosphor-bronze adjustable arm that, once set to the resistance for your valves, stays set.

Terminals are fitted in convenient positions. Five different styles—3, 6, 10, 15 and 20 ohms.

From all good dealers or direct.

Then fit
**PEERLESS
VARISTOR**

THE
**BEDFORD ELECTRICAL
& RADIO CO., LIMITED**
22 Campbell Rd., Bedford.

LONDON: 21 Bartlett's Bldgs.,
Holborn Circus, E.C.4.

GLASGOW: 113 St. Vincent
Street, C.2.

1/3

**RADIOTORIAL
QUESTIONS AND ANSWERS**

(Continued from previous page.)

the wires, some slight vibration or accidental bending may allow two of them to touch. This, of course, may result in all sorts of "fireworks," as such an accident is likely to short one of the batteries, or else to cause one or more of the valves to burn out.

THE "PROGRESSIVE" FOUR.

R. N. (Camden Town, London, N.W.).—"I built the 'Progressive' Four two months ago and cannot speak well enough of it. It is the 'real goods' at last, after about thirty other circuits.

"Last night I received no less than 40 stations on L.S. in 20 minutes, i.e. two a minute, all, except one, clear of 2 I.O. And this with only three valves, the H.F. being cut out of circuit.

"Three of my friends, having built this circuit, declare it is the loudest and purest they have heard, it leaving nothing to be desired on London, Daventry and several Continentals.

"In spite of these excellent results I still have one 'grouch' against it, namely, reaction bursts in too suddenly at one point, and the dial always has to be taken over that point (a soft plop), and slightly back, so as to obtain best results for distance. All my friends' sets are the same. Is this a peculiarity of this circuit? The fault remains whether H.F. valve is in circuit or out. Neither grid-leak values, copper screening, H.T. voltage or varying the reaction tapping has any effect upon this sudden 'plop.' It appears that only about five degrees control reaction. Before those five degrees no effect is obtained, and after, only a gradually increasing whistle (oscillation)."

A Cure For Overlap.

Dealing with the points in your letter in the order in which they arrive, we must first of all congratulate you on having found the real goods! To be able to pick up forty stations on the loud speaker in twenty minutes is a feat that many a wireless engineer using an "expense-no-object" set has never accomplished.

And that you should be able to do this in Camden Town, and yet find only one station that interferes with London, fairly takes our breath away. The more we think of it the more amazed we are that any man who can get two stations a minute for twenty minutes straight off should have it in his heart to have one grouch left about the set!

Speaking frankly, if we had a three-valve set that would do this we should not dream of altering it, and indeed, we should allow nobody within ten yards of it! A set like that does not want improving so much as appreciating. (There are spots on the sun, you know!)

However, if you and your friends are determined to tackle this soft plop that you talk about, you need not fear that it is a peculiarity of this circuit. It is quite a well-known fault, and it can nearly always be cured by altering the reaction tapping, and by trying different grid leak values.

We notice that you mention both of these, but we do not think you can have tried them thoroughly, for it is very-very seldom indeed that trouble of this kind does not succumb to such treatment, especially if the filament voltage is critically adjusted at the same time.

Despite the fact that you had no luck before when you tried this, we should certainly try it again, trying both high and low voltages on the H.T. with grid leaks up to three megohms, and down to say, a half or 25 megohm. If, at the same time, you can vary the capacity of the grid condenser by adding another condenser fixed in parallel or in series with it, we feel sure that you will overcome the tendency to "plopping," as it is only in very stubborn cases that a variation in the capacity of the grid condenser is necessary. Generally the H.T. and the grid-leak values will, of themselves, cure the trouble. In the original "Progressive" Set, the reaction control was singularly sweet and free from "overlap," which is the usual name for the fault you describe.

TROUBLE WITH THE "HANDYMAN."

W. K. (Bishop's Stortford).—"I made up the 'Handyman.' But instead of being the Handyman, I think it is the postman. For all it does is to knock, knock, knock! This knocking is regular (about three to the second), so that what I want to know is 'How can I turn my postman into a "Handyman"?'"

Almost invariably trouble of this kind is due to the use of a grid leak of unsuitable value, and we think that if you replace this component with one of correct value, the set will begin a "delivery" of which even the P.M.G. would be proud!

**Send your valve
troubles to us for
solution**

We will solve them for you free. Our new wonder "Beriton" process guarantees you matched valves whether your set is a 2-valve or a super-het.

6/6 R.C.
H.F.
and L.F.
9/-POWER.



POST FREE

Beriton valves reflect rare satisfaction.

Beriton

BERITON, LTD. (Dept. P.),
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LONDON, E.C.1.

THE LITTLE CELLS THAT SATISFY.

Eton Primary H.T. Battery P.I. Porous Pot Cells, S1 and S2 Sac Cells. All complete.

	1-cell	6-cell	12-cell	30-cell
P.I.	6d. .. 3/3	.. 5/9	.. 14/-	
S.1	6d. .. 3/-	.. 5/3	.. 12/-	
S.2	4d. .. 2/6	.. 3/10	.. 9/6	

Send 1d. stamp for booklet giving full particulars to:—

THE ETON GLASS BATTERY CO.
46, St. Mary's Road, LEYTON, E.10

PLEASE be sure to mention
"POPULAR WIRELESS"
when communicating with
Advertisers.

THANKS!

WET H.T. BATTERIES
Solve all H.T. Troubles.
SELF-CHARGING, SILENT, ECONOMICAL.
JARS (waxed) 2 1/2" x 1 1/2" at 1/3 doz.
ZINCOR, new type 1 1/2 doz. SACS 1/2 doz.
Sample doz. (18 volts), complete with
bands and electrolyte, 4/3, post 9d
Sample unit 6d. 16-page booklet free.
Bargain list free.
AMPLIFIERS 1-VALVE 19/- 2-VALVE 30/-
2-VALVE ALL-STATION SET 24/-
P. TAYLOR, 57, Studley Road,
STOCKWELL, LONDON.

**EVERYTHING
EASY TERMS ON
RADIO**
WOOLDRIDGE RADIO CO. LTD.
1, LISLE ST, LEICESTER SQUARE
LONDON, W.C.1.

NEWS FROM SAVOY HILL.
(Continued from page 250.)

told a long-suffering and anxious public that the only change contemplated was less talk and more light entertainment. But the influence of the uplifters was too strong. A mild compromise has been suggested—one which undoubtedly contemplates an extension of the proportion of programme time devoted to the eternal "talks."

The Hard Case of Scotland.

Scotland appears to be the worst sufferer from the present obsolete system of radio distribution in this country. Captain Eckersley encountered much difficulty and some hostility during his recent "Midlothian campaign," but his superb platform technique and obvious sincerity about the Regional Scheme quelled the rising storm.

But there was one significant by-product. Two Scottish Members of Parliament asked the P.M.G. whether his sanction was the only thing that stood in the way of the early provision of a high-power station for Scotland. The reply was that the B.B.C. had made no application for a new high-power station for Scotland. While this answer may have been technically and severely accurate, its implications were calculated to discredit the B.B.C. and to put them into an entirely false light.

Savoy Hill has been seeking sanction for its Regional Scheme ever since this was approved by the Eccles Committee nine months ago. The Regional Scheme includes a high-power twin-wave-length transmitter for Scotland; but the scheme stands or falls as a whole, not in segments as suggested by the P.M.G. If the Regional Scheme is delayed any longer, the growing indignation of listeners will have far-reaching consequences, from which the political field will not be immune. It is expected that both Labour and Liberal Parties will not be reluctant to challenge the Government on the policy of procrastination in broadcasting development which is driving another nail into the coffin of the present Post Office administration.

The Need for Research.

The B.B.C. appears still to be unable to give any satisfactory account of what it is doing about programme research. So far as can be gleaned, the only "Development Section" at Savoy Hill is in the Engineering Department, and has to do only with technical experiments. What of the whole vast field of programme research? It is almost unthinkable that this is not being properly attacked. The disease is false economy and failure to assess intangible values at their right level.

In proportion to the amount of money at present available for programmes, £20,000 a year would not be an excessive allotment to research. Experimenting should not be done in the haphazard incidental manner; it requires as specialised and scientific treatment as can be secured anywhere.

Dale Smith's Success.

Among the many artistes whose reputations have been established and enhanced by broadcasting is Dale Smith, who to-day is easily one of the most pleasing and efficient performers before the microphone.

Silent Working

Many a good loud speaker has been condemned because it emitted weird noises that were solely the fault of inferior H.T. Batteries.

SURE-A-LITE Batteries give a service that is definitely better than that of any other make. **SURE-A-LITE** cells are larger, they last longer, they maintain their voltage better. **SURE-A-LITE** Batteries work in silence.

Each battery is sealed with a guarantee of perfect condition when you buy it.

SURE-A-LITE

BRINGS MOST IN — GIVES MOST OUT

REGISTERED TRADE MARK

"Supra"	66-volt	7/11
	108-volt	14/3
"Giant"	66-volt	10/6
	108-volt	17/6

Grid Bias. Each 66-volt battery tapped every 14 volts up to 6 volts. Each 108-volt battery tapped every 14 volts up to 9 volts.

Wholesale Stockists.
Irish Free State: J. P. Digby & Partner, Corn Exchange, Dublin
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The better battery

The Battery Co.,
92, Hurst Street,
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CONDENSERS of QUALITY!

No mass production methods are employed in the manufacture of Camden Condensers. Every Condenser is stamped with a Serial No., and accompanied with a guarantee of 6 months' real service. Telegrams: KAMELCO, Telephone: Runcorn 109. Send for list and prices to Camden Electrical Co., Stanley Chambers, Runcorn.

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REPAIRS
Any make of L.F. Transformer, Loudspeaker or headphones repaired and despatched within 48 HOURS—TWELVE MONTHS' GUARANTEE with each repair. 4/- Post free. Terms to Trade.
TRANSFORMER REPAIR CO.,
"Repairs" Dept.
214, High Street, Colliers Wood, London, S.W.19.

D-XELLENT! DX IN-PLUG COILS

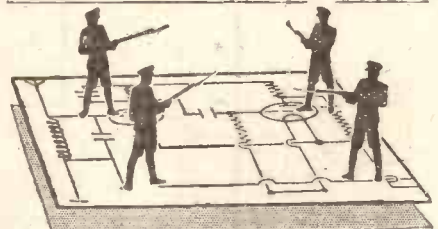
From No. 25 1/- to No. 500 4/-

DX SHORT-WAVE SET
4 Coils Nos. 3, 5, 7, 9 .. 7/6

"P.W." Test Report, March 10:—"The fact that one of the first stations tuned in was 3 L O of Australia is ample proof that the coils are efficient."

If unable to obtain send P.O. 7/6.
DX COILS LTD., LONDON, E. 2.

HEADPHONES REPAIRED 4/-
Transformers 5/- Loudspeakers 4/- All repairs remagnetised free. Tested, guaranteed and ready for delivery in 24 hours.
Discount for Trade. Clerkennell 1795.
MASON & CO., 44, East Rd., City Rd., N. 1.



PROTECTION!
Guard against the danger of burnt-out valves and costly repairs to over-discharged batteries. Fit a Sifam Meter and obtain that vital accuracy of control without which faultless reception is impossible. Free leaflet "Distortion" from **SIFAM LTD., (Dept. A), 10a, Page Street, Westminster, S.W.1** M.B.

ALL APPLICATIONS FOR ADVERTISING SPACE IN "POPULAR WIRELESS" MUST BE MADE TO THE SOLE ADVERTISING AGENTS, JOHN H. LILE, LTD., 4, LUDGATE CIRCUS, LONDON, E.C.4.

TECHNICAL NOTES.

(Continued from page 250.)

It has been stated that the cardinal principle in volume control is to begin as "early" as possible in the receiving circuit. In other words, the nearer the control is placed to the aerial end of the circuit the better the results and the simpler the control and, conversely, the nearer to the reproducing end the more energy must be handled by the volume control.

Perhaps the simplest volume control is a variable high resistance in the aerial lead, which serves to cut down the incoming signal energy, and is of real value especially in the reception of powerful local stations. Alternatively, a variable high resistance may be shunted across the aerial-and-earth terminals of the set; this resistance should have a value up to several megohms.

Threshold Control.

If the energy is not controlled on the threshold of the circuit, the next best thing is to control it as soon as possible in the high-frequency stages. Here one method is to introduce a resistance—up to $\frac{1}{2}$ megohm—in the positive H.T. lead so as to control the plate current of the high-frequency valves; but this method I do not recommend particularly, as it is liable to introduce distortion.

On the other hand, with a volume control in the plate circuit of the H.F. valves it is possible to use a somewhat higher value of H.T.—with some stabilising method—and then to operate the receiver right up to the verge of oscillation as well as right down to quite a low efficiency.

With a circuit employing ordinary reaction the volume control is obvious, whilst an additional method is to shunt a variable resistance across the terminals of the reaction coil—this resistance being, of course, of the non-inductive type.

The set may be tuned with the variable resistor serving to by-pass more or less of the energy in the reaction coil, and so to get down below the oscillation point with precision. This is a well-known method of controlling reaction and volume, especially in critical short-wave receivers.

Eliminator Care.

I have received several questions with regard to the operation and care of battery eliminators, one question which has occurred several times relating to the peak voltages developed in the smoothing condensers when the H.T. unit is switched on or off. The point is that if the unit is in operation, and the set is then switched off, an extra load is thrown on the condensers in the unit, and this may perhaps damage them. This danger is avoided by switching off the eliminator unit before switching off the set. If the set is switched off first and the unit is running without any load, the full peak voltage is developed across the condenser terminals, whilst at the moment that the unit is switched off—in these conditions—the voltage may for an instant rise to a very high value, especially where high-value chokes are used. If this instantaneous voltage should be very much higher than that for which the condensers are rated for normal working, or even for possible overload, the condensers may be broken down.

A Safeguard.

If a high resistance, however, is connected across the output terminals of the unit, it is impossible for these very sudden peak voltages to be developed, since the high resistance allows the charge to leak away and the condensers are, therefore, protected from the effect mentioned. If this high resistance is used across the output terminals, it does not matter whether the unit is switched off before or after the set is switched off, but in the absence of this precaution it is best to switch on the unit after the set and to switch off the unit before the set. Incidentally, the danger just discussed arises with supply units which have resistances for the purpose of obtaining intermediate voltages.

Repairing Cabinets.

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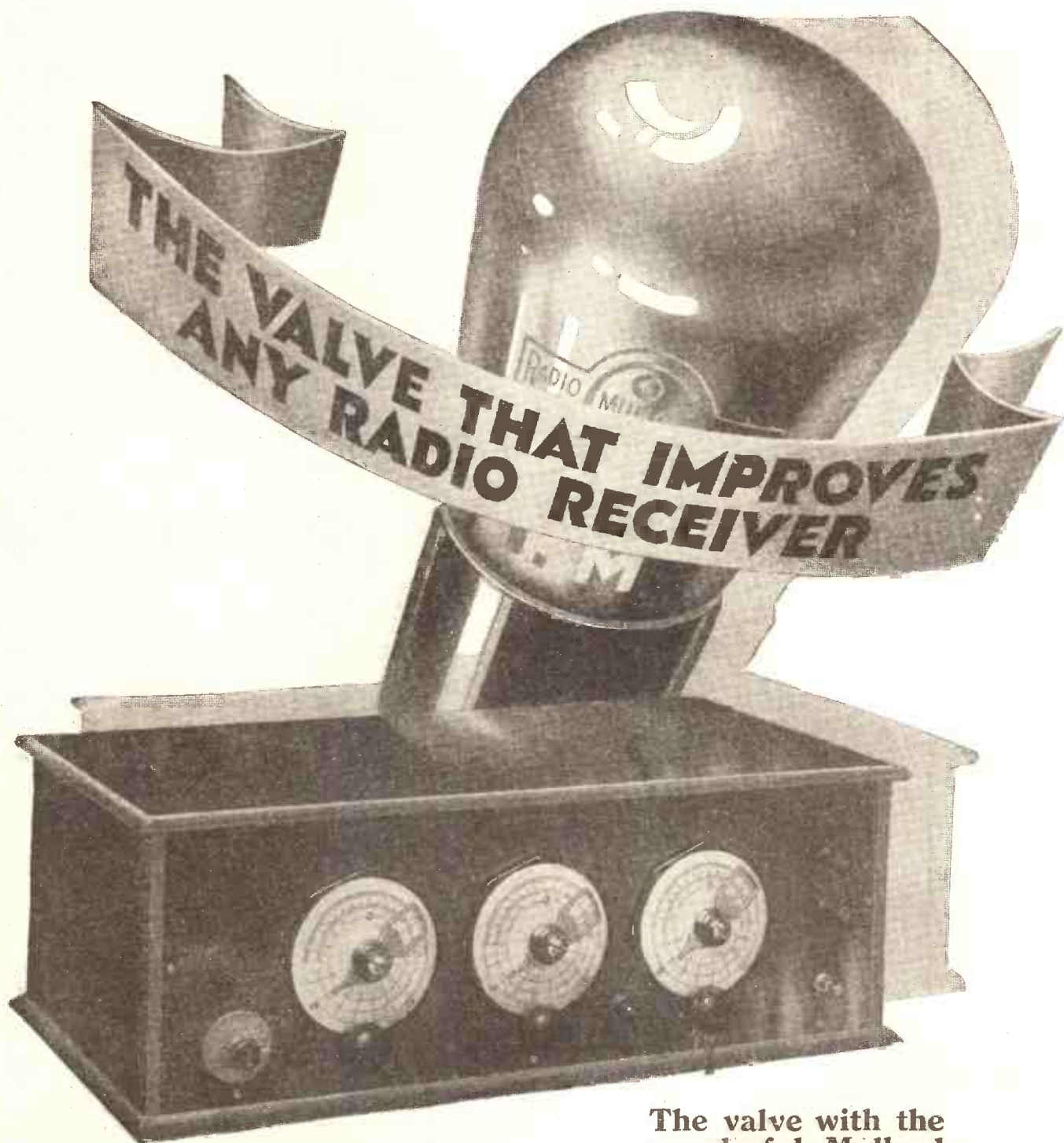
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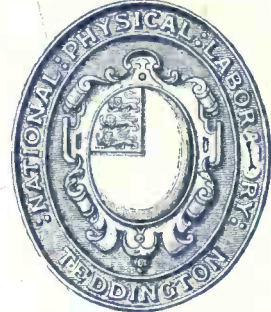


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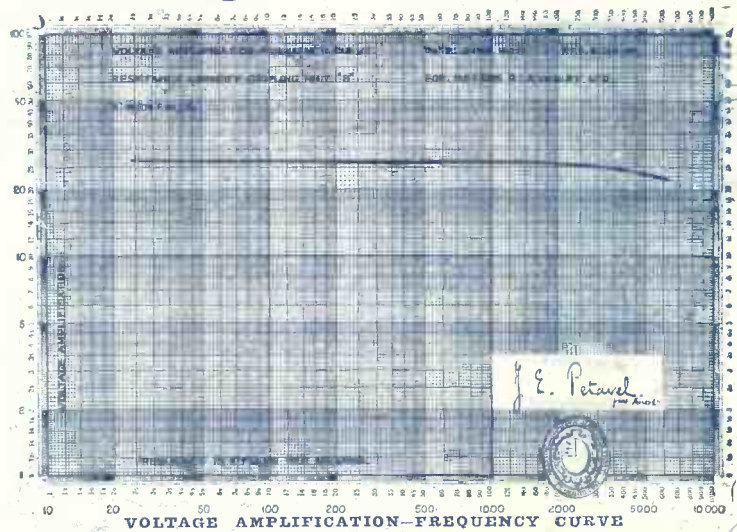


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