

The Wireless ^{6d} Constructor

Vol. XVI.

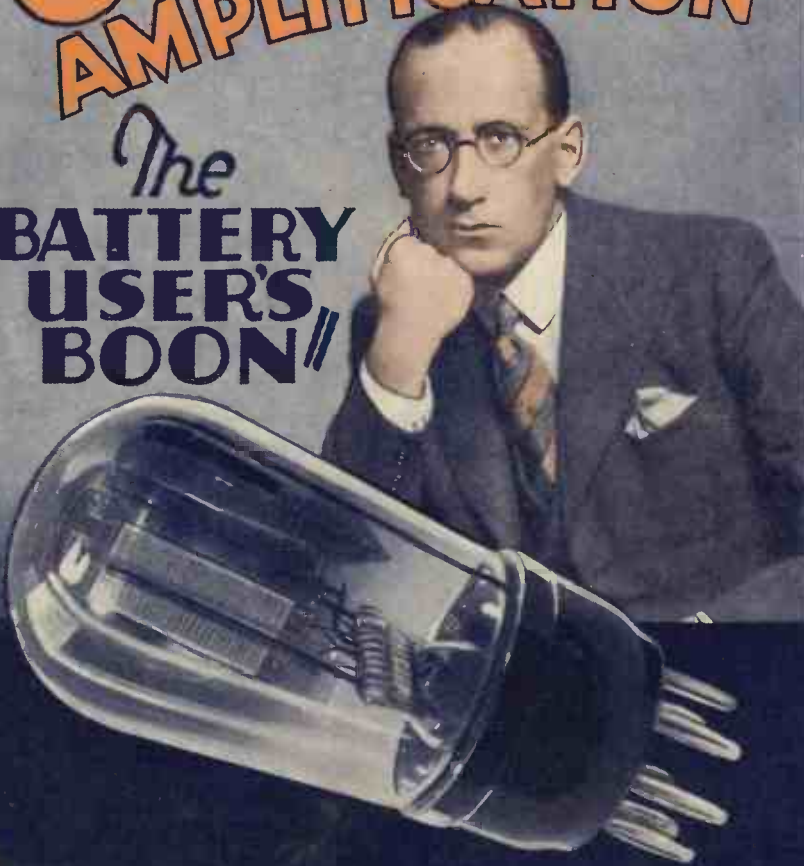
JUNE, 1933.

No. 80.

John Scott-Taggart

**"ON
CLASS B"
AMPLIFICATION**

The
**"BATTERY
USER'S
BOON"**



THE
WESTECTOR

"COLD VALVE"

and

**"CLASS B"
AMPLIFICATION**

are embodied in

THE
"BESTECTOR"

A MAGNIFICENT SUPERHET
DESIGN FULLY DESCRIBED
THIS MONTH.

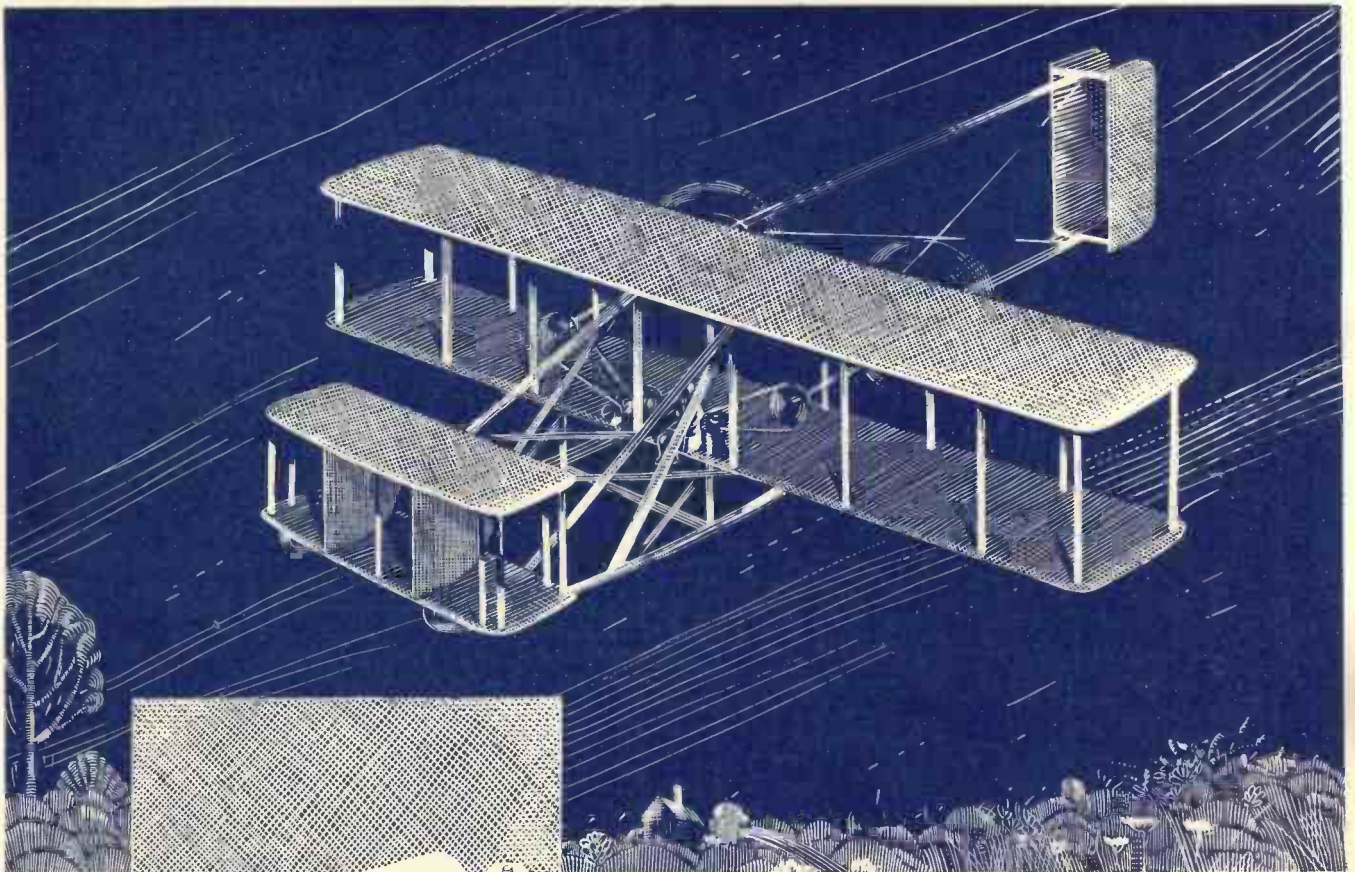
ALSO INSIDE:

VICTOR KING discusses
SOME CONTROVERSIAL
COMPONENT QUERIES

"S.T." contributes
QUESTIONS I AM ASKED
etc., etc.

ORVILLE and WILBUR WRIGHT

30 years ago, Orville and Wilbur Wright made the first flight by Man in a "heavier than air" machine. Their triumph was the beginning of Man's conquest of the air. The whole history of aviation is an epic of sacrifice and triumph. Its tremendous advance is an example of what can be achieved by men who have faith in their beliefs and confidence in themselves. The advance of aviation is similar to the progress made by Dobilier over their 21 years of trading. Starting in a small way, unheralded and hardly known, they have, through sheer determination and perseverance, brought their products to a standard of efficiency and reliability that is the envy and admiration of the whole industry.



T.9.
DUBILIER
 CONDENSERS

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As some of the arrangements and specialties described in this Journal may be the subject of Letters Patent the amateur and trader would be well advised to obtain permission of the patentees to use the patents before doing so.

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THE *BEST* DETECTOR

exclusively specified
for the
"B'ESTECTOR SUPER"

The introduction of the new WESTECTOR enables the rectification of radio-frequency currents to be obtained by the use of a robust unit, which needs no anode or filament current, and which has a distortionless output. The "Wireless Constructor" has taken advantage of these properties in presenting to you the "B'estector Super." This fine receiver incorporates a type W.4 WESTECTOR, thereby ensuring permanent and efficient detection.

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HIGH FREQUENCY
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COSSOR 240B

—the new valve
for

CLASS "B" AMPLIFICATION

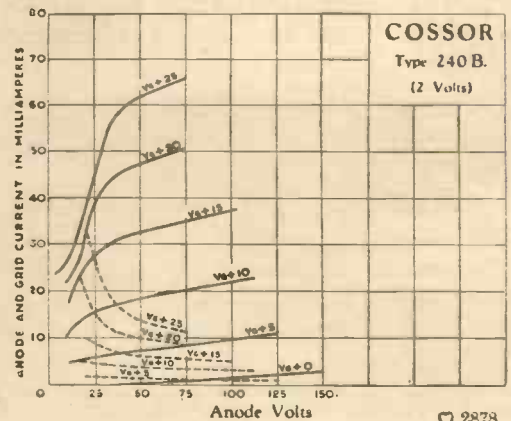
Filament volts 2.0. Filament amps 0.4;
Anode volts 150 max.; Max Anode
Current Swing 50 mA.; Max. Peak
Applied Signal (Grid to Grid) 40 volts;
Static Anode Current at
 $V_a=100$. $V_g=0$ (each half) 1.5 mA. Price **14/6**

Full instructions for the use of this remarkable
new valve, including circuit diagrams will
be supplied on application to our Technical
Service Department.



Volume equal to that of the average Mains Receiver is now obtainable from Battery Sets with this new Cossor Valve, and with this remarkable output, the H.T. Current demand of the Cossor 240 B. is lower than that of a small power valve. Thus, a really large output is obtainable without in any way over-stressing the average H.T. Dry Battery.

Anode and Grid Current/
Anode volts curves of
Cossor Class "B" Valve
Type 240 B.



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2878

The WIRELESS CONSTRUCTOR

The EDITOR'S CHAT

The "Bestector Super"—"S.T." on "Class B"—Controversial Queries—New B.B.C. Station—The World's Hobby.

OUR outstanding set design for June is the "Bestector Super"—a highly efficient super-heterodyne circuit for battery valves, incorporating two of the very latest developments in radio, viz.: the Westector and "Class B" amplification.

The Westector is employed as the second detector, thereby effecting economy both in H.T. and L.T. current consumption.

The "Class B" output stage provides "mains volume" with a remarkably low H.T. current consumption. For average volume it is only about 15 milliamps. total for the whole set.

Also in this issue you will find a striking article on "Class B" amplification from the pen of John Scott-Taggart. Our distinguished contributor deals with the advantages of the method, and points out that, so long as 15 years ago, he himself was alive to the possibilities of this principle.

Mr. Scott-Taggart, in addition, contributes his popular "Armchair Notes" feature; while Victor King, in his usual inimitable manner, deals with "Some Controversial Component Queries."

Test Transmissions

The new West Regional transmitter at Washford Cross, near Watchet, in Somerset, is now complete. Preliminary tests have been carried out, and the performance of the transmitter has proved entirely satisfactory.

A series of test transmissions, intended for reception by the public, began on April 24th. These trans-

missions will continue daily (except Sundays) until further notice on a wavelength of 309.9 metres (968 kcs.).

We urge our West Regional readers to take the opportunity during these reception test transmissions to make sure that they can obtain satisfactory reception from the new station. A pamphlet entitled "Receiving the West Regional Transmitter" has been prepared for the assistance of those who may experience difficulty in re-

ceive the rather astonishing fact that there are to-day over 40,000,000 wireless sets in use in the world. And it is quite likely the figure given is a very conservative one, for in any case over 37,000,000 official returns have been made by listeners in countries where a licence system is in force.

France, Spain, and several South American states have no licensing system, and so a guess is made at the number of sets in use. The "guess" works out at 3,000,000—but it's probably a bad guess. Plus "pirates," in those countries where there is a licensing system, the figure is probably nearer five or six million.

SING-SING RADIO



Each cell in the famous Sing-Sing Prison, New York, is fitted with a writing table, soft bed and headphones, the latter being supplied with programmes from the favourite stations at certain hours daily.

ceiving the new station satisfactorily. Copies can be obtained free of charge from local B.B.C. offices, or will be sent post-free on receipt of a postcard, marked with the letter "W" in the top left-hand corner, and addressed to the Chief Engineer, B.B.C., Broadcasting House, London, W.1.

The World's Hobby

Statistics collected and analysed by the International Broadcasting Union

Top of the List

Assuming that there is an average of four listeners per set, it can be easily seen how vast is the world's listening public—160,000,000.

Curiously enough, Denmark takes first prize as the most "radio-minded" country in the world, with 140 sets per thousand population. In Great Britain the proportion of sets to population increased from 92.44 to 117.5 per thousand during the last year.

As might be expected, the figures for the United States do not lag far behind Denmark's record. Actually America occupies the second position in the list, having 138.34 radio sets per thousand of her population.

This represents an increase of 2.49 per thousand over the figure of 135.85 quoted for last year.

Some instructive facts about

HANDLING MAINS UNITS

By
J. R. WHEATLEY.

with special reference to the mounting of home-made units and vacuum lamp trickle chargers.

A MAINS unit capable of delivering high voltages at high current is reasonably easy to construct, since suitable components are readily obtainable. It must be borne in mind, however, that such a unit must be handled with great care, and it is really not a sufficient safeguard to assume that because it is packed away in the interior of a set, or in some remote corner, that precautions need not be taken against shock and dissipation of heat.

Precautionary Measures

For this reason the unit should not only be mounted in a metal box, but the baseboard and the panel, if a panel is employed, should preferably be of fireproof material.

It must not be forgotten that, although adequate fuses may be incorporated, a mains unit always generates a certain amount of heat. It is suggested that in a unit of the "power" class, a teak baseboard may be employed with a panel of either bakelite or Paxolin. Teak is one of the very few woods which is practically non-inflammable, and the panel materials mentioned do not easily burn, nor are they affected by reasonably high temperatures.

Avoiding Shocks

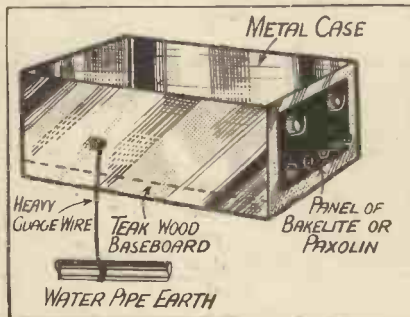
When a mains unit is mounted, as it should always be, in a metal case, never omit to connect the earth terminal on the case to earth by means of a piece of wire of substantial gauge. If this is not done, in the event of an

internal short between the high potential side of the eliminator and the case, the case may develop a voltage several hundreds of volts above earth potential and would probably result in a nasty shock being received if the case were touched.

Preventing Burns

In the case of an L.T. eliminator or an L.T. trickle charger, in which high-wattage vacuum lamps are used, mounting this as a whole in a plain metal box is usually inadvisable, since the metal covering would soon reach

AS IT SHOULD BE

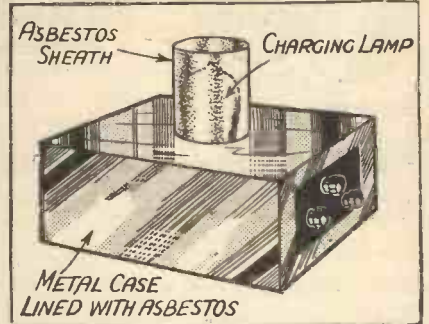


Don't forget, when housing a mains unit in a metal case, to earth the case itself. Failure to do this may result, in the event of an internal short, in a nasty shock when the case is touched. Heavy gauge wire should be used for the earth connection.

a temperature sufficiently high from the heat radiated from the lamp to cause a nasty burn.

In the case, therefore, of a unit or trickle charger of this type, it is suggested that the metal box either be

lined with asbestos and a hole cut so that the top of the lamp, or lamps, project through it; or, as an alternative, the lamp be mounted externally and a cylindrical roll of asbestos placed round the lamp to prevent heat radiated from the lamp scorching near-by objects, and also to prevent burns from the lamp itself.



In cases where a trickle charger with a high-wattage vacuum lamp is used, the case should be lined with asbestos to protect it from excessive heat. A sheath of asbestos round the lamp itself is also a protection against burns.

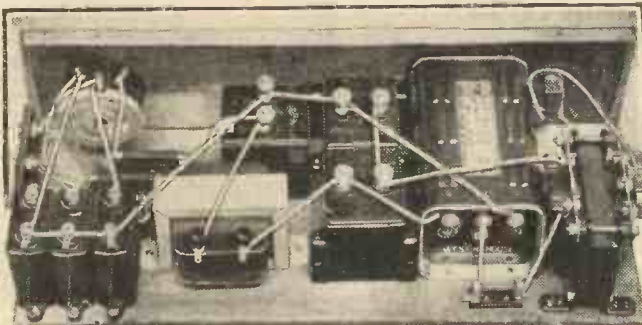
* **DRILLING PROBLEMS** *
* Urging the necessity for keeping *
* your drills up to the mark for *
* neat work. *

BLUNT drills are responsible for more bad and untidy constructional work than any other tools. The drill whose point is not what it was is always liable to slip out of the centre-punch mark and to skid over the work, with most unsightly results.

Supposing that you are lucky and that it starts as it should, the odds are that it will tear its way out on the underside, making an unpleasant-looking mess on the back of a panel or terminal strip. Keep your drills up to the mark if you want to turn out neat work.

An Oval Hole

Another evil thing about the dull drill is that when you use it for making holes in ebonite its failure to cut properly makes you turn the crank of your hand-drill at far too high a speed. This has two unfortunate results. In the first place, you heat up both the ebonite and the drill to far too high a temperature. Secondly, when you are cranking fast it is most difficult to avoid wobbling, with the result that the hole when made is too often oval rather than round. And if you want to make a real mess of things, try drilling a thin plywood panel with a drill that has lost its keenness! R. W. H.



A TYPICAL UNIT

This photograph illustrates a typical home-constructor's mains unit using metal rectification. Note how the condensers are arranged on the baseboard.

CLASS "B" AMPLIFICATION

by JOHN SCOTT-TAGGART
A.M.I.E.E., F. INST. P.

Hot on the tracks of Q.P.P. comes puffing another H.T. economiser. It is a little out of breath because after a couple of years in the United States it has suddenly decided to sprint across the Atlantic to startle us with its merits.

The new invader is provided with a passport describing it as "Class B" amplification—an annoying and meaningless description of a spectacular blessing.

Following On

Probably I have kept in as close touch with American progress as has anyone in this country, and the more I think of the last ten years the more I feel we are merely treading in the footprints of our creditor cousins instead of blazing the trail ourselves.

It is all very well to pride ourselves on our stability, but our inertia and lack of inventive enterprise are becoming painfully obtrusive at uncomfortable frequent intervals.

Nor are we bold enough to bridge the gap of months or years which nearly always cleaves the old world from the new. We seem to wait for America to "try it on the dog"—and the dog has certainly thrived on its richly progressive diet.

"Class B" amplification is a case in point. Having seen the development of the scheme in the States, we belatedly decide to produce the valves and transformers for a public which contains a much larger percentage of battery users.

Senseless Delay

The delay seems senseless to me. Perhaps I am constitutionally impatient. But it appears so unnecessary to lag behind the U.S.A. If we are going to copy American technique, let us do so quickly and not stagger along on foot behind the progressive chariot of Uncle Sam.

Having unburdened myself of these unpatriotic sentiments, let me express some satisfaction that we have not delayed "Class B" amplification so as to give Q.P.P. a run. A big manufacturer (both he and his business are outsize) shook his head sadly and critically when in my company the other day. He grumbled, "Great mistake. Great mistake bringing out

too keen to switch over to new technique. This, however, is partly due to lack of real leadership on the part of designers and partly to the excessive price of new gear which tends to throttle at birth any developments. As soon as time and competition have pruned prices, radio technique alters and prices tend to rise again!

The Method in Outline

Let us hope the valve fashioners and transformer coilers let us down gently in the present instance.

"Class B" amplification is certainly a boon of boons and its popularity is safe to predict. In its broad outlines it resembles Q.P.P. amplification. Two three-electrode valves (separate or combined in one bulb) are used at the "bottom bend" in push-push.

A split secondary transformer feeds the two grids so that each valve amplifies one half-cycle, the valves operating in turn. Their output circuits are combined to act upon a loudspeaker via a push-push transformer. The diagram shows the general circuitual arrangement.

Effect of Grid Current

So far, "Class B" resembles Q.P.P. But now watch for the difference. Q.P.P. operates with a negative potential on the grids and the grid volts must never become positive. Every reader must know that we give the grid negative bias because otherwise the grid would become positive and electrons would be drawn to the grid and form a grid current which would damp down the potentials we are trying to place on the grid. In fact, the grid current would act almost as a short-circuit and there would be loss of signal strength and distortion.

Valve makers supply curves which show merely what

"The battery-user's boon" is how our contributor describes this development which enables five or ten times the output to be obtained from a battery-driven set.

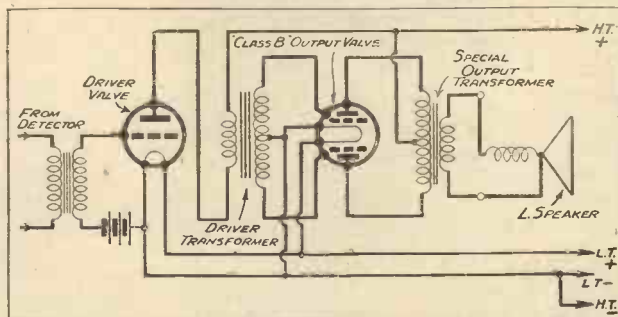
The author incidentally discloses his conception and publication of the quiescent principle of amplification nearly fifteen years ago.

this 'Class B' so soon after Q.P.P. Should have kept Q.P.P. going for at least a year."

Of course, you and I and everybody else feel rather as though we had purchased a young dog in showing any interest at all in Q.P.P. We should have cried "Show me the other hand"—and we should have found there "Class B" amplification.

But, of course, whatever we know, we are entirely, at the mercy of the valve contrivers and component-makers. And you constructors are not

APPLYING THE PRINCIPLE



This diagram illustrates the general circuit arrangement of "Class B" amplification, and shows how the split secondary of the driver transformer feeds the two grids of the "Class B" output so that each valve amplifies one half-cycle. The combined outputs from the two valves (in one bulb in this diagram) act upon the loudspeaker through a special push-push transformer.

An Available Output of 2 Watts!

happens when negative potentials are applied to the grid. If the anode-current curve were completed it would continue to rise in a straight line.

In "Class B" amplification we use a valve whose curve lies almost wholly in the "undesirable" zone—i.e. to the

The so-called "driver" valve preceding the "Class B" valve should be of a kind capable of delivering the necessary power. This may mean a small power valve followed by a step-down transformer having low resistance windings.

At the time of writing, there is no

And what results! With the Cossor 240B. valve (two special triodes in one bulb) it is possible to obtain 2 watts of undistorted output. And this with a standing current of 6.5 milliamps. (4 for the "Class B" valve and 2.5 milliamps. for the driver valve). The average current for an evening works out at 11 milliamps. for the two valves. This is with 120 volts on the anodes and with an available output of 2 watts on the loudest passages.

Economical Volume

With 90 volts on the anodes the average consumption is 6.5 to 7.5 milliamps. for the two valves, and the maximum output available is reduced to 1 watt.

The battery user probably regards one-third of a watt as giving a big volume of sound, and the average commercial mains set will give about 1 watt. For the battery user to be handed double this output is a remarkable feat, and those who like lots of punch can now indulge their passion at minimum expense.

The absence of a grid-bias battery and the fact that matching is unnecessary will be welcomed by the home constructor.

Moving-coil speakers will usually be employed with the "Class B" type of quiescent amplifier, and are obtainable with suitable transformers already fitted to them.

Although final recommendations for components, etc., are not possible at this moment, the reader may take

(Please turn to page 107)



THE "RAW MATERIAL."—The three main components needed for practical "Class B" working are shown separately here. On the left is the Varley driver transformer with alternative ratios of 1:1 and 1.5:1; a "Class B" valve in its holder is in the centre; with a special output choke on the right.

right of the vertical ordinate through zero grid volts. In other words, the current at zero volts is very small, but increases in a straight line as the grid voltage is made positive.

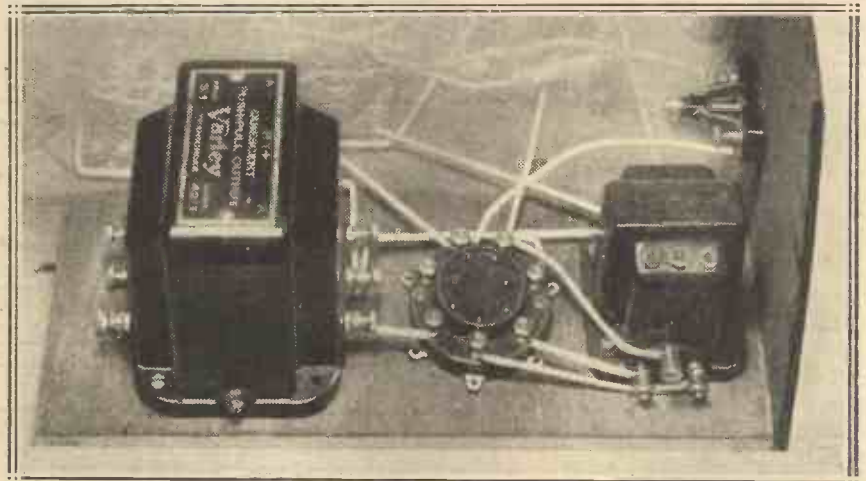
We deliberately "ask for trouble" in "Class B" amplification, because we apply positive impulses (due to successive half-cycles of L.F. current) to the grids. The resultant grid currents, however, are made to produce as little trouble as possible, and this is done by the use of a "driver" valve and a special L.F. push-push transformer feeding into the "Class B" valves.

Power Operated Valve

The great merit of the ordinary amplifying valve lies partly in the fact that it is potential operated and absorbs a negligible amount of energy. In "Class B" amplification, however, the grid currents put a definite "load" on to the input transformer.

The grid to filament path of the valve becomes, in fact, a resistance, and the input transformer must be designed to match this load. The problem is not unlike that considered when we match the output valve to a moving-coil loudspeaker.

certainty as regards the best type of driver valve and "Class B" input transformer. A step-down transformer (say, 2:1, although 1:1 is sometimes used) sounds depressing and the driver valve sounds a nuisance, but we shall accept these apparent disadvantages as essential to the operation of the scheme for the sake of the results.



THE "FINISHED PRODUCT."—Here the components shown above are actually wired into circuit at the output end of a receiver. Note the special 7-pin valve holder with one terminal unused. The driver transformer in this case is made by Lissen.

A VISIT to ATHLONE

THE new Dublin station which is causing such a stir in the ether is under the control of the Free State Post Office. And from the engineer-in-chief of the Post Office, Mr. Monaghan, I got permission to go to Athlone to see the new broadcaster.

Athlone is the nearest town to the station, which is actually at Moydrum, a little over two miles out of Athlone, and almost at the geographical centre of Ireland.

Unimposing Building

It is pleasant, open country round about Moydrum, and as you come up near to the field, fenced round with short posts and steel wire, the twin lattice masts stand up clear above the low surrounding trees. The masts are about 300 feet high, and rock on a stone ball-joint so that they can withstand the full sweep of the wind.

Four sets of guy wires keep the masts upright, these being anchored to 40-ton concrete blocks put in the ground with a deep cement foundation. There is a T-type of aerial some 600 feet long between the two masts, and the down lead comes straight to a transformer house midway between the masts.

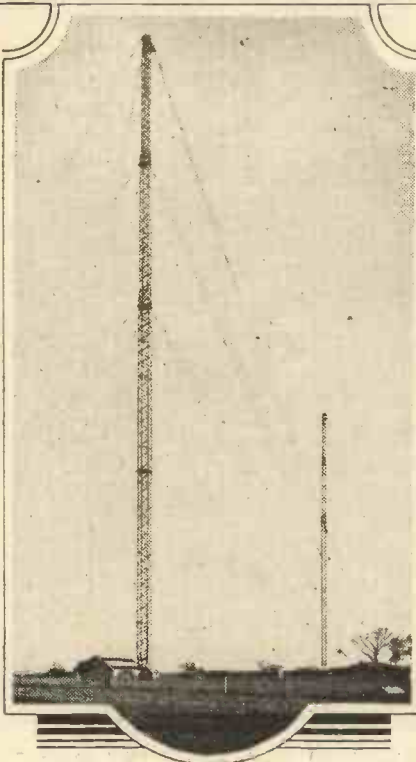
After seeing the imposing buildings which the B.B.C. puts up for its 60-kilowatts, I had to look twice before I could see the Athlone station building! It is less than a quarter the size of an ordinary B.B.C. building, and there is nothing imposing about it—being simply a stone hut shaped like an ordinary garage and with not even large windows in the walls to relieve the monotony of the stonework.

Flood-Lit Panels

The entire building is taken up with the transmitter. There are no external offices worth mentioning, and so the whole gear is housed in the one rectangular building in which there are roof windows to give light without dazzle on to the transmitter panels below.

The transmitting house is close to the base of one of the masts and the usual twin-feeder wires on telegraph posts run out to the transformer hut beneath the swaying down lead.

Inside, you can see that the transformer building is a single-span affair, as the roof is supported by steel



AN EYE-WITNESS ACCOUNT

by Our Special Correspondent of a visit to the powerful new Irish Free State broadcaster. Sponsored programmes are a feature of Athlone's transmissions, which can be clearly heard on a wavelength of 413 metres—just above the Midland Regional.

girders. This metal work does not seem to have any effect on the transmitter. There is flood lighting above the panels so that the light always comes down in the same direction—the sloping windows being above the floodlight bowls.

Roughly speaking, the Athlone transmitter looks like one side of a B.B.C. regional station—that is, there is the familiar control desk at which the man on his "beat" sits watching five aluminium engraved panels distinctly à la B.B.C.

As the Athlone plant is more recent than any B.B.C. station, with the exception of the new West Regional, there are a number of little differences which make the station very interesting.

Control-Desk Arrangement

"The arrangement is like this," explained an engineer. "Here is the control desk in the centre with two indicator lights above the five main peak voltmeters."

These indicator lights are not used at existing B.B.C. stations, but are at other British-built Marconi transmitters, such as that I have seen at Beromünster, in Switzerland.

"As usual, the buttons to my left and right are the relay switches for the H.T. controls and for the rectifier output. The control desk, you see, faces the output stage of the transmitter where there are the two master



Athlone's programmes come from the Dublin Studios, and here we see the Dublin Station orchestra about to "strike up." The studio accommodation is rapidly being increased, and the musical side is under the control of Dr. Vincent O'Brien, who holds the position of Musical Director.

A Visit to Athlone—continued

tuning controls and four very important meters.

"But to show you how it works, we must come over here to the right, to the first panel."

"Is Athlone valve or crystal controlled?" I asked.

currents are brought into the transmitter at a very early stage.

"The next panel, you see—the long one—is exactly the same as that over to the left. Between them is the output panel.

"As at B.B.C. stations, the output

in push-pull. All the valves in each panel are connected in parallel, thus forming one huge valve stage handling the 60 kilowatts. One of the panels is only half of the push-pull stage.

"In a push-pull arrangement, you know (just as in a receiver), you must have a transformer to couple the stages together for the output. Here the output transformer is the H.F. tuning circuit in the aerial. The coils—air-spaced coils wound with heavy copper tubing—are behind the centre panel. Two steering wheels which you can see on the front are for the control of coupling between the H.F. circuit."



"We are crystal controlled here. A quartz crystal is housed in a thermostatically controlled oven in the right-hand corner of the transmitter there," he said, pointing from the control desk.

"In the same panel is what the engineers call a harmonic selector and balanced amplifier—in other words, a series of valves all tuned to harmonics of the oscillating crystal so that the final valve is oscillating at the correct frequency for the working wavelengths."

"The wavelength can be changed, of course?" I asked.

Push-Pull Output

"Yes. The present wavelength is very satisfactory, but it only takes a few minutes to retune the circuit for any wavelength between 300 and 550 metres. The crystal has to be changed, of course, and the selected harmonic retuned. A sidetone wavemeter can be worked on the control desk.

"In the next panel—that is, the second from the right—are the larger air-cooled valves which step up the power and which introduce the modulation. I don't want to bother you with technicalities, but low-power modulation is used here at Athlone.

"This means that the speech

IN THE TRANSMITTING ROOM

The 60-kilowatt transmitter was built at the Marconi Company's works at Chelmsford and was erected just in time for the broadcasting of the Eucharistic Congress last summer.



The Control Engineer (below), sitting at his desk, is able to adjust the output from the transmitter to suit the requirements of the moment. His task is the important one of

PREVENTING OVERLOADING

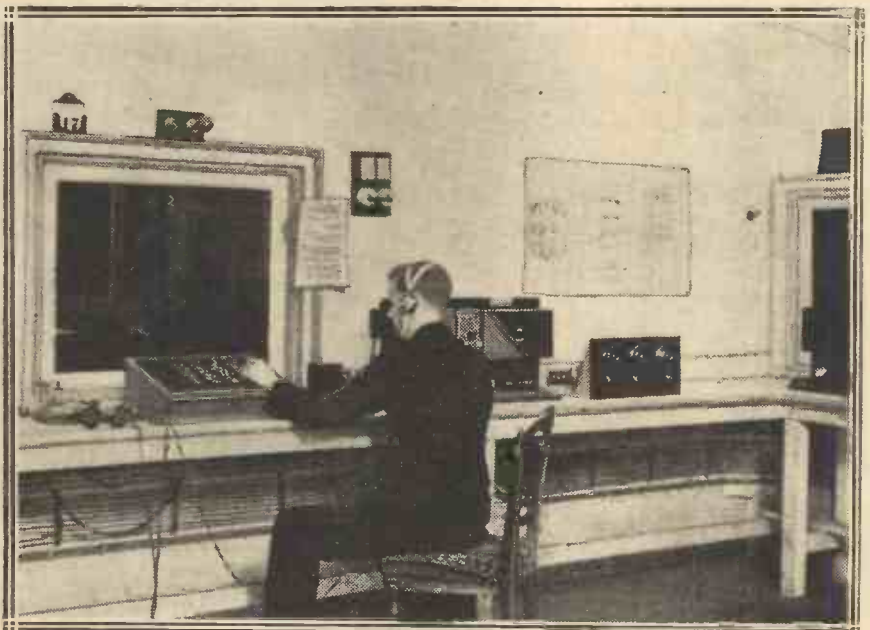
Viewing the Meters

Above this panel I noticed a covered-in affair looking like the flue pipe of an "Ideal" boiler. That, I was told, is the insulated casing through which the two feeder wires go through the wall to the transformer hut in the middle of the field.

"If you sit at the control desk," continued the engineer, "you will find that the five peak voltmeters are just below eye-level, the vital signal lamps at eye level, and the four big meters (together with a batch of smaller ones) are—just above eye level—in the output control panel.

"These not only show the voltages in the final valves but they also tell us the whole story about the cooling water flow. In the event of a breakdown,

(Please turn to page 106.)



An ALL-PURPOSE METER

THE problem of testing and repairing radio equipment, with the exception of tuning troubles, is essentially one of defective valves or incorrect voltages.

Correct voltages appearing at various test points in the circuit will indicate circuit continuity and therefore, with the above exceptions, will also indicate a satisfactory operating condition. For instance, an open

FUNDAMENTAL CONNECTIONS

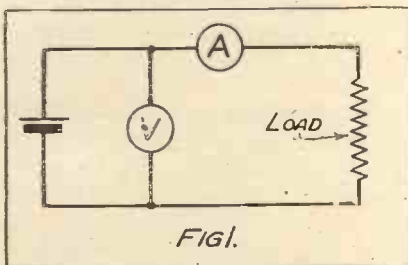


FIG. 1

To measure the total current flowing in the circuit, the ammeter is connected in series with the load, which in the diagram is represented by a resistance.

primary winding of an L.F. transformer will be evidenced by the absence of voltage at the valve anode; an excessive current drain in any anode circuit might indicate insufficient grid-bias voltage or a shorted valve element; in an A.C. mains set a shorted filter condenser would result in little or no voltages being delivered to the set, and so on.

In testing valves for their electronic emission a sensitive milliammeter is required.

Saving a Fortune!

The voltage and current ranges encountered in radio sets, L.F. power amplifiers and public-address systems are very wide, and may vary from 1 to 1,000 volts, and from 1 to 250 milliamperes. Individual meters to measure these values would cost a small fortune, and it is the purpose of this article to describe how the utility of one meter may be extended to cover all of these ranges.

Full details of how to convert a simple milliammeter to a multi-range instrument suitable for measuring voltage, current, and resistance.

By J. E. WATSON, A.M.I.R.E.

The meter required for this purpose is a 0-1 D.C. milliammeter. The usefulness of this instrument in itself is very limited, but by the use of a few resistors plus a simple application of Ohm's Law, its sphere of utility may be greatly enlarged. D.C. voltmeters and ammeters are essentially the same from the standpoint of construction, and whether they are classed as voltmeters or ammeters depends upon how they are connected in an electrical circuit.

Essentially the Same

In Fig. 1 the meter A is an ammeter connected in series with the load and reads the total current flowing in the circuit. The instrument V is operating as a voltmeter, and measures the difference of potential across the battery.

When an ammeter or milliammeter is used as a voltmeter, the current flowing through the meter must be limited to such value as that for which

FOUR DIFFERENT RANGES

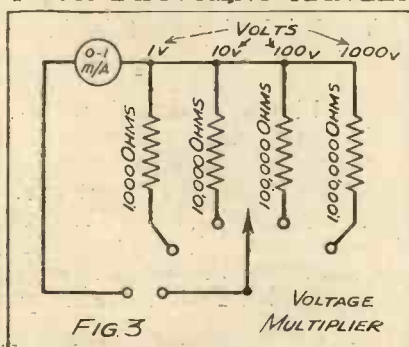


FIG. 3

This arrangement converts the meter into a voltmeter capable of covering four ranges. The resistance of the milliammeter is, of course, assumed to be negligible.

the instrument was designed, and this is done by placing a limiting or multiplying resistor in series with the meter. A voltmeter is simply an ammeter with a multiplier connected internally and calibrated in volts.

According to Ohm's Law,

$$E=IR \text{ or } I=\frac{E}{R} \text{ or } R=\frac{E}{I}$$

where E is Voltage.

I is Current.

R is Resistance.

In order to determine the value of multiplier resistance to cover a desired

CONVERTING TO VOLTS

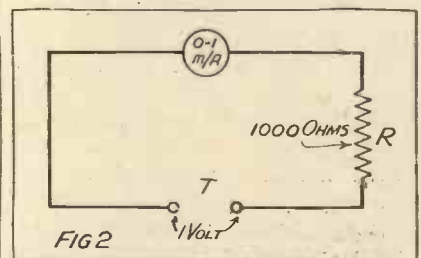


FIG. 2

The 0-1 milliammeter will read full scale when one volt is applied, provided the resistance R has a value of 1,000 ohms.

voltage range, it is simply necessary to solve for R in the third formula shown above. Let us take a specific case.

Full Scale Readings

We wish the meter to read full scale when 1 volt is applied, and we know the meter current is limited to 1 milliampere, then, assuming the internal resistance of the meter to be negligible, we find

$$R = \frac{E}{I} = \frac{1}{\frac{1}{1,000}} = \frac{1,000}{1} = 1,000 \text{ ohms.}$$

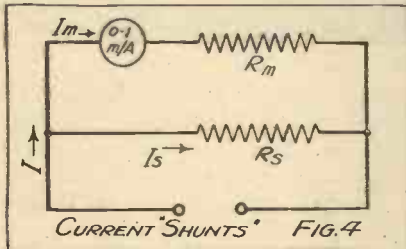
A series resistor of this value, connected as in Fig. 2, will so limit the current through the meter that when 1 volt is impressed across the terminals, T, the instrument will read exactly full scale.

With R remaining constant, we will find the current directly proportional to the voltage, so that if a half or a

An All-Purpose Meter—continued

quarter of a volt is applied, the reading will be in direct scale proportion. In other words, the original calibration may be read as volts instead of milliamperes. By increasing

INCREASING THE RANGE



If the resistance of the meter is known it can be made to read higher current values by using a shunt resistor, such as R_s in the above diagram.

the value of the multiplier resistor, R , higher voltages may be measured.

To convert a milliammeter having a full scale reading I into a voltmeter to read a maximum voltage E , then the resistance of the multiplier will be given as

$$R = \frac{1,000 \times E}{I}$$

By using a number of multipliers to cover different ranges and arranged with a suitable switching method, a useful unit may be constructed. Fig. 3 shows the necessary resistors to convert a 0-1 milliammeter into a multi-range voltmeter capable of reading 0-1, 0-10, 0-100, 0-1,000 volts.

As stated previously, the original calibration holds true for the range 0-1. Using the 10-volt range, the actual calibration is simply multiplied by 10, the 100-volt range multiply by 100, and the latter range multiply by 1,000.

Higher Current Readings

The meter may also be made to read higher currents than that for which it was designed by the use of parallel or shunt resistors. In this manner only a portion of the current to be measured passes through the meter, the remainder flowing through the shunt. Knowing the internal resistance of the meter, and by choosing a proper shunt resistor R_s in Fig. 4, a simple range factor may be obtained relating the total current to the measured current.

Let R_m equal Resistance of meter.

R_s ,, Resistance of shunt.

K ,, Factor by which range is to be increased.

Then by a simple process of mathematics the following formula can be obtained:

$$R_s = \frac{R_m}{K-1}$$

which will give the value of shunt resistor required to increase the meter range by a factor K .

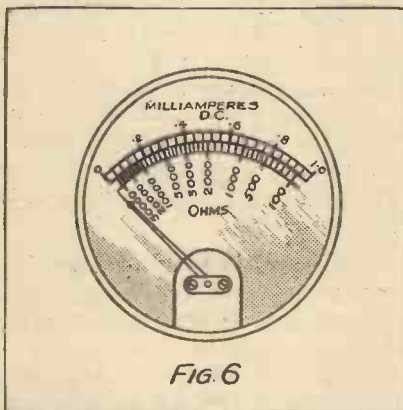
A Practical Example

For instance: Suppose our 0-1 milliammeter has an internal resistance of 20 ohms and we wish to extend the range 5 times ($K=5$), i.e. we desire to read up to 5 milliamperes. The resistance of the required shunt (R_s) will be

$$R_s = \frac{R_m}{K-1} = \frac{20}{5-1} = \frac{20}{4} = 5 \text{ ohms.}$$

By a direct application of Ohm's Law we can also convert the milliam-

OHMS AND MILLIAMPS



Here the milliammeter is also calibrated in ohms, so that the instrument can be used for measuring both current and resistance.

meter so that it will measure resistance in ohms. This law says:

$$I = \frac{E}{R}$$

where R is Resistance of circuit.

E is Voltage drop across resistor.

I is Current through resistor.

Measuring this current with a milliammeter, and keeping the voltage constant, we find the current I to be inversely proportional to the circuit resistance, and it is therefore possible to calibrate the meter in ohms. In Fig. 5 we find a circuit for this purpose.

Here we have a definite voltage E , in series with a calibrating resistor R , in series with the meter.

X , the resistance to be measured,

is connected to the terminals Y . The value of the calibrating resistor R is chosen with respect to the desired voltage E , so that when the terminals Y are short-circuited the meter will read maximum current of 1 milli-ampere.

For example: If we chose a voltage E of 2 volts and short-circuit Y , the value of R will be found to be 2,000 ohms.

$$I = \frac{E}{R} = \frac{2}{2,000} = 1 \text{ ma.}$$

Now suppose we connect a resistance of 2,000 ohms across the terminals Y . The milliammeter readings will be given by:

$$I = \frac{E}{R + R_m} = \frac{2}{2,000 + 2,000} = \frac{2}{4,000} = \frac{1}{2,000} \text{ amps.} = 0.5 \text{ ma.}$$

and we know when the meter reads 0.5 ma., with these circuit values, the resistance across terminals Y has a value of 2,000 ohms.

Resistance Calibration

In this manner all the meter readings will correspond to some definite value of resistance and, as previously stated, the instrument may be calibrated in ohms.

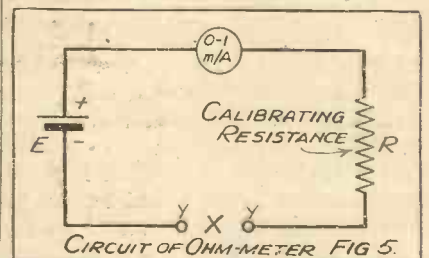
Increasing and decreasing the values of both E and R will make it possible to measure higher and lower values of resistance, respectively. Fig. 6 shows a scale calibrated in ohms.

In this case the constants were $E=2$ volts and $R=2,000$ ohms. Substituting various values for X , suitable calibration points were obtained as shown.

When used in conjunction with a rectifier system, the meter may be pressed into service as an A.C. instrument.

(Please turn to page 108)

MEASURING RESISTANCE



The value of an unknown resistance X may be determined from a direct application of Ohm's Law, X being connected between the terminals $Y Y$.

The "Bestector" Super



C“CLASS B” amplification and Westector rectification—two of the most important of the number of striking developments recently made available to the home constructor. And the two main features which give the “Bestector” Superhet its outstanding individuality.

The advantages of both “Class B” and the Westector confer the greatest benefits when these schemes are combined with a circuit employing the superheterodyne principle. In spite of their application to a wide variety of circuit types, they might almost have been developed especially to improve the battery superhet.

Saving Battery Power

I hope those who have used them in receivers other than superhets will forgive my “laying claim” to them in this way. You will remember I have always believed in the future of the superhet (mains or battery), so it is natural I should enthuse over the obvious application of the new forms of amplification and detection.

When the advantages of the two new systems are considered, the de-

**“Class B”
AMPLIFICATION
and
WESTECTOR
“COLD VALVE”**

are incorporated in this magnificent
SUPERHET

☞The first of its kind to be described.
☞The last word in efficiency.

Designed and described by
VICTOR KING.

sirability of their application to battery superhets is immediately appreciated.

In the past the large H.T. current required, and the consequent high upkeep costs of batteries, has been the chief impediment to the wider use of battery-driven superhets. And both the Westector and the “Class B” valve aid considerably in reducing this current.

The Westector being a metal rectifier uses neither H.T. nor L.T. current, and thus the usual consumption of the second detector, the valve replaced by the Westector, is saved. At the same time, this rectifier is particularly suitable for handling large inputs without distortion.

Due to the intermediate-frequency amplification, the currents needing rectification at the second detector of a superhet are nearly always fairly big. Thus the metal rectifier, which is really a small edition of the Westinghouse mains rectifier, falls in very nicely with the conditions extant in the superhet.

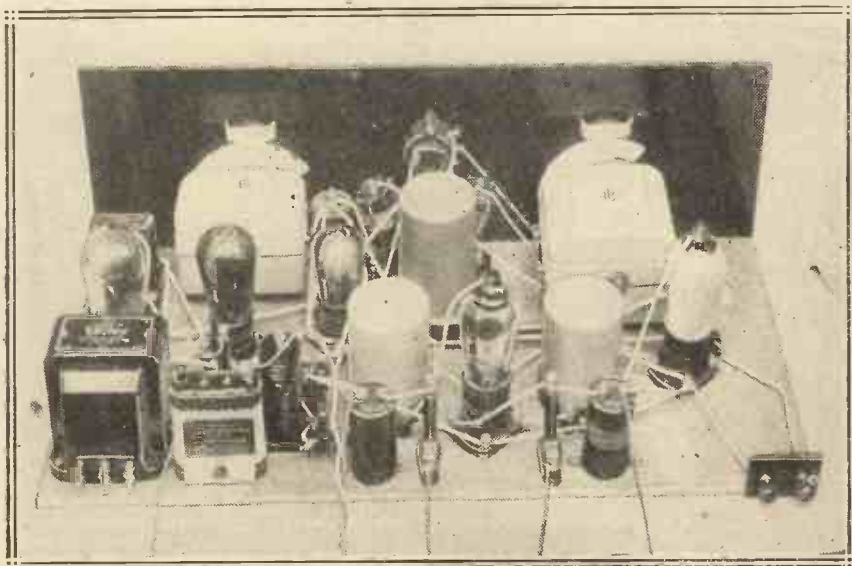
Special Output Valve

If there is a big input for the detector, then there must also be a big input for the output stage. As a matter of fact, unless the last valve of a superhet is capable of giving a large undistorted output, full advantage is not being taken of this type of receiver.

With ordinary output stages, a valve capable of very big power would require more H.T. than could economically be provided by dry

VOLUME

The sort of worthwhile volume you have learnt to expect only from mains equipment is the claim made for “Class B” amplification, and the “Bestector Super” justifies it in a manner which comes as a revelation to most battery users.



ECONOMY

The amazing volume which the “Bestector” gives even on distant foreigners is not obtained by ruinous expenditure of battery power. The “Class B” output stage works on the quiescent principle, which means that the average battery consumption is remarkably low.

The "Bestector Super"—continued

H.T. batteries. Consequently a compromise between power and H.T. current has been necessary in the past.

Now all that is banished by the "Class B" valve. This valve consists

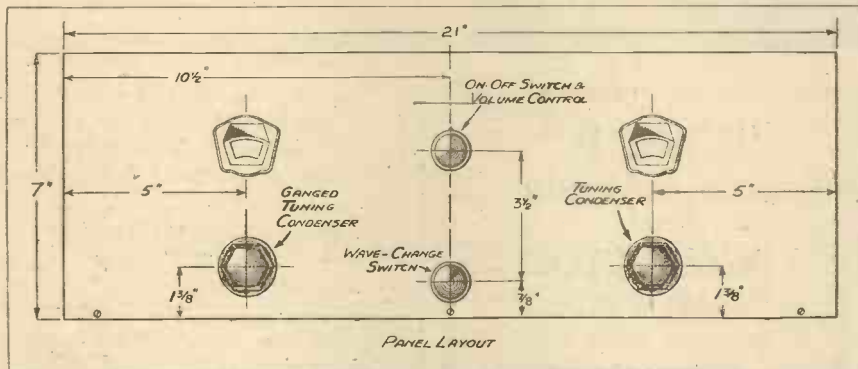
according to the strength of reproduction.

The total quiescent current of the set is 10 to 13 milliamps., and increases to about 15 milliamps. for

size H.T. battery, it is ideal for working from one of the larger capacity batteries.

It must not be thought that the "drive" valve is a wasteful extra that does not pull its own weight. Apart from the operation of feeding the "Class B" valve, it adds its share to the L.F. amplification, so that the "Bestector" really has two L.F. stages.

SIMPLE DRILLING—STRAIGHTFORWARD TUNING



The symmetrical panel presents no constructional difficulties, and in action the set is remarkably easy to handle despite its tremendous range.

of two triodes in the one bulb, but employing the same filament. In a way they are like two Q.P.P. valves working on their bottom bends in the usual way.

But no matching has to be carried out and no G.B. is required. The reason for the latter is in the design of the valve. The characteristics of the two halves are so arranged that the anode bends fall on zero grid volts.

The main difference between Q.P.P. and "Class B" is that grid current is permissible in the latter. This may seem rather staggering after the way one has been told to "avoid running into grid current," where ordinary amplification is concerned.

Low Current Consumption

The ill effect of the grid current is nullified by the "drive" valve which forms an intermediate stage of amplification between the second detector and the "Class B" valve. The "drive" valve is coupled to the push-pull valve by a special transformer.

This transformer differs from the ordinary inter-valve component in that it has a step-down ratio and low-resistance secondary. Current, in the form of grid current, can thus flow without appreciable alteration of the voltage across the secondary.

The "Class B" valve will give an undistorted output of around 2 or more watts, but takes a quiescent current of only about 2 milliamps. This increases when the set is working

average volume. Thus, while the set is not quite capable of being run economically from a standard-

Coupling Methods

The first one is resistance-capacity coupled to the Westector, the scheme of connections being very similar to those employed with a diode detector.

The L.F. voltages are produced across the 1/4-megohm resistance, and are passed on to the grid via the H.F. choke and the .01 fixed condenser. The purpose of the choke is to keep H.F. out of the low-frequency side of the set.

The first valve of all is a screened-grid mixer or first detector, the

THE NEW "CLASS B" TECHNIQUE



Between the panel and the 7-pin "Class B" valve holder is the special drive transformer operated by a small power valve which goes into the adjacent valve holder.

The "Bestector Super" —continued

feed from the oscillator being to its screening-grid. The oscillator valve, V_2 , is an ordinary three-electrode type.

From the aerial the input to the screened-grid valve is via a band-pass coil, the tuning condensers of which are in the form of a double-gang component. A potentiometer connected up with the aerial and earth provides control of volume.

Designed for Quality

The intermediate-frequency amplifier is another screened-grid valve and is coupled "fore and aft" by two intermediate transformers. These transformers are provided with trimmers across primaries and secondaries, which ensure that the intermediate part of the set is in tune throughout.

These transformers are set at about 110 kilocycles, this frequency being employed not only because it is usual, but because it has been proved in the past to be the most effective frequency from the point of view of practical considerations.

The output choke in the anode circuit of the "Class B" valve has a tapped winding, enabling a high-resistance speaker (or low-resistance one with a transformer giving a high-resistance input) to be matched up with the special valve.

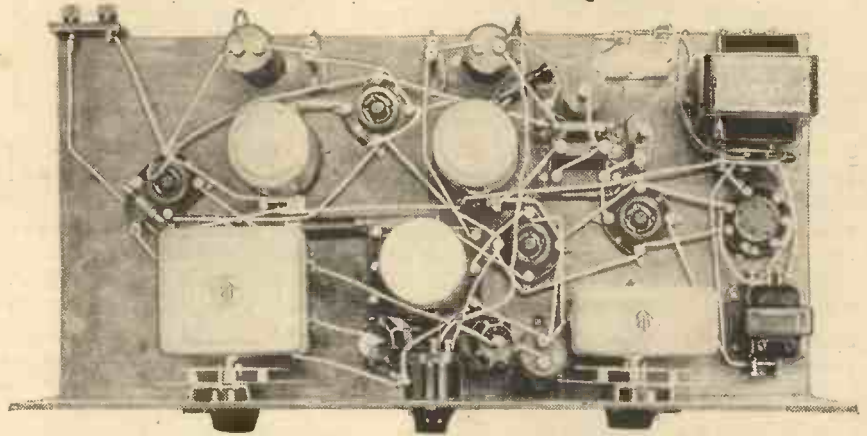
Similarly, from end to end the construction is designed to be simple.

Compared with the superhet of a few years ago, the "Bestector" emphasises that the superhet is fast

should be countersunk on the underneath of the panel.

The band-pass coil and the screened oscillator coil are controlled by the one wavechange switch. This is achieved by a common rod which

SMALL GRID BATTERY REQUIRED



One good feature of "Class B" amplification is that a 9-roll grid-bias battery is sufficient, since the "Class B" valve itself requires no bias.

taking its place as an equal with the other common types of home-constructor sets.

There are one or two small points to which I must call your attention before dealing with the operation.

First of all, the fitting of the two variable condensers. Templates are

runs through the band-pass coil and into the oscillator.

You will see that a special lead is run from a screw on the side of the gang condenser casing and serves to join this to earth. The cans over the two intermediate transformers are also earthed.

COMPONENTS FOR THE "BESTECTOR SUPER"

Component.	Make used by Designer.	Alternative makes of suitable specification recommended by Designer.	Component.	Make used by Designer.	Alternative makes of suitable specification recommended by Designer.
1 Panel, 21 in. x 7 in.	Goltone	Lissen, Peto-Scott	1 L.F. "Class B" Driver transformer	Lissen	R.I. "Driverma," Varley, Benjamin
1 Baseboard, 21 in. x 10 in.	Peto-Scott	Camco, Lock, Gilbert	1 "Class B" output choke	Varley	R.I., Benjamin
1 Cabinet to fit above	J.B. "Nugang" type A	—	2 1,000-ohm resistances and vertical holders	Graham Farish "Ohmite"	—
1 Double-gang, completely screened condenser and disc drive	J.B.	—	1 1-meg. resistance and vertical holder	Graham Farish "Ohmite"	—
1 Single-screened variable condenser and drive	Lewcos	—	1 3,000-ohm resistance with terminals	Graham Farish "Ohmite"	—
1 Band-pass coil unit	B.P.F./G.R.	—	1 250,000-ohm resistance with wire ends or terminals	Dabilier 1 watt	Graham Farish "Ohmite"
1 Oscillator unit	Lewcos T.O.S./R.	—	1 2-meg. grid leak with wire ends	Goltone Lewcos "Super"	Dabilier 1 watt, Tunewell
1 Intermediate transformer	Colvern "Colverdye" 110	—	1 H.F. choke	—	Goltone, R.I., "Ready Radio"
1 do. do.	do. type M110	—	1 Westector	Type W.1	—
4 Four-pin valve holders	Benjamin	Lotus, Telsen, W.B. Benjamin, Wearite	5 yards insulated sleeving and 7 yards 18-gauge tinned copper wire	Goltone	Wearite
1 Seven-pin valve holder	W.B.	Telsen, T.C.C.	6 Battery plugs	Belling-Lee	Bulgin, Eelex, Clix
2 .25-mfd. fixed condensers	Dubilier 9200	T.C.C., Telsen	2 Accumulator spade terminals	Belling-Lee	Clix, Eelex
2 .0001-mfd. fixed condensers	T.C.C. 34	T.C.C., Telsen	1 Bias battery clip	Bulgin No. 2	—
1 .01-mfd. fixed condenser	Dubilier 610	Dubilier	1 Terminal strip, 2 in. x 2 in.	Belling-Lee	Goltone, Igranic
1 .04-mfd. fixed condenser	Dubilier 9200	—	2 Terminals	—	—
1 .0002-mfd. fixed condenser	Dubilier 665	—	Flex, Screws, etc.	—	—
1 .01-mfd. fixed condenser	T.C.C. "M."	—	—	—	—
1 10,000-ohm potentiometer, with switch	Bulgin V.S.32	—	—	—	—

Thus from aerial to speaker the circuit is designed for good quality. There is the volume control right at the start, the Westector with its H.F. filter, the "Class B" valve with its power-handling properties, and the output matching transformer.

provided with these for marking the positions of the necessary holes on the panel.

The actual securing of the condensers is achieved by screws passing right up through the baseboard into them. The holes for these screws

No screws are provided on them for this purpose. But the fixing screws nearer to the panel make contact with the cans via the base of the components.

The fixing screw on one side is earthed by a small piece of copper

The "Bestector Super" —continued

foil that passes under the transformer and is pierced by the screw. The foil is bent round and passed under one of the terminal screws of the component. The necessary earthing is obtained with both transformers in this way.

Seven-Pin Valve Holder

No battery terminals are employed, the connections, apart from the grid-bias ones, being by means of long flex leads or a battery cord as desired. The grid-bias battery is held on the baseboard by one of the usual metal clips. See that you leave room for a nine-volt battery when fixing the near-by components.

There are seven sockets on the "Class B" valve holder, and it is usual to number these from one to

"BESTECTOR SUPER"
ACCESSORIES

LOUDSPEAKERS.—Blue Spot, B.T.H., Amplion, Magnavox, Rola, H.M.V., Marconiphone, Celestion, R. & A.

BATTERIES.—H.T. 120-volts super capacity. Ediswan, Pertrix, Lissen, Siemens, Magnet, Marconiphone, "Silver Knight," Ever Ready, Drydex.

G.B.—9 volts. Siemens, Ever Ready, Ediswan, Lissen, Magnet, Drydex, Pertrix.

L.T.—2 volts. Ediswan, Lissen, Block, Oldham, G.E.C., Pertrix, Exide.

AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite," Graham Farish "Filt" earthing device.

seven. Their disposition is so arranged that the valve can be fitted in one way only.

But to be on the safe side, you should check over the orientation of the sockets on your holder with those shown in the wiring diagram to see that they are in the same relation.

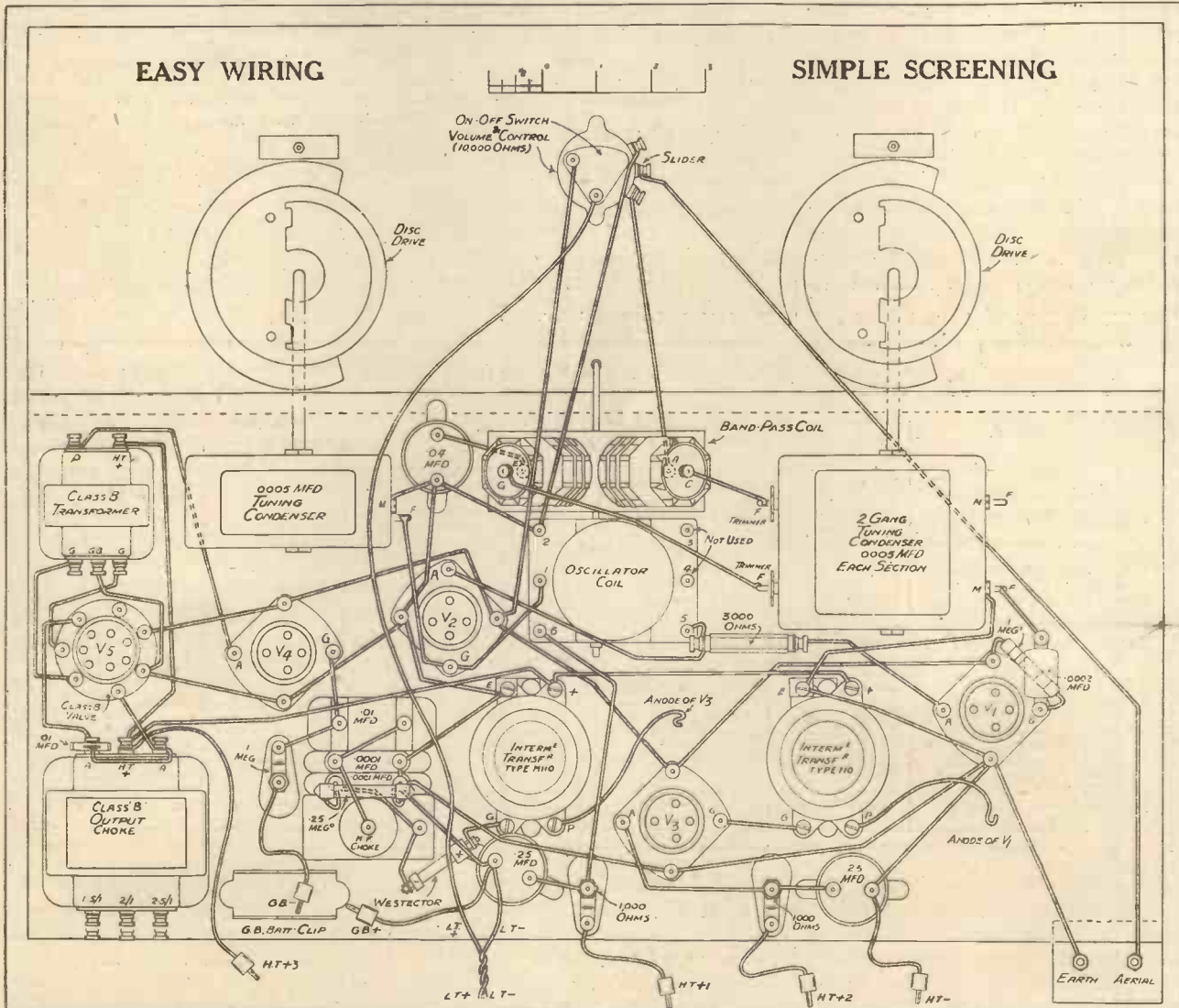
Then there will be no possibility of incorrect connections if you follow the wiring carefully. One terminal, No. 6, is not used.

You will see that quite a number of the small fixed condensers and fixed resistances are supported by their connections or joined direct under terminal screws. The Westector itself is wired up in this manner.

Connecting the Detector

There is a right and wrong way of joining up this component. You will note that one end of it is larger in diameter than the other and is also coloured red. This end is the one joined up to the coil.

Apart from the above points there is nothing out of the usual in the construction. And it is hardly



By means of self-screening units the wiring is rendered very easy, the five-valve superhet thus being no more difficult to construct than a straight three- or four-valver.

The "Bestector Super"—continued

necessary for me to go over the standard processes of panel drilling and component wiring. My space will be better devoted to notes on operation, simple as this is.

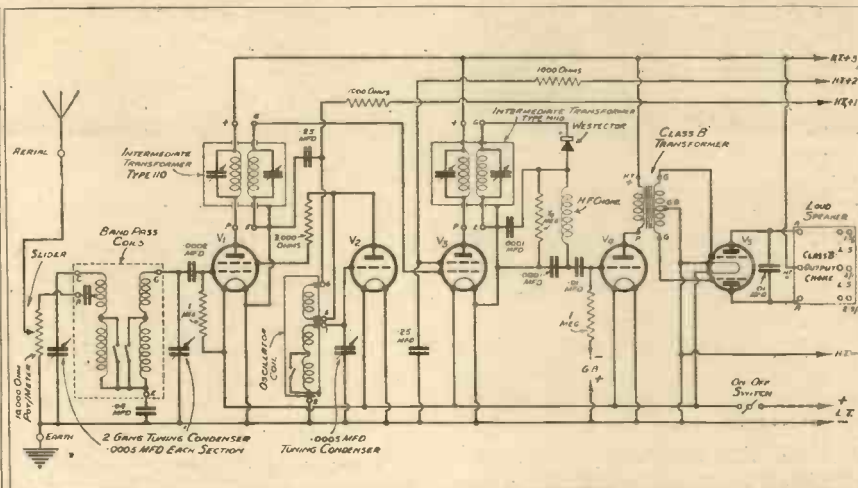
Operating the receiver is almost as easy as tuning a one-knob set. The only dial that is very critical is the oscillator tuning, the right-hand one.

The other controls apart from this are the band-pass tuning dial, on-off switch, wavechange switch and volume control.

Dual-Purpose Control

The volume control and on-off switch are combined with one knob. When minimum volume is reached a further slight turn to the left switches off the set. Similarly, the first part of the tuning of the knob to the right switches on the set; after that it works as an ordinary volume control.

There are one or two preliminary setting jobs to carry out before the receiver is all ready to log stations. So when you have made the external connections, giving H.T.1 about 90



THE CIRCUIT

The high selectivity which is a feature of every well-designed superhet is further enhanced by the use of a band-pass aerial circuit. Complete prevention of H.F. finding its way into the L.F. end of the set is effected by the Westector and its associated circuit.

volts, H.T.2 70 to 80, and H.T.3 the maximum of the battery up to 150, proceed as follows.

Adjusting the Trimmers

Plug in the grid bias, this may quite satisfactorily be $1\frac{1}{2}$ to 3 volts higher than that normally recommended for the small power valve used. Next set the trimmers on the intermediate transformers half-way across.

These trimmers take the form of small levers fixed to the bases of the transformers. There are two on each transformer.

Put the wavechange switch to medium waves and switch on. The wavechange switch should be pulled out for medium waves. The volume control should also be set to maximum by being turned fully to the right.

Now, if you slowly turn the oscillator tuning you are almost bound to hear a station. If you do not, move the left-hand dial a little, and again slowly rotate the oscillator dial.

Pick out a weak transmission, and tune it in fully on both dials. You are now in a position to set the trimmers:

First of all, deal with those of the band-pass tuning condenser. Turn

VALVES

Make	"Mixer"	Oscillator	S.G.	Driver
Cossor	229S.G.	210 Det.	220S.G.	220F.A. or 215P.
Mazda	S.215B.	L.210	S.215B.	P.220
Mullard	P.M.12A.	P.M.2D.X.	P.M.12A.	P.M.2A.
Marconi	S.22	L.210 or L.2B.	S.22	L.P.2
Osram	S.22	L.210 or L.2B.	S.22	L.P.2

THE "CLASS B" VALVES.

Tests with the "Bestector Super" were conducted with a Cossor "Class B" valve, which is now on the market, and types by Messrs. Mullard, Mazda, Marconi and Osram will shortly be available.

(Please turn to page 106)





WHEN summer conditions have been in force for several weeks, whilst the weather has not belied the term, one might expect to find that foreign-station listening was getting to be a problematical affair. But so far the chief problem has been what to select from all the good alternatives going.

Even the simple sets are still consistently roping in plenty of fine programmes from the Continent.

* * *

Apart from stations like our Paris friends, the Brussels Brothers (1 and 2, on 509 and 338.2 metres respectively), Rome, Prague, Fécamp, and such stalwarts, there has been excellent reception from many of the rather low-powered transmitters.

Italy, for instance, has been strongly represented on many nights by Bolzano—a little one-kilowatt,

on 368.1 metres. As this is a shared wavelength, with three other stations of greater power all using it, one might have thought that Bolzano's chances of getting over to Britain were infinitesimal; but as a matter of fact, his strength has been of the

Some helpful notes on long-distance reception, and news of the best stations to provide alternative programmes.

"listen-to-me" class, that simply demanded attention at times.

In addition to low-power long-distance surprises, the dials have been interesting for other reasons. We had a spectacular catastrophe on 385 metres, owing to Radio-Toulouse being burnt out by one of the worst

broadcast-station fires on record. And there seems to be considerable doubt, at the time of writing, as to what is going to happen about replacing this favourite station.

* * *

Then on 309.9 metres we have had the supplanting of Cardiff by the birth of the West Regional. The B.B.C.'s tests from this station are being very favourably received on the Continent. In this country the new-comer certainly gets over well, and reports of the reception in the true service area indicate plenty of local satisfaction.

* * *

When the Regional programme has completely taken over from the Cardiff and Swansea transmitters, the engineers will "fade-in" the West National; but this is a matter of almost entirely local interest, because the wavelength and programmes will be identical with London National's.

* * *

On long waves Luxemburg has been untiringly testing on 1,191 metres, and listeners are watching for the new Kalundborg, of which great hopes are entertained. Even the Moscow stations have been getting over, strongly at times, which considering the distance is a tribute to the radio-entertainment possibilities of the summer of 1933.

H.T.B. with G.B. for Q.P.P.!

SOME interesting new Pertrix H.T. batteries have now been put on the market by Britannia Batteries Ltd., of 233, Shaftesbury Avenue, London, W.C.2, for use in conjunction with receivers employing quiescent push-pull amplification.

In these a grid-bias battery portion is included in the carton of the main battery, but is not connected electrically with the H.T. section. This automatically ensures that you get new G.B. with your new H.T., and there are other special features which will repay the reader who investigates these attractive propositions.

For exact adjustment of voltage the 120-volt battery, for instance, has positive tappings at 50, 60, 64½, 69, 75, 100, 110, and then at every 1½ volts to maximum, the G.B. section included in this carton being a 15-volter.

Full details of all the new Pertrix lines can be obtained on application to the above address.

For "Class B"

The special valves, transformers, and so forth which are now being

POINTS FOR PURCHASERS

 Interesting details from manufacturers about recent trade activities.

made available for use with "Class B" amplification are appearing on the market with such success and rapidity that it is not possible to refer to them all in the very limited space at our disposal.

Will interested readers therefore accept the general notification that THE WIRELESS CONSTRUCTOR advertisements concerned with this latest development are of special interest to all who wish to keep right up to date and participate in the most modern methods of reproduction.

Interesting New Accumulator

In developing the new "Extralife" accumulator, Ediswans have made use of a new principle which they call "balanced capacity." By special design of the plates an exact electrical balance is maintained between the positive and negative elements of the cell, which conserves the charge and

prolongs the life even under adverse conditions.

A range of these accumulators has now been placed upon the market at the same prices as for the ordinary types.

On the Mains

If you are toying with the idea of mains-operation you will be glad to know that the Heayberd Handbook on Mains Equipment is available to any reader who encloses 3d. in stamps, the firm's address being 10, Finsbury Street, London, E.C.2.

This handy compilation is full of diagrams, hints and practical technical information for the owner of the mains-driven set.

Dubilier Enterprise

The Technical Director of the Dubilier Condenser Co. (1925), Ltd., Mr. Philip Coursey, has just sailed for America to investigate the resistor and condenser market there.

The firm is at present very closely in touch with the latest U.S.A. practice, but it was thought that a personal visit would assist forthcoming development.



B.B.C. NEWS

Topical notes regarding British Broadcasting Personalities and Programmes.

By Our
Special Correspondent

The Couperin Bicentenary

SEPTEMBER 12TH will be the bicentenary of the composer Couperin, and the B.B.C., to mark the occasion, plans to put on a special work in the Foundations of Music series. Mr. Hely-Hutchinson is organising the feature, and it should prove to be an excellent entertainment.

Real v. Imaginary

The B.B.C. is working out a novel idea for a feature programme. It is simply this: conventions have emerged covering the music of distant lands; composers have idealised and caricatured. Often the real music is quite different. So the B.B.C. is to put on a gramophone recital contrasting the imagined with the real.

Competition for No. 10

No. 10 Studio at Big Tree Wharf is in keen demand. This is due chiefly to the discovery that it is better suited for vaudeville than any studio in Portland Place. Hitherto it had been taken for granted that No. 10 would be used only for symphony work, particularly at the week-end. But one vaudeville performance there changed the situation.

First of all the artistes preferred it as being both in itself and its surroundings more like an ordinary music-hall. Then there is more room for an audience. Also there is more informality and intimacy.

So it is not surprising that Mr. Sharman is hard after it for his start-up vaudeville shows. This has put the wind up the Music Department, who complain of grave congestion interfering with week-end rehearsals.

B.B.C. Music Library

The B.B.C. Music Library is being rapidly developed, and soon will make the B.B.C. practically independent of all outside libraries. The latest step in this direction was the assembling of orchestral material for all the standard non-copyright arias.

The Urge for Physical Jerks

Once again the request for early morning broadcasting of physical jerks is to the fore. It is eight years since this subject first became acute

AMERICA'S BIGGEST



America's biggest transmitting "tube"—a 200 kilowatt—is here being contrasted with one of the ordinary receiving type.

Then, as now, the B.B.C. takes cover behind the Ministry of Health, which thinks it is dangerous to put out standardised exercises for listeners.

The objection is that certain exercises are definitely injurious to many people and that the harm of these broadcasts might easily outweigh their value. This is the purist medical view.

Somehow, I think the B.B.C. is over-cautious. England is about the only country in the world which has no broadcasting of physical exercises. Let's not be quite so subservient to bureaucratic objections for once.

I am sure a "daily dozen" broadcast would be enormously popular, and I would risk the casualties.

Fredrich Wuhrer

This great pianoforte artistic will appear in the programmes early in July.

Sir Henry Wood in 1935

The Prom Season of the year 1935 is to be something "extra special," for it will mark the fortieth year of Sir Henry's conductorship. The B.B.C. is already planning a gigantic festival to do honour to Sir Henry Wood and to beat all previous Prom records.

The world will be scoured for star artistes, and the season probably will be extended at both ends. Incidentally, the next Parliamentary Committee of Enquiry into the B.B.C. will be sitting simultaneously to recommend what is to happen at the end of 1936 when the B.B.C. licence lapses.

Those Orchestra Sections

There is a movement afoot to persuade Dr. Adrian Boult to re-name

B.B.C. News—continued

the various sections of the B.B.C. Symphony Orchestra. It may be remembered that last year there was a similar movement to give the whole orchestra a new title, and I believe any really bright suggestion would then have been found acceptable. Now, however, any departure from the title "B.B.C. Symphony Orchestra" would find but little favour.

As for "Section A," "Section E," and so on, I imagine any change would be welcomed in most quarters, and not the least by listeners, who, generally speaking, are quite in the dark as to the constitution of these various sections of the main orchestra.

What is wanted is something which will indicate the type of orchestra; something original. Dr. Boult cannot be expected to worry about such a

I pointed out to them that, despite being "overworked," the orchestra was already recognised as being among the finest in the world; and while they modestly admitted this fact, they held to the opinion that they were, as they called it, "overschooled."

B.B.C. and Moscow

Mr. Vernon Bartlett, the B.B.C.'s Foreign Affairs Correspondent, has for very obvious reasons cancelled his visit to Moscow, and is proceeding direct to the Balkans from Poland.

At the time of the political trouble between Britain and the Soviet the B.B.C. was actually making final arrangements for Mr. Bartlett to broadcast to British listeners direct from Moscow, and, in addition, we

a friendly visit to Moscow this summer.

Derby Dialogues?

A running commentary on the Derby this year is due to be carried out in very much the same style as it has been year after year. Why can't we have something original?

To begin with, I should like to hear something about the Derby two or three days, or even a week, before it is run. Arouse listeners' interest; make them eager to hear the running commentary, and have them primed up with information and interesting facts about the race itself, the horses, jockeys, owners and trainers.

In the case of the Grand National, listeners only heard of the race for the first time a few minutes before the race was run, and I suppose a similar silence will be observed on the Derby until the relay from Epsom is actually started.

One will find that the newspapers are already discussing the most important racing event of the year, and it seems almost incredible that no one should think fit to make it a topic for the microphone. Why not, for instance, let listeners hear a little informal conversation in one of the big clubs, Derby dialogues or Derby chats, or something?

The Admiral and the Union

This may be Admiral Sir Charles Cypendale's last attendance at a full Spring meeting of the International Broadcasting Union in his capacity as President. Sir Charles, who, of course, is Controller of the B.B.C., has been President of the Union since its inauguration five or six years ago, and is held in great esteem by the broadcasting authorities of every European country.

It seems inevitable that the Admiral will resign from the B.B.C. at the end of the year, and there is little doubt that he will endeavour to leave the Union before then.

Sir John Reith is, however, doing his utmost to persuade his friend, the Controller, to remain; but since the retiring age of sixty has been fairly rigidly enforced in the B.B.C., there is no reason to hope that the Admiral—always a stickler for the observance of rules—is likely to agree to a concession in his own case.

RADIO COMES TO THE RESCUE



When the Milford Haven fishing centre was put out of telephonic communication with other parts of the country, short-wave radio stepped into the breach and enabled the orders to be dealt with. This is the operator at the Sremsca cut.

trifle, but I know him well enough to feel certain that if a suggestion is put up to improve the popularity of his orchestra without affecting his actual musical policy, no feelings of conservatism will prevent him from adopting it.

Hard-Worked Musicians

Incidentally, some of the members of the Symphony Orchestra were telling me that they consider themselves the most hard-worked orchestra in the world. For one thing, they contended that the orchestra made too many public appearances, including, of course, studio broadcasts; and, in addition, there are those rehearsals upon which Dr. Boult is so insistent.

listeners were to have been treated to some "Red" music.

Such broadcasts, if they could have been pulled off without trouble, would have considerably strengthened the goodwill between the B.B.C. and the Soviet broadcasting authorities at a time when close co-operation between the two organisations is just becoming vitally important.

In the autumn the B.B.C. will have to conduct some very delicate negotiations with Russia on the question of wavelength allocation and interference between stations. It is all the more unfortunate, therefore, that Mr. Bartlett, in his official capacity as a B.B.C. representative, should have been unable to break the ice by

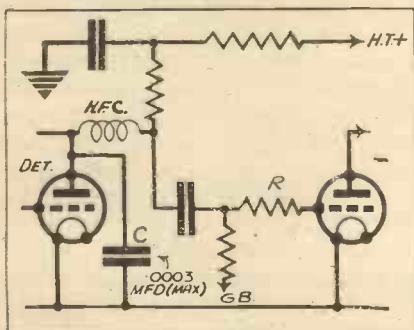
IMPROVING the DETECTOR

The advent of the highly-sensitive S.G. receiver has brought in its wake new problems which have to be overcome. In this interesting article our contributor, Mr. J. English, describes the effects of H.F. leakage and shows how easily it may be remedied.



A RADIO "disease," to which receivers with a sensitive H.F. stage are particularly susceptible, is that form of instability which only breaks out when the receiver is fully tuned to a transmission.

FOR R.C. COUPLING



When an R.C. stage immediately follows the detector it is advisable to insert an H.F. stopping resistance (R) and a small by-passing condenser (C).

Curiously enough, the stronger the latter the more pronounced the trouble.

There are varying degrees of this "disease," which is not due directly to instability in the H.F. stage itself. It may be a slight distortion of speech or music, more likely a burbling sound mixed up with the latter, an intermittent H.F. oscillation, or, in its most chronic form, a violent slow-speed oscillation.

Characteristic Symptoms

Other characteristic symptoms are that the receiver is completely stable when not tuned to a transmission, while the distortion or instability can be reduced and often eliminated by lowering the amplification of the H.F. stage or by weakening the input from the aerial.

In whatever form it appears, this kind of trouble is sufficient to render the receiver useless for either local or

distance reception, and unless you know the cause of the trouble and how to put it right, it can cause you quite a lot of annoyance and disappointment.

Now the real seat of the disorder is not in the H.F. side of the receiver, as might at first be supposed, but in the detector stage itself, particularly so when this is followed by a resistance-capacity coupling. When the receiver is fully tuned to a station, there is an

A GOOD CHOKE NECESSARY



The use of a good H.F. choke in the detector anode circuit is a great help in preventing high-frequency currents leaking into the L.F. stages. This applies to all classes of sets, but it should also be remembered that transformer-coupled L.F. amplifiers are not so susceptible to H.F. leakage as are those of the resistance-capacity type.

excessive leakage of H.F. past the detector into the L.F. stages, where it is further amplified, often to quite an alarming extent.

Consequently there exists a powerful H.F. potential spread over the output end of the set, whence it may be back-coupled partly through the H.T.

supply and partly through such stray couplings as the capacity between aerial and loudspeaker leads, to the H.F. stage. Thus is set up the H.F. instability and L.F. choking which causes the trouble.

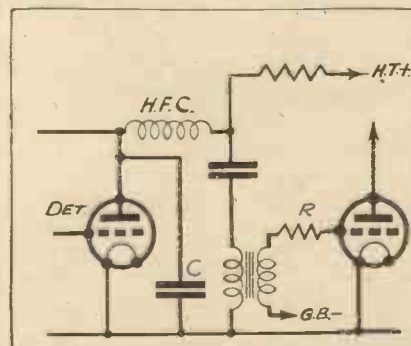
Whenever you run into such a spot of bother as this, you can easily prove for yourself that the detector is the cause of all the trouble by this simple experiment. Connect a .001-mfd. fixed condenser across the detector anode and filament, when complete stability results, unless the H.F. leakage trouble is particularly acute; but even then a marked improvement is noticeable.

A Satisfactory Remedy

This is not a satisfactory cure, however, because this shunt condenser causes considerable loss of the high notes at the same time. The only satisfactory remedy here is some form of H.F. filter without appreciable effect on reproduction.

The H.F. choke and differential reaction condenser of the ordinary detector circuit acts as a rudimentary H.F. filter. This alone is not sufficient

THE PARALLEL-FEED METHOD



If the remedies outlined for R.C. coupling are inadequate, the expedient of changing over to parallel-feed transformer-coupling may be tried.

Preventing Post-Detector Leakage

to overcome instability due to post-detector H.F. leakage, but you can make it more effective by the addition of a small by-pass condenser where this is not already provided, together with the insertion of a fixed resistance in the lead to the grid of the next valve.

Try a "Canned" Valve

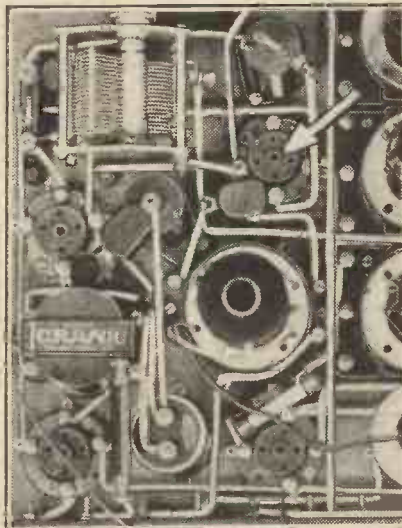
This "stopping" resistance, if not greater than $\frac{1}{4}$ megohm, causes practically no loss of volume or quality, while effectively restraining H.F. energy from reaching the L.F. side. Where the detector is transformer-coupled this resistance alone is generally sufficient to cure the trouble unless the receiver has a severe attack of the "disease."

In such cases the effect of improving the post-detector H.F. filtering must be assisted by isolating the H.F. stage from any remaining back-coupled H.F. leakage. Your coils will, of course, be of the modern screened

type, and your S.G. a metallised valve. If not, try the effect of "canning" this valve—it is well worth while.

The H.T. supply to the anode circuit of the S.G. valve should also be properly decoupled. Just a 1,000-ohm resistance in series with the H.T. + lead with a 1-mfd. condenser shunting the valve side of the resistance to L.T.—is all you require.

USING A DIODE



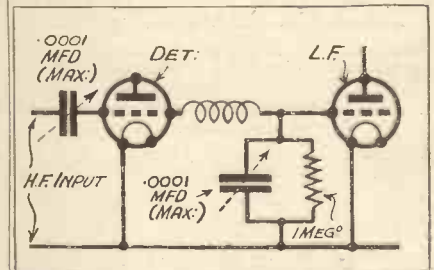
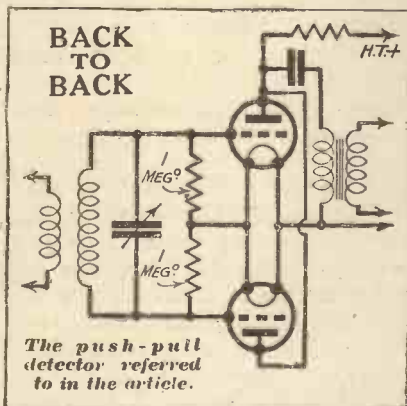
Apart from the conventional methods of detection, there is much to be said for the push-pull and diode schemes from the standpoint of post-detector H.F. leakage. The push-pull detector (left) is "self-filtering," and does not require special treatment. The diode needs a first-class H.F. choke—in some cases two chokes in series may be used—and a small by-passing capacity as shown. The photograph shows the application of the diode to the superheterodyne circuit, in which it functions particularly well as a second detector.

If you are using R.C. coupling after the detector and still get H.F. instability after trying such remedies as those described above, why not change over to the more modern shunt-fed transformer coupling? This change in itself is very likely to effect a complete cure, with a gain in amplification and still retaining high quality reproduction.

Push-Pull Detection

Those of you who have a liking for experiment will find considerable interest in the possibilities of push-pull detectors. Here we use two detector valves working "back to back" from a single coil input, their output circuits being coupled in parallel to the next valve.

When both valves are properly balanced, the H.F. currents in each detector anode circuit are exactly out of phase, and thus cancel out. Consequently there is no need for a post-detector H.F. filter, and no H.F. energy to leak into the L.F. side, there to become dangerous. This is certainly a type of detector stage worthy of more attention in the future, especially for inclusion in super-sensitive receivers.



MOST constructors are aware that, for the very best reproduction, it is necessary to mount a moving-coil loudspeaker so that its diaphragm is in the centre of a large baffle board.

Although the need for this expedient is almost universally recognised, it is not always so well known why the baffle improves reproduction. Ignorance of the principles involved often leads experimenters to employ baffles when they are not needed and to use unsuitable materials in their construction.

It is the low notes only which are affected by using a baffle.

Musical notes, like radio waves, have wavelength. Bass notes (low frequencies) possess relatively long

WHY BAFFLE THE LOUDSPEAKER?
 It is important to employ an adequate baffle for good moving-coil reproduction.

waves, while the upper end of the musical scale works on comparatively short waves.

The diaphragm of the loudspeaker, of course, radiates sound waves into the listener's room and does so from both of its sides.

Since one side of the diaphragm is "pushing" while the other is "pulling," it will be readily appreciated that the waves produced by the front will be of a sort which

would "cancel out" those emitted by the back if they were allowed to intermingle. Such intermingling does occur, but only with the low notes. So we use a large area baffle which prevents "back radiation" from mixing with "front radiation."

Where the high notes are concerned the wavelength is only a matter of inches, so the diaphragm itself acts as a very efficient baffle.

Low notes, on the other hand, have wavelengths of feet and even yards, so a large baffle area, extra to the diaphragm, is required to effect separation.

The baffle itself must not radiate, but it will be "driven" by the diaphragm if it is not rigid. Thick baffles are rigid but not essential.



I HAVE just been listening to a bunch of radio plays—three in one night seems a pretty good dose. I was particularly interested in one which is by a colleague of mine.

It is refreshing if a little surprising to find that wireless men possess interests outside radio. My own pet recreation is novel-writing—if a couple of fairly successful novels is sufficient justification for the claim. I have even been asked by Universal Pictures if I'm prepared to sell the film rights of a story.

I may get to Hollywood yet!—and what rejoicings would go up from Messrs. Frank, Fincham, Blake, and my other enemies. Watford, St. Helens, Chorlton-cum-Hardy and Papplewick would go gala.

Work in Hand

But lunches with Clara Bow and tea-parties with Joan Crawford are not very likely. Writing non-technical matter is a spare-time hobby, but I haven't had any spare time lately, and this summer is going to be busier than ever for me.

I am writing a very comprehensive book on modern wireless methods—the first wireless book I have written for about seven years. There are also some important sets undergoing experimental tests. It will be very hard to beat the success of the "S.T.300" and "S.T.400."

I think there have been more letters of appreciation for the "S.T.400" than for any set ever published in a wireless paper, and I wish to thank each and every one of my correspondents.

There have been a few squeals, of course; but out of the huge number of "S.T." sets built, one expects a few failures. But I believe in publishing squeals as well as appreciations. This is very unusual, of course, but a hushing-up policy does not appeal to me.

Looking Forward

The future for home constructors seems to me to be very bright, but the last year has shown that the public is becoming more discriminating and thinking more than once before building a set.

Informal and provocative, as usual, Mr. John Scott-Taggart deals this month with a wide variety of diverse and interesting topics ranging from spare-time hobbies to speed-cops.

We are going back to the system of "following" the designs of well-known designers, and it is a curious fact that widely-built sets are invariably the product of designers of many years' experience.

Giving Youth a Chance

As a matter of fact, I know of no really popular set developed by a new designer. This, I think, is a great pity. Young blood (by which I really mean new blood, since few of us are eligible for the old-age pension) should be encouraged.

But no, the old gang still cling to their power. I suppose I am the oldest gangster of them all, and after giving

the public six years' rest I find my sets far more successful than they were before.

Clever young designers have been tried by the wireless papers—I have given several their chance, myself—but the old gang seem to be irremovable.

The public, of course, is to blame. They will not "chance their arm." The unknown designer remains unknown, and we old fogies cling to our jobs with gnarled fingers.

However, some of us try to arrest the development of sclerosis of the inventive faculties, and the future for the home constructor is most promising.

Important Developments

A year ago, dismal Cassandra's were prophesying the end of progress, and yet to-day the home-constructed model could leave the average manufactured set standing.

The new Ferrocart coils, the Westector and "Class B" amplification are examples of developments which tend to render obsolete most existing sets. Especially important is "Class B" and Q.P.P. amplification, because the battery user can now outstare (and shout down) the mains-valve snob.

Just when home constructors' designs are becoming stereotyped, someone or something comes along and new life is given to the greatest of all hobbies. It has always been like that and will probably remain so.

* * *

Talking about wireless drama, why is it the B.B.C. should put over such

Television in the News Again

gloomy plays as "Macbeth" and the tragedy of "Agamemnon" on Sundays? These gory entertainments are certainly not calculated to brighten the Sabbath.

But to make a Sunday programme at all light and enjoyable "would offend religious susceptibilities." The B.B.C. can make us weep or yawn on a Sunday, but they must not make us laugh!

Dialling Relaxation

It must be infuriating to some people that one can turn the dial or dials a few degrees and obtain the programme which can make of Sunday a day of relaxation, not of morbid misery.

Ultimately, foreign programmes will force the hand of the B.B.C., but for the present Portland Place is certainly continuing to play for safety.

Sir John Reith is so right in not giving us what we want that he may be right in this matter of Sunday programmes. But I think that on the whole the B.B.C. err on the Calvinistic side.

Pandering to Puritans

As regards plays which "cleanse the heart with pity and terror," these are obvious sops to the puritanical. Drama is approved for Sunday diffusion provided it is both classical and tragic.

The Puritans, as everyone knows, stopped the practice of bear-baiting not because it was cruel, but because it gave pleasure to the ("human") participants.

The B.B.C., for similar reasons, veto light Sunday programmes. We might enjoy them.

Television is in the news again.

Sam Goldwyn, of Hollywood, believes in it, says it is imminent, that it will affect the cinemas, but not the producers (including Sam Goldwyn).

As one of the very few Californians who have both made money and kept it, Sam is worth listening to. The head of Philco has also listened to him, but disagrees. In fact, Mr. Samuel Goldwyn "has gone completely off the deep end."

Television at a Price

Philco's, apparently, are satisfied that they can produce a perfect television receiver, but it will be

at least eighteen months before any sane financier can be interested in television, and then it is estimated that the price of sets will be between £350 and £500.

"If Mr. Goldwyn is getting ready to back a television venture and if he wants to lose his shirt, well, it is his own shirt! In the meantime, the publication of his optimistic views is doing incalculable injury to both the cinema and the radio industry."

Perfection Next Year

This cold douche is all to the good, but Philco exaggerate the effect of television optimism. We are all as hard-boiled as half-hour eggs. As for losing shirts, it is the public that normally indulges in this practice.

CARLOS INKSTRAIN



Here is a photograph of Carlos, who, to use his own words, is "spying the inlet looking for the Ellerman steamer 'Cressado,' bound from Liverpool, containing the wireless apparatus."

The suggested price of £350 for a television viewer may startle one, but I prefer such an estimate to the confident speculations about the £15 set which will give perfect results next year.

In my opinion, however, television will never be a commercial proposition unless the sets cost less than £100. A figure of £40 would give television a chance, but nearly perfect results must be obtainable.

I refuse to believe that a public nourished on the high technical standard of the films will lap up an inferior imitation. Television has a

steeper hill to climb than had broadcasting.

There's Money In It

Any sort of a noise was good enough in the early days of radio because the only standard of comparison was a gramophone of indifferent quality. But television will always be compared with the "talkies," and until it can put up a comparable show the less ballyhoo the better.

I firmly believe in the future of television, because there is going to be a lot of money made out of it. But for a few years more, money sunk in television uncertainties is going to go down the jolly old sink.

An Apology! Captain Browne, R.N., thinks my reference to him as a gallant reader does not compensate him for my having split his infinitive.

A Seat in the Park

Captain Browne says: "I did not say 'to fitly symbolise,' although I may have written that if you wore side whiskers it would fitly symbolise a push-pull stage in your latest set."

As I am writing this on a 2d. seat (yes, I've just paid) in Hyde Park (it is 2.40 p.m., by the way), I am unable to look up the original letter.

Even the annoying passage of a football over my head will not urge me out of my seat until the lights twinkle in the Regal Cinema, which looks very regal with a multi-coloured picture of George Arliss, as a king, on the façade.

Letter from Portugal

[I feel a certain proprietorial right in Mr. Arliss, having travelled three thousand miles across America sitting next to him in the train.]

Darn that football: it whizzed two inches past my ear, just then.

Well, if here isn't a letter from good old Carlos, of Portugal! And a photograph of the old chap! I see he has written at the back of the photograph (reproduced herewith) that it is an illustration of him "spying the inlet looking for the Ellerman steamer *Cressado*, bound from Liverpool, containing the wireless apparatus."

I certainly seem to have treated Carlos badly. I still have the silver

(Please turn to page 105)



A PRACTICAL MAN'S CORNER

By R. W. HALLOWS, M.A.

Making a Seven-Pin Valve Holder

IN the old days of wireless we used to make our own valve holders; but, then, we made most of the parts that we used, not even excluding low-frequency transformers and variable condensers. What new-comer to wireless, I wonder, would tackle the task of putting 12,000 turns of spider-web wire on to the secondary of a transformer, or that of assembling several dozen fixed and moving vanes into the .001-mfd. variable condenser that was the ordinary thing in those days?

There is no reason, though, why anyone should jib at the task of making a seven-pin valve holder for "Class B" and other modern valves. It is a very simple business once you know how to set about it, and it does not take long. Marking out accurately the drilling centres of seven pins would certainly not be too easy if such a thing had to be done, but there is no need to bother about anything of the kind. The easiest method of finding the drilling centres is that illustrated in Fig. 1, where the valve is made to act as its own template.

The Valve as Template

Here is the way in which it is done. Take a piece of thick paper and wrap up in it tightly the piece of ebonite which you are going to use as your valve-holder base. Arrange the wrapping so that you have a smooth, flat surface covering what is going to be the upper side of the holder.

Damp your paper to soften it; then take the valve, see that it is fairly and squarely in the middle, and press it down hard so that its pins indent the paper. With a lead

Into these pages, month by month, our contributor packs a wealth of practical information and advice on constructional work. The regular reader of this "Corner" cannot help picking up a more or less complete training in radio workshop practice, while every month there are wrinkles to read, gadgets to make, and hints to help you.

pencil, dot each of the dents carefully. You will now have no difficulty in marking with a centre punch the drilling centres of the seven holes, punching, of course, through the paper into the ebonite beneath.

Completing the Holder

For the base of the valve holder, a piece of $\frac{1}{4}$ -in. or $\frac{3}{8}$ -in. ebonite is

FINDING THE CENTRES

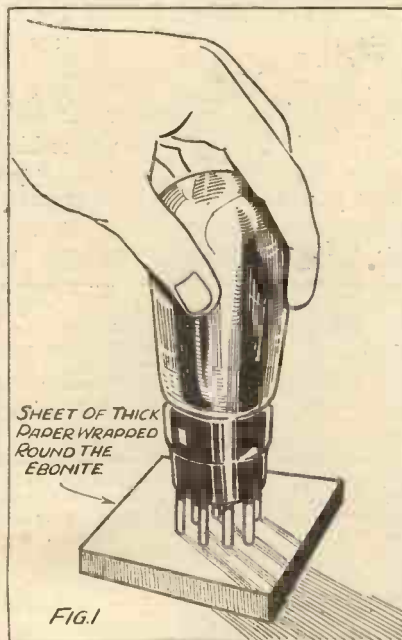


FIG. 1
The valve is made to act as its own template, the pins being pressed firmly on the dampened paper so that the drilling points are clearly marked.

required, which may be either 2 in. square, or circular in shape and 2 in. in diameter. Use very small, thin valve legs, such as those employed for making 6-pin coil holders. These have usually 6 B.A. shanks. Make sure that they are 6 B.A. by trying a nut on to them, and then make the holes with a No. 42 Morse drill.

No. 44 is actually the correct size for 6 B.A. tapping, but this is rather a tight fit, and No. 42 allows a good thread to be made in ebonite. (Should they be 5 B.A., you will require a No. 39 or No. 40 drill, whilst for 4 B.A. a No. 33 is the right size.) Tap your holes and screw in the valve legs with a soldering tag, preferably of the shake-proof pattern, beneath each.

Arrange the tags so that they are well separated from each other, as shown in Fig. 2, then drill a 6 B.A. clearance hole (No. 33) through each, and through the ebonite. Countersink all of these holes deeply on the underside. Insert a $\frac{1}{2}$ -in. 6 B.A. screw into each, tighten down with a hexagon nut, and then run on a terminal nut. You have then your seven valve pins connected to seven terminals by means of soldering tags. Should soldering tags not be available, use little strips of copper, brass or any suitable metal which is available.

A Home-Made Drill Gauge

If you don't possess a drill gauge, I strongly advise you to make one for all the drills in your possession, whether they are few or many. It is an easy job, and one which is very well worth while, as we will see in a moment. All that you need to make it with is a piece of fairly hard sheet metal of any kind not less than about $\frac{1}{8}$ in. in thickness.

A Practical Man's Corner—continued

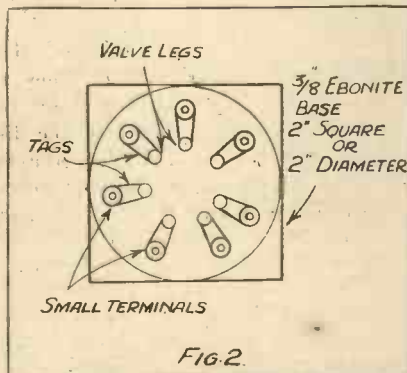
Begin by looking out your stock of drills, and arrange them in ascending order of size. We will suppose that there are nine, ranging from No. 40 Morse to $\frac{3}{8}$ -in. In that case a rectangular piece of metal about 3 in. in length and 1 in. in width will be just what is wanted. Scribe two straight lines along the whole length of the piece of metal, as shown in Fig. 3.

Care Necessary

On the upper line mark the centres for the five smallest drills, and on the lower the centres for the four biggest. Having punched the centres, take each drill in turn and run it through the metal, being very careful to go straight and not to let the drill wobble. You can, if you like, scratch in the drill-size against each hole with the point of a scriber, but this is not absolutely necessary.

Suppose that you want to make a hole through a screen that will be just a comfortable fit for the systoflex

READY FOR USE



The finished valve holder consists of seven valve legs connected to their respective terminals by means of soldering tags.

covering of a lead. Take a piece of the systoflex and try it in the holes in your plate until you find the one which is the best fit; then find the drill which fits the hole and use that.

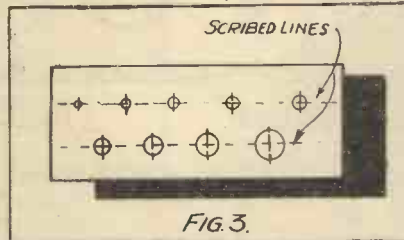
The same procedure will enable you to make tight-fitting holes for screws, terminal shanks, spindles, the bushes of components and so on. Once it is made, the drill plate saves a great deal of time and makes for neat, tidy work.

Repairing a Potentiometer

Most of us, I suppose, have experienced that exasperating piece of

trouble, a break in the windings of a wire-wound potentiometer. It seems a pity to discard a comparatively expensive component without making some attempt at repairing it, and, as a matter of fact, the break can often be mended successfully if you are

FOR THE WORKSHOP



When the drilling centres have been marked, the different sized holes are made, care being taken not to let the drills wobble. A gauge of this type will be found most useful in constructional work.

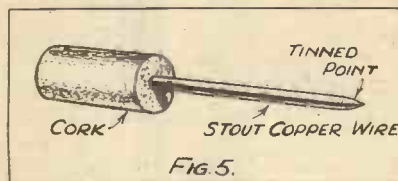
prepared to take a little trouble over the job.

The wire is so tightly put on to the former that as a rule only one or two turns come adrift when a break occurs. Find the ends, and, at the sacrifice, if necessary, of a turn or two, twist them together tightly as shown in Fig. 4, scraping them very gently with the point of a small penknife before twisting. The next process is to solder the joint, and unless you possess a very small soldering iron, it is best to make a special tool for this purpose. A useful pattern is illustrated in Fig. 5.

Fine Soldering

It consists, as will be seen, of nothing more than a piece of stout copper wire pushed into a hole in an ordinary

QUITE EASILY MADE



A special "iron" suitable for fine wire is readily made with the aid of a length of stout copper wire and a cork. The end of the wire is brought to a point and carefully tinned.

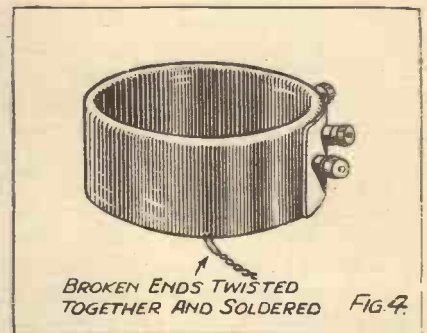
bottle cork. If you do not possess any copper wire of big enough gauge, you can purchase a piece or a short length of $\frac{3}{16}$ -in. or $\frac{1}{4}$ -in. copper rod

at any ironmonger's for a penny or so.

Bring the wire or the rod to a point, and tin this in the ordinary way. You will then be able to solder the joint in the broken wires without much difficulty. Whatever you do, use a flux of a non-acid type or corrosion may wreck your potentiometer within a comparatively short time. Having made your joint, cut the ends of the wires off short, dress the soldered joint with shellac or a drop of stove enamel, and tuck it neatly away. The potentiometer will probably be as good as ever when the job has been done.

Repairs to fine broken wires are, as a general rule, actually much easier than they look. The most ticklish one that I ever undertook concerned

DON'T SCRAP IT!



A wire-wound potentiometer can often be repaired by twisting the broken ends of the wire together and soldering them with a very small soldering iron.

a break in the windings of an aperiodic H.F. transformer wound with No. 47 single silk-covered wire, which is finer than a human hair. At first sight the job seemed impossible, but the transformer was an expensive one, and desperate diseases demand desperate remedies.

A watchmaker's "eyeglass" had to be used to enable the wires to be seen at all, but they were successfully soldered, and the transformer was perfectly satisfactory after the repair. Nothing venture, nothing have, is as good a motto in the wireless workshop as in most other places.

YOU WILL SAVE MONEY—

if you take advantage of the economy hints in "The Wireless Constructor." Many a reader has found that the practical ideas in one sixpenny number have saved pounds of unnecessary expense.



SPEEDOMETERS *for your* Radiogram

If you desire to get the best results from your records you must see that your turntable revolves at the correct speed, and some simple methods of achieving this are described below

By J. F. CORRIGAN.

CORRECT playing-speed is a matter of paramount importance in radiogram operation. The best of recordings reproduced on the best of machines will be ruined, so far as tonal character and quality go, if attention is not paid to the speed of its playing.

Facts such as this are universally realised by all radiogram enthusiasts. There is, indeed, no need for me to labour the point. There are three methods of ascertaining a radiogram's playing-speed.

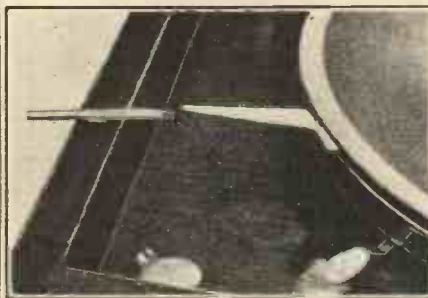
The first is to count the actual revolutions made by the turntable in, say, half a minute, and then multiply by two. This method will give you roughly the turntable speed of your machine. I feel bound to say, though, that it is not entirely reliable, no matter how careful you may be with your counting.

There are at least two or three good "speed-testers" on the market at the

present day. These mechanical gadgets, as you are probably aware, depend for their action upon a principle similar to that actuating the governor of a radiogram motor. In these articles a weight revolving around the turntable spindle is acted upon by centrifugal force, and it swings outward. A pointer is attached, the pointer being calibrated by the makers so that it registers when the turntable is being revolved at, above, or below the correct playing speed.

Stroboscopic methods of observing the periodic motion of moving bodies

USING A POINTER



One method of finding the revolutions per minute is to fix a paper pointer under the record and to count the number of times it passes a mark on the side of the cabinet.

are not new in principle, but their application to the determination of radiogram and gramophone turntable speeds has only been made comparatively recently. A stroboscopic speed-tester consists, simply enough, of a disc of white card which is ruled in black and white sectors.

A.C. Essential

The stroboscopic disc has a central hole, and it fits the turntable spindle. The radiogram motor is started up, and the stroboscopic disc is observed in the light of an A.C. electric lamp.

Note that a stroboscopic disc will not give any result at all unless it is observed under the illumination of an A.C. electric lamp. The reason for this we shall see presently.

An electric globe, fed by an alternating current, does not give a steady light, although to our comparatively insensitive eyes its illumination appears to be steady enough. In reality, the illumination derived from the lamp varies in its brilliancy at twice the frequency of the current.

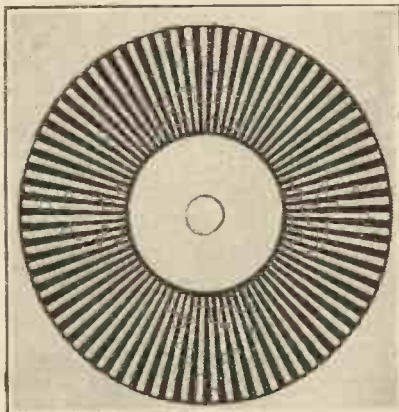
The Usual Case

Suppose, as is now almost universally the case in this country, that your A.C. lamp operates upon a 50-cycle current supply. This means that the filament is heated by the positive component of the current-cycle, extinguished, and then heated by the negative current component every $\frac{1}{100}$ th second.

If we take a stroboscopic disc, ruled in black and white lines or sectors, and, after placing it on the revolving turntable, we view the disc under the illumination of a 50-cycle A.C. electric lamp, the lines or sectors of the disc may appear to be stationary or they may appear to move in the direction of the turntable's movement, or against it, according to the actual revolution speed of the

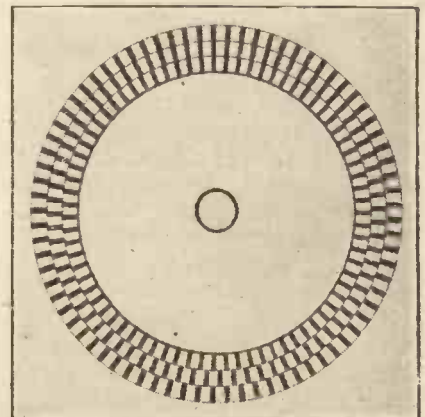
(Please turn to page 107)

SINGLE SPEED



Those who have A.C. mains can use a stroboscope disc to determine the turntable speed. In the case of the disc shown above, the black lines appear to be stationary at 80 r.p.m., provided the main has a periodicity of 50 cycles.

MULTIPLE TYPE



This stroboscope disc has three portions. On 50-cycle mains the outer ring appears to be stationary at 78 r.p.m.; the middle ring at 79 r.p.m., and the inner ring at 80 r.p.m.



PICK-UP HINTS AND TIPS

Some interesting notes on various practical aspects of radiogram reproduction.

By A. BOSWELL.

O PINIONS vary greatly on how long a needle should last. But however strongly you advocate the "one-needle-one-side" principle, you must admit automatic record changers call for long-playing needles.

Since chromium, by its use on motor-car radiators, became an "everyday metal," new uses for it have continually been found, and among these its application to long-playing gramophone needles.

Chromium needles are produced by the Columbia Graphophone Co., Ltd., are inexpensive, and will play up to thirty records.

Groove Length

The band of enthusiasts who pin their faith in fibre needles, no doubt mainly because of their record-saving properties, will be interested in the pick-up introduced specially for "fibres." It is somewhat on the expensive side, but that will not deter those who prefer this type of needle to all others.

And now, before leaving the subject of needles, do you know the length of a record? It certainly sounds funny to talk of the length of a circular object, but I refer to the length of the groove if it were in a straight line.

It has been calculated (although I did not work it out myself) to be about 220 yards for a normal ten-inch record. Four minutes for the 220 yards—the needle is certainly no record breaker!

Advising a Friend

Radiogram enthusiasts are often supposed to be radiogram experts by their friends. So here are a couple of tips in case you are called in to advise on the purchase of an instrument.

Test the motor for interference on record reproduction in this way: Switch over to "gram," turn the

volume control to maximum and hold the pick-up above the centre of the turntable, just clear of the latter.

Note how much hum there is and whether there is any crackling. Now switch off the motor and listen again. Any difference in the sound is due to the motor. And, remember, crackling is more likely to get worse than better.

The second hint concerns needle-scratch. Unless there is a tone control

RECORDS WORTH CONSIDERING

"Can You Spare a Dime?"	Brunswick.
Bing Crosby	
"Moop Song."	Brunswick.
Kate Smith	
"Piccaninnies' Heaven."	Decca.
Jack Hylton and his Band	
"The Lord Mayor's Show."	Imperial.
Jack Payne and his Band	
"The Kid From Spain." (Piano Medley).	Broadcast.
Peggy Cochrane	
"Boadicea March."	H.M.V.
Played at Leicester Band Festival	
"Look What You've Done."	Columbia.
Eddie Cantor	
"Playing With Fire."	H.M.V.
Anona Winn	
"Skirts."	Regal-Zono- phone.
Billy Cotton and his Band	
"What More Can I Ask?"	Columbia.
Layton and Johnstone	
"Under Heaven's Blue."	Columbia.
Albert Sandler	
"In the Moonlight."	Regal-Zono- phone.
New Grosvenor Orchestra	

on the radiogram, don't be too pleased if scratch is almost non-existent. It may mean that most of the higher frequencies are also non-existent.

A heavy bass effect may appeal to your friend at first. But the chances are he will soon tire of it.

There is hardly a single star performer, dance-band or orchestra heard on the radio which has not recorded some items. The pick-up enthusiast who takes full advantage of this is in a happy position.

By the judicious choice of records he can put on a synthetic radio programme containing all his favourites. If the records are purchased without being heard, they can be kept for that night when a good programme is specially wanted and the broadcast items appear particularly dull.

An automatic record changer would provide the finishing touch, but I wonder how many could keep the records without being tempted to "see what they are like"!

Warped Discs

Have you ever noticed how poor the record broadcasts from foreign stations are at times? I was simply amazed at one I chanced to hear the other night.

True, the item was a national anthem, and would get played a good deal, which accounts for the bad wear of the record, but that was not all. Not only did the motor slow up on heavy passages, but the waviness of reproduction was obviously caused by a warped record!

With insensitive pick-ups, and in cases where a big output is wanted from two stages, a high-ratio interval step-up transformer often simplifies amplifier design.

The input transformer used for Q.P.P. amplification has a ratio as high as 1 to 8 or even 1 to 10. By ignoring the centre tap such a transformer can be used as an ordinary one, and is worth experimenting with if you have one on hand.

Straightening Hints

Writing about warped records reminds me of an item I had intended mentioning—how they can be straightened. Some people seem to imagine a warped record is just as much done for as a cracked one.

This is far from being the case. Straightening a record is far easier than repairing a cracked one, if indeed the latter can be accomplished.

Here's the "recipe." Take two pieces of glass big enough to cover the record, clean and polish thoroughly and lay aside.

Now warm the record. Holding it by the edge between the fingers, rotate it like a joint on a spit in front of the fire.

Finally place between the sheets of glass and weight with heavy books. Remove when cool.

By the by—it's better to repeat the process than to overdo it the first time and distort the disc. Sometimes, warming the glass as well proves helpful.



CURING INTERFERENCE ON D.C. MAINS

ELECTRICAL disturbances due to the working of motors and similar machinery are the greatest bugbear of the town-dwelling radio enthusiast; he may possess the most selective and sensitive of receivers, but his range of reception may be limited to the local stations simply because, if the volume control is advanced to a point when foreigners should come rolling in, a crescendo of crackles and bangs issues from the speaker and effectively drowns any programme which would otherwise be received.

From time to time a mild outcry has been raised against this particular form of persecution, but it would seem

that legislation is necessary before the trouble can be tackled at the right end—i.e. at the source of the disturbances.

ting from direct current mains will be most affected since D.C. motors and generators, using brushes and other types of rubbing contacts, are constantly sparking and therefore generating H.F. energy, which will, of course, be picked up on the aerial.

But it is not generally known that a large amount of "interference" is introduced into the receiving set via the mains themselves, and can therefore be rejected by a suitable arrangement of H.F. chokes and by-pass condensers.

HOW TO MAKE A MAINS H.F. FILTER

By **BERNARD BARNARD**

Such an arrangement, which is here described, allows the D.C. free access to the set, but will not pass H.F. currents, and "shunts" these away from the receiver to earth.

When D.C. mains are employed there is the possibility of H.F. energy being picked up by the mains wiring and so causing background noises in the loud-speaker. Fortunately, these unwanted H.F. currents are quite easy to keep out of the set wiring by employing the method described in this article.

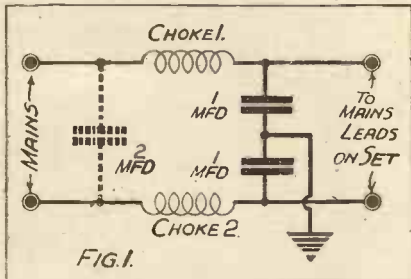
It is not proposed to give details of housing the components used in the smoothing unit, as the space required is very small and almost any discarded wooden box or cabinet can be pressed into service for the purpose.

The components required are as follow:

- One 2-mfd. fixed condenser, 500-volt test.
- Two 1-mfd. fixed condensers, 500-volt test.
- $\frac{1}{2}$ lb. (approx.) 22-gauge D.C.C. copper wire.

The wire is used for constructing two H.F. chokes which should be wound on a former about 3 inches in diameter, layer fashion, the turns

THE METHOD USED



The H.F. stopper consists of two chokes, one in series with each side of the D.C. mains. Any H.F. that passes through the chokes is by-passed to earth via the 1-mfd. condensers.

that legislation is necessary before the trouble can be tackled at the right end—i.e. at the source of the disturbances.

The B.B.C., in conjunction with the Post Office, has done much good work in this field, but their hands are tied as long as there are no means of forcing the owners of electrical machinery to prevent that machinery radiating H.F. energy.

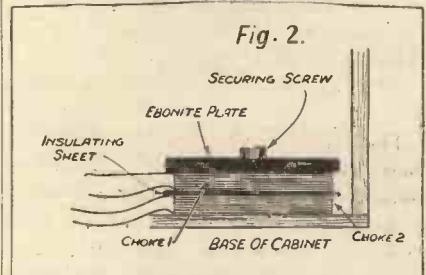
Minimising the Trouble

Set owners must therefore make the best of a bad job and make such modifications to their installations as are necessary to minimise the trouble.

Much more can be done at the receiving end than is generally supposed.

It is to be expected that sets opera-

HOME-MADE CHOKES



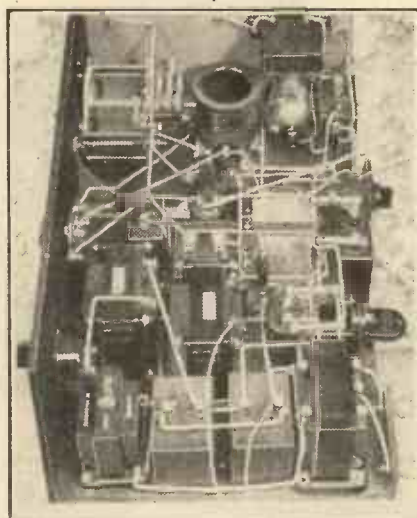
The H.F. chokes are wound with No. 22 gauge D.C.C. copper wire on a 3-inch diameter former, a sheet of good insulating material separating the two windings.

being secured by the simple method of tying them together at several points of the choke's circumference.

About 50 turns for each choke will be sufficient and, although the exact number of turns is not important, it is advisable to make sure that they are more or less identical in this respect.

Condenser Connections

Reference to the diagram on this page will show how the two condensers are connected; the 2-mfd. is connected directly across the mains, and also to one end of each choke. The two 1-mfd. condensers are joined together. One terminal (outer) goes to the set and to the other end of choke 1, the other outer terminal being connected similarly to choke 2 and the set.



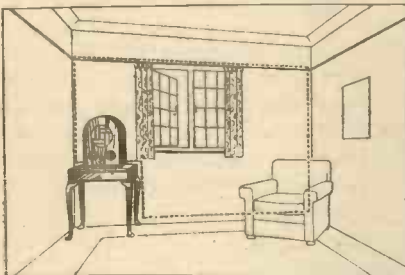
When D.C. mains are employed there is the possibility of H.F. energy being picked up by the mains wiring and so causing background noises in the loud-speaker. Fortunately, these unwanted H.F. currents are quite easy to keep out of the set wiring by employing the method described in this article.

Curing Interference on D.C. Mains—continued

The joined terminals on the condensers should go to a good earth (if possible an earth connection independent of that used for the receiver).

The way in which the unit rejects the H.F. currents which form the

FOR USE INDOORS



The erection of an indoor loop aerial is useful in cases where interference is picked up by the normal aerial system.

“interference component” is roughly as follows.

H.F. currents cannot readily pass through the two chokes and will take any easier path to earth which may be open to them, such as via the capacity of the mains; so that much of the unwanted current is lost or “by-passed” at this point. An additional 2-mfd. condenser may also be joined as shown dotted in the diagram.

Insulation Precautions

Some will get through, however, and this residue is effectively dealt with by the two 1-mfd. condensers with their earthed centre point.

The arrangement of the two chokes can be seen from Fig. 2.

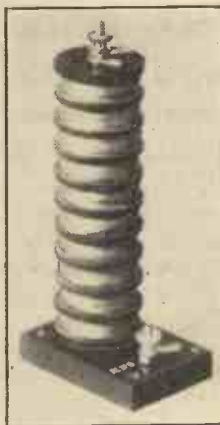
Take the precaution to interpose a good sheet insulator between them, however, as the insulation of the

wire is insufficient to withstand the full mains voltage for any length of time. A thin sheet of ebonite or celluloid will serve very well.

Having completed this simple constructional work, it is only necessary to place the unit in circuit between the mains point and the mains leads from the set.

Suitable plugs and sockets for the input and output ends of the unit are shown in the accompanying diagram.

You may now switch on the set and test out the smoothing unit. You are sure to find an enormous improvement, but the degree of success attained varies considerably with local conditions.



A COMMERCIAL TYPE

A commercial mains H.F. choke made by Messrs. Wright & Weaire. These special chokes are wound with wire of substantial gauge since they may be called upon to carry the whole of the current taken by the set.

Unless you are very unfortunately placed, a reduction of interference level of at least 50 per cent may be confidently expected.

In these circumstances you will find that the remaining interference takes the form of loud rushing noises when the set is tuned to a dis-

tant station; this is due to modulation of the received carrier wave by that part of the interference which is picked up on the aerial.

The residual interference can be greatly minimised by the use of a loop aerial!

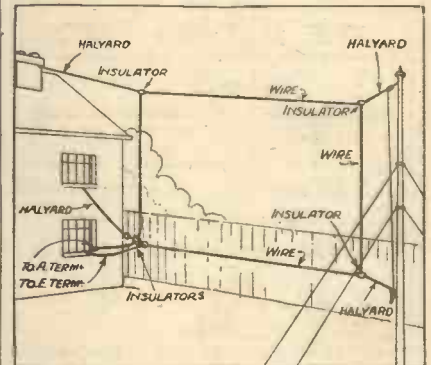
No Direct Earth

Such an aerial takes the form of a vertical loop of wire, of largest possible dimensions, one end of which is connected to the aerial terminal of the receiver and the other end to the earth terminal; no direct connection to earth is made from the set.

Both indoor and outdoor loops are shown in the sketches, and no difficulty should be experienced in erecting an aerial similar to one of these.

Obviously, with a loop aerial a certain amount of sensitivity must be lost, but, since the interference level is

WHEN SPACE IS NOT LIMITED



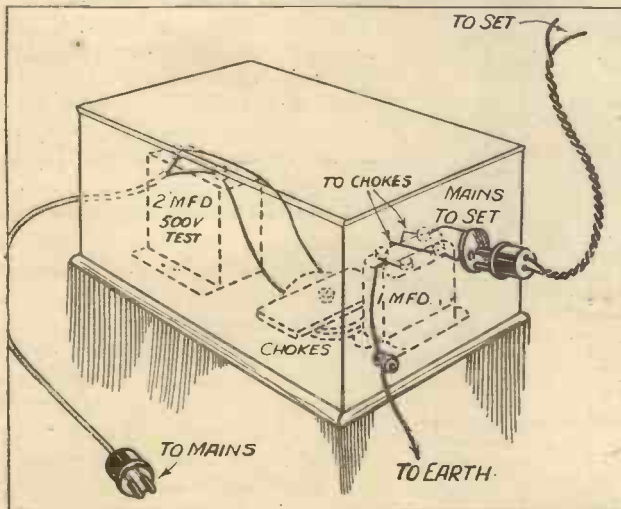
Provided sufficient space is available, an outdoor loop aerial is to be preferred to the indoor type. Such an aerial consists of an unbroken length of wire, one end being joined to the aerial terminal of the set and the other end to the earth terminal.

reduced to a much greater extent, the overall result is a considerable gain where distant reception is concerned.

More Generous Lines

In conclusion, where electrical interference is extremely severe it is often of advantage to construct the smoothing unit on more generous lines and to install it close to the electric light meter; if this is done, H.F. energy will be prevented from entering any of the lighting circuits in the house, which will, of course, help to reduce the interference which the aerial picks up. Such an installation should be carried out by a competent electrician.

THE COMPLETED FILTER UNIT



This diagram shows the suggested arrangement for the filter unit. The 2-mfd. condenser may not be needed in every case, the mains leads then going direct to the chokes. The two 1-mfd. condensers are essential and are connected as follows: One side of each of the chokes is joined to one terminal of each condenser. The remaining two condenser terminals are connected together and to earth.



QUESTIONS I Am Asked

by JOHN
SCOTT-
TAGGART

Q. 24. Is an indoor or an outdoor aerial the better when there is interference from mains, etc. ?

A. It is impossible to say definitely. It depends on whether the outdoor aerial would approach the source of interference. Usually a large aerial is desirable so as to get as big a proportion of radio signals as possible, but there is no definite rule.

Q. 25. What are the chief losses in a tuned circuit ?

A. The losses are chiefly in the inductance which may have a high-frequency resistance of, say, 12 ohms (on the medium waveband) as against, say, 3 ohms for the variable condenser. High-frequency resistance is caused by eddy-current losses, skin-effect and dielectric losses.

Eddy currents are stray unwanted currents which are produced in the metal of the wire by the magnetic field produced by the H.F. currents. Eddy currents are greater when thick wire is employed.

Skin-effect is the name given to the fact that H.F. currents travel on the outside of wires, and not evenly through the wire as do direct currents. As a result only part of the metal is usefully employed as a conductor. To decrease the resistance due to skin-effect a thicker wire is usually employed. This unfortunately increases the eddy-current losses, but these are generally more than balanced by the reduction of skin-effect.

Litz wire, which consists of a number of fine insulated wires suitably twisted together, reduces both eddy currents and skin-effect.

Dielectric losses are due to the coil former and the insulation on the wire. Air-spaced coils would be ideal but are only practicable for very short-wave work. Actually, bakelite tube and

enamelled wire cause no appreciable loss. Cotton-covered wire can be a source of trouble owing to the absorption of moisture. Even silk-covered wire must be watched.

Q. 26. Why does a valve not pass a large current when the H.T. is connected ?

A. It is because the current through a modern valve consists purely of electrons which travel from the filament (or cathode) to the anode. Each electron is a bit of negative electricity, and the stream of electrons exerts a repelling effect on the electrons leaving the filament.

The science of radio is one that is still developing, and its whys and wherefores are full of interest. In this exclusive feature all that skill and ability which have made our contributor famous as an expert radio consultant are placed at your disposal every month.

Even if your particular trouble is not dealt with in this issue, you cannot fail to appreciate the characteristic enlightenment which Mr. Scott-Taggart brings to every subject.

A crowd can never leave a football field all at once because those in front get in the way of those behind. The same applies to electrons. They hate each other like poison and repel each other since they are all negative. In fact, in a valve, the electrons are widely spaced. They "keep their distance"—which is about 1/100th millimetre. This is a wide separation when one considers that an electron is the smallest particle we know, and is only about 4/1,000,000,000,000th of a millimetre in diameter. Electrons on their way to the anode are terribly standoffish. If you and I went for a walk and were as companionable as electrons in a valve, do you know how close to each other we should be ? We should stroll along 1,000,000 miles (yes, a million miles) apart.

Is it any wonder that, although the filament of a valve may give off 100

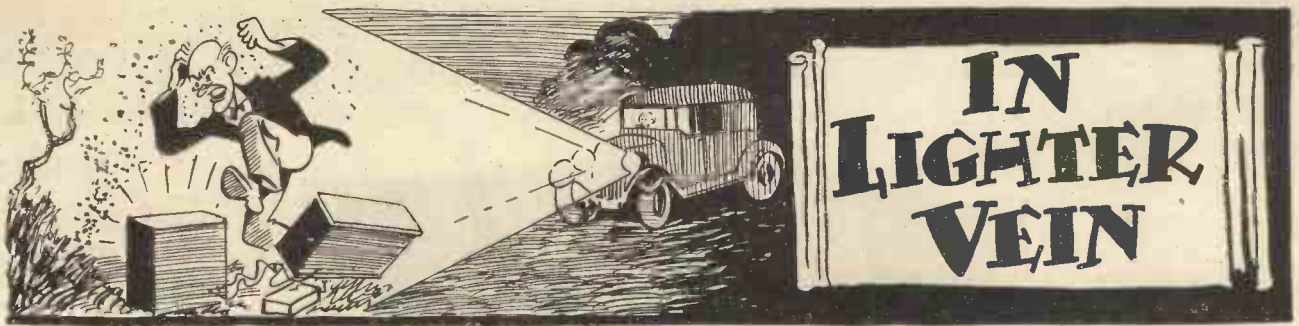
amperes of electrons, the anode current may be only 10 milliamperes ?

Q. 27. How can I test a 2-mfd. condenser ?

A. Try for a short-circuit by connecting momentarily across your accumulator. A spark would indicate a direct short. Such a fault is unlikely. For leakage test, connect condenser across the full voltage of your H.T. battery for a moment, and then disconnect from H.T. The condenser should now be in a charged condition. Short it with a piece of wire; a spark should be obtained as the free end of the wire approaches the other terminal. Charge up the condenser again and leave for several hours and repeat experiment; if you get no spark, it is likely that there is a leakage inside. Make sure by repeating the test. A perfect condenser will retain its charge, sometimes, for days. A condenser with a slight leak will cause some wastage of H.T. (in many sets even with the receiver switched off), but beyond the possibility of noisiness it will usually not interfere with the working of a set; this is because these large condensers are usually placed in harmless positions.

Q. 28. I do not understand how in your A.C. "S.T.400" you obtain sufficient H.T. voltage to work your valves. Simple arithmetic shows that the 250 volts supplied by the mains transformer will be cut down to 150 volts owing to the 2,000 ohms of the field winding of the speaker.

A. Sorry, but your arithmetic is too simple. The 250 volts from the mains transformer is the R.M.S. value of the A.C. voltage. The peak voltage is nearly half as much again, and the D.C. voltage supplied by the rectifier is nearer the A.C. peak voltage. The voltage drop across field windings, etc., was such as to produce the right potential on the anode of each valve.



IN LIGHTER VEIN

"FIFTEEN love," I cried, getting in a magnificent swipe.

"Fifteen all," echoed the Professor from the other end of the lawn.

We were engaged not in the mere tame pastime of whanging a ball over a net, but in the far nobler sport of wasp-tennis. In case you have never indulged in it, let me explain. Each player requires a racket. The Professor and I had acquired ours from Primpleson and Tootle, both of whom were luckily out when we called in search of weapons. The game consists in swatting wasps on the wing, sitting shots not being allowed. Every wasp killed is one up to the slayer, scoring being as in tennis. Anyone who gets stung loses the set.

A NEW SPORT!



"Both of us must have put real beef into our swipes. . . . There was a horrible splintering of wood and twanging of breaking strings."

The game went forward at a mad pace. We reached deuce for the twenty-seventh time in the fifth and deciding set, and for a moment there was a complete lack of quarries. Then a fine fat wasp zoomed over my head and hovered above the middle of the lawn. The Professor and I were after it like greyhounds after a hare. It swooped towards earth.

Squash Racquets

"Mine," I roared.

"Mine," screamed the Professor.

Both of us must have put real beef into our swipes. The wasp, I think, must have flown into a thousand fragments. There was a horrible splintering of wood and twanging of breaking strings.

"It would be better," I suggested, "to get these back in their presses

This month the Professor turns his attention to wasps, and evolves a completely novel and "infallible" method of destroying them. The results from the Professor's standpoint are somewhat unfortunate, as "Wayfarer" points out.

before their owners return to their respective homes. This will be a perfect godsend to them, for the Mystery Of The Spontaneous Shattering Of The Rackets will give them something to talk about for days."

Something Scientific

Having restored the rackets to their owners, the Professor and I returned to the garden of the "Microfarads," where we flung ourselves into deck-chairs intending to seek refreshment in strawberries and long glasses of lemonade. Wasps, however, appeared to regard our food and drink as gifts sent to them by the gods. Within five minutes we were in full flight for the house.

"Look here," I said, "there must be the father and mother of a wasps' nest close by. They've got to be exterminated. Surely with our united brains we can devise a new and infallible method of so doing which will be of the greatest service not only to ourselves but also to readers of THE WIRELESS CONSTRUCTOR. Something really scientific, of course. Now how about bombarding them with neutrons or googly electrons or cosmic rays or something?"

An Infallible Idea

"I have it," cried the Professor. He threw himself into a chair, from which he leapt almost before he had alighted, with Toodles, Mrs. Goop's gigantic tomcat, clinging, all claws, teeth and angry screeches, to his southern aspect. Detaching himself from the Professor, after a dozen lightning short-arm jabs to the mark, Toodles did five circuits of the room at lightning speed with every hair erect, fled through the French window and ascended the tallest poplar in about three bounds.

"When you said that you had it," I inquired, "I take it that you were not referring to Toodles?"

Professor Goop sat down in another chair, but rose hastily and leaned against the mantelpiece.

"My idea," he said, "is something completely novel and absolutely infallible for the destruction of wasps' nests. We, my dear Wayfarer, will show the world how it may be done in perfect safety."

"And how," I asked, "do you propose to do the deed?"

"You have doubtless read that bacteriologists have discovered that milk can be completely purified by subjecting it to certain sound waves.

Shattering Microbes

"These waves have the effect of literally shattering such microbes as it may contain to atoms. All that we have to do is to find the wavelength which shivers the timbers of wasps. We will then apply it via the wireless set and the biggest loudspeaker that we can borrow, and not one wasp will be left to tell the tale."

It was clearly a magnificent conception, and we started experimental work at once. A basin of golden syrup was placed close to the loudspeaker, and as soon as a few wasps

TOODLES TAKES A HAND



"He threw himself into a chair, from which he leapt almost before he had alighted."

had collected we tried the effects of various kinds of broadcasts upon them in order to discover in a general sort of way whether any of them contained what journalists of the popular press term the death ray.

It was proposed by me and seconded by the Professor (after I had put in a little persuasion with the help of an

In Lighter Vein—continued

earth tube that happened to be lying handy) that he should remain in the room to conduct the experiments, whilst I stayed outside and closed the window as soon as a satisfactory number of wasps were assembled upon the bait. I pointed out that mine was by far the most dangerous post since the number of wasps outside was clearly infinitely greater than that within.

There were seven in the first batch, and the Professor tried them with a topical talk. The whole seven immediately left their feast and stung him enthusiastically.

PROOF OF FINDING



“Edward Bugsnip was entrusted with the task of locating the nest. When he reported half an hour later it was clear that if nothing else had happened the nest had certainly located him.”

Having applied the blue-bag, we decided that music should be tried. Eleven wasps formed the audience this time, and the Professor turned on one of those super-wobbly contraltos in which the B.B.C. seems to specialise. A shudder ran through the frame of every wasp. Then each deliberately plunged its head beneath the golden syrup and committed *hari-kari*.

The Plan of Campaign

The problem was obviously solved. We rigged up at once a set designed for a 50-watt output, borrowed Sir K. N. Pepper's Super-Bullroarer loud-speaker and determined to do the deed that very evening. Meantime, Edward Bugsnip, the Professor's gardener, was entrusted with the task of locating the nest. When he reported half an hour later it was clear that if nothing else had happened the nest had certainly located him, for he seemed to have bumps and tender spots all over. He had marked it, he assured us, with a large white stick, and how it had marked him needs no description of mine.

Our plan of campaign was simple. It was decided—and here again the earth tube had played its part—that the Professor should operate the

receiving set and the loudspeaker close to the nest, whilst I, seated in his Baby Forced-in saloon, should direct a spotlight upon the scene of action. Mine, as I explained quite clearly to him, was plainly the post of danger, since any insects not stunned by his loudspeaker would be attracted by my light.

Zero Hour

As soon as it was dark the little car was moved into position and the Professor proceeded to erect his apparatus within a few inches of the mouth of the now quiescent nest. Large bowls of golden syrup were provided for massed suicide on the part of the wasps, and anxiously we waited the zero hour of 10.15 p.m., at which time the wobbliest of all contraltos was billed to burst into song from the London Regional. Carefully I directed my spotlight upon that small but important hole in the ground. Equally carefully I saw that all the doors of the car were firmly shut and all the windows completely closed.

My eyes were focussed upon the clock, my right ear and both my lips were focussed upon the telephone which connected me with the Professor.

“Ten-fourteen—ten-fourteen and a half—ten-fourteen and forty-five seconds—fifty seconds—fifty-five seconds. One—two—three—four—Go!” I shouted into the microphone.

The Professor switched on. “—unable to sing to-night. In her place we are having a talk upon the Mother-love of the Freshwater Shrimp,” I heard from the loudspeaker. Before the paralysed Professor could do anything the talk had started. Next instant about ten million wasps leapt from their fastness beneath the earth and flung themselves upon him in a paroxysm of wrath.

Locked Out

Fortunately I had been wise enough to lock all the doors of the car or the Professor would probably have fought his way in and brought his aggressors with him. Perhaps I ought to have switched off the spotlight, but one cannot always think quickly enough in emergencies. I kept it fixed upon him as he ran hither and yon, and this may have helped the wasps to keep their prey in view. He dashed up to

the car, beating upon the window and yelling for admittance.

“Not much,” I yelled. “The only thing is the pond.”

As it was not the fifth Saturday in the month the idea of a bath, and a cold one at that, would in the ordinary way have made little appeal to Professor Goop, but needs must when the devil drives.

Breaking all records for the cross-country fifty yards, he plunged into its slimy waters, catching his foot in a variety of wires as he did so and taking both the set and the loud-speaker in with him.

It was hours before the wasps finally went back to bed, and the Professor got a magnificent amount of practice in under-water swimming.

Wobbly contraltos are definitely the goods when it comes to wasp-stunning, but make very sure that the one you select is not going to be indisposed at the critical moment.

ALL DOORS LOCKED



“He dashed up to the car, beating upon the window and yelling for admittance.”

* WHEN DRILLS *
* WEAR OUT *
* A useful economy hint. *

MOST people, when a drill begins to polish rather than to cut, consign it to the dustbin and purchase a new one. A much better method is to discover whether there is not at your local garage a fitter who knows something about tool-making in general and drills in particular. If there is, you will probably find that he will undertake the job of grinding your drills for quite a modest sum.

Given such a handy man, it pays over and over again to let him have your entire stock of drills at intervals, which, of course, depend upon the amount of use that they have. Failing a fitter of this kind, a tool shop will undertake the renovation of drills.
R. W. H.

THE MONTH ON SHORT-WAVES



All the latest news about this interesting waveband.

HEADPHONES and hot-weather (optimistic ever!) do not go well together, and I do not believe in being any more of a martyr to the short-wave cause than I can help.

Yes, you have probably guessed correctly. Following another month of experience with my new short-wave superhet adaptor, I have renounced headphones almost entirely.

A New Adaptor

I mentioned last month that I contemplated making a permanent change-over to loudspeaker listening if results continued to be as satisfactory as they had started off, and now I am absolutely convinced that I am not missing anything by searching direct on the speaker.

But knowing short waves as I do, I am going to reserve to myself the right to change my mind if—but sufficient unto the day! At present the superhet adaptor is definitely

“holding the field,” and several of my short-wave friends have warmed up to the extent of asking me for details.

Will readers who have taken the trouble to write in kindly note that I am hoping to make arrangements for the circuit to be published before very much longer. Meanwhile, perhaps it will interest you to know that fundamentally it is a perfectly straightforward combined oscillator and first detector superhet scheme preceded by a tuned S.G. H.F. stage. And now to business.

With the exception of one or two really good nights, the American stations have been very mediocre in my district during the last month. W 8 X K at times was fair to good, but W 2 X A D has been very poor. Only once was he above R.4, and then the general background level was too high to be comfortable.

I have given up looking for reasons when trying to explain away some-

thing connected with short waves, but why W 2 X E should suddenly have sprung into the limelight when the other American “punch-merchants” comparatively were so poor is quite beyond me! I have heard him on several occasions, and although the strength was never greater than R.4, intelligibility was very good.

Getting the Antipodes

W N C is also a new one to me. From what I can gather, it is a new phone station at Florida, and when I heard him he was calling G A T on a wavelength of approximately 20 metres. Can any CONSTRUCTOR reader amplify the details?

Concerning the other side of the world, I was not once able to listen to the Sunday transmissions from Australia, but for those of you that are up with the lark on weekdays, it is often possible to get a very good signal from the Antipodes. Between 7 and 8 a.m. B.S.T. appears to be about the best time at present.

Heard Johannesburg?

I am wondering who is going to be the first reader in these Islands to report reception of Johannesburg on 49 metres? I have had one letter from Burma reporting R.8, and if they can do that sort of thing in Burma, well— Anyway, thanks, L. J. Q.; for your most interesting letter. We are glad to hear that you are keeping the short-wave flag flying in Burma. G. T. K.

IN spite of all the publicity given to Broadcasting House and to the Brookmans Park station, many people are misled by the aerial on top of the B.B.C. headquarters in Portland Place.

Time and time again I have come across listeners living in the London district who consider Broadcasting House to be their nearest B.B.C. station. Let me assure them that although the studios wherein their programmes generally originate are in Broadcasting House, the actual radio waves come from the aerials at Brookmans Park.

A Bit Tall!

Good radio jokes do not often come my way, so I pass on one told me the other day. I was assured that its origin was quite spontaneous, too.

“By Jove! It’s ten o’clock. I must be going,” said Jones, jumping up. “It’s only eight minutes to by my watch,” replied his friend.

 * **“ON THE GRID”** *
 * * * * *
 * *Brookmans Park and London* *
 * *listeners—“Too much reaction!”* *
 * *—Measuring L.T. voltages—* *
 * *Rapid radio progress.* *
 * * * * *

“Well,” responded Jones, “I put mine on by the wireless to-night.”

Came the retort: “Ah, old man! You must have been using too much reaction!”

And now to turn to something a little more practical. Measure your L.T. voltages at the valve holder!

Though most constructors realise that a high-resistance voltmeter should always be used for taking voltages on a radio set, they seldom seem to appreciate the best points at which to make the measurements. L.T. voltages are usually measured directly across the battery itself.

Unfortunately this does not show up any loss of voltage that may be

due to dirty spade-tags or bad joints. Measure your L.T. across the filament terminals of a valve holder with the set switched on.

In this way you will ascertain whether the filaments are really getting their full voltage.

Latest Developments

“Cold valves,” “Q.P.P.,” “Class B,” H.F. pentodes, double diode-triodes, and—what next?

We have certainly had a surfeit of new developments in radio of late—developments which will greatly enhance the attractiveness of the Radio Show this year. Even if nothing else comes along in the meantime, there will be less reason than for several years past for the pessimists to say, “Radio progress is at a standstill.”

As a matter of fact, never before has the circuit of the really up-to-date receiver changed so much in so short a time. A. S. C.

AS WE
FIND
THEM



NEW
APPARATUS
TESTED

Screened H.F. Choke

VALVE development, with its consequent increase in all-round magnification, has made it essential to reduce stray magnetic couplings to an absolute minimum by employing metal screening.

This, of course, has applied to tuning coils for a long time, but only

WELL SCREENED



The "Gottone" screened H.F. choke is specially suitable for use in shunt-feed S.G. circuits and has a high inductance value. The winding is capable of carrying up to 50 milliamps.

lately has it been considered necessary to carry out this procedure in the case of H.F. chokes.

Actually, there are two ways of preventing the choke field from affecting adjacent portions of the circuit. One is by using a special method of winding, as in the binocular types, and the other by employing a metal screen surrounding the choke.

Messrs. Ward & Goldstone are manufacturing a choke of the latter type, the calculated inductance being 250,000 microhenries and the D.C. resistance 550 ohms. This particular model with its high inductance value is specially suitable for use in conjunction with S.G. valves, as, for instance, when parallel-feed H.F. coupling is employed.

The choke is capable of carrying

Under this heading we publish reviews of apparatus submitted by radio manufacturers and traders for examination and test in "The Wireless Constructor" laboratories.

up to 50 ma., and a low self-capacity is ensured by the sectionalised method of winding. The retail price is 4s. and the makers are Messrs. Ward & Goldstone, Frederick Road, Manchester.

Clix Components

The latest addition to the Clix range is an excellent wall plug having non-collapsible pins. Even when deliberately compressed with a pair of pliers the pins return to their original set.

A GOOD WALL PLUG



The latest addition to the Clix range is an excellent wall plug having non-collapsible pins.

Moreover, the pins provide a parallel surface contact as distinct from an ordinary splayed plug which gives a point contact only.

Another feature is the case with which the flexible connecting leads can be attached. The usual securing screws are dispensed with and instead the end of the wire is merely passed between the head of the pin and a bridge piece, where it is firmly gripped in position.

Strain on the flex at the contact point has been eliminated, and there is no possibility of the connections "pulling out" in normal use.

This Clix wall plug is supplied in either brown or black finish, is beautifully made, and retails in the 5-amp. type at 9d.

A further component in the Clix range is a seven-pin chassis mounting valve holder for the new double valves. It is priced at 1s.

The valve holder incorporates a floating socket mounting, each socket automatically aligning itself to any variations in centres or angle of the incoming valve pins.

The insulating discs are of bakelite, and connection is made to the sockets by passing the connecting lead through a side hole and securing it with a vertical screw. This valve holder is a first-rate job and should achieve considerable popularity with those constructors who prefer chassis designs. - The makers are Lectro Linx, Ltd., 79a, Rochester Row, London.

Block Accumulators

The Block accumulator is a notable development of the famous Fuller Block accumulator which many readers who served in the forces during the war will no doubt remember.

The new accumulator has no interleaving plates to disintegrate or buckle and has twice the capacity of an ordinary accumulator of similar size and weight.

Our tests with this battery, which have extended over a period of some months, have been very satisfactory.



**FOR
"CLASS B"**

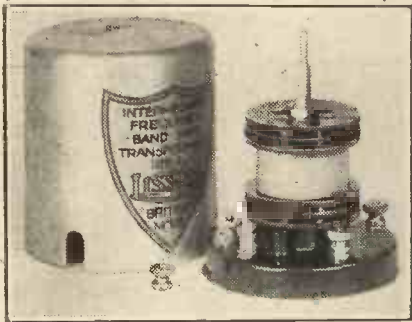
This is the new W.B. seven-pin valve holder for "Class B" valves.

As We Find Them—continued

The maker's claims as to the capacity and reliability under working conditions have been fully borne out.

The Block accumulator is built into an attractive coloured container, the

MATCHED AND SCREENED



The Lissen intermediate superhet transformers are designed to work on a frequency of 126 kcs., and are capable of giving a very high degree of selectivity.

terminals are large and clearly marked, while a useful refinement in the form of a carrying strap is provided. We can thoroughly recommend this battery, which is made by Block Batteries, Ltd., Abbey Road, Barking, Essex.

Lissen I.F. Transformers

Given a good design together with properly matched intermediate stages, the superheterodyne receiver is unquestionably a delightful instrument to handle.

But if the intermediate transformers are not efficient the marked advantages of the superheterodyne principle will be sadly lacking, selectivity and sensitivity both falling far short of the high standard that one is led to expect.

Manufacturers are fully aware of the necessity for accurate matching, and research is constantly being carried out with the object of providing the home constructor with "one hundred per cent" matched components. Messrs. Lissen, for instance, have now entered the field with an intermediate band-pass transformer designed especially for the constructor.

Each transformer is sent out tuned to a frequency of 126 kilocycles, and the makers state that the response curve obtained with two of these components will be quite flat for approximately 3.5 kcs. (plus or minus), cutting off to less than one-hundredth of the peak at 9 kcs. off resonance.

The transformer coils are wound in double slots on a paxolin former and are spaced accurately so as to ensure

the correct degree of coupling. In the base of the coil are two preset condensers and each unit is completely screened with a metal cover.

We would commend these transformers to the attention of superhet enthusiasts, who will be interested to know that although the efficiency is high, the price is very moderate—7s.6d. being the cost per unit.

The makers are Messrs. Lissen, Ltd, Worple Road, Isleworth, Middlesex.

"Class B" Components

Those who are contemplating conversion to "Class B" amplification will be interested in the R.I. "Drivermu" input transformers and "Class B" output choke.

HAS NO PLATES



The Block accumulator has no interleaving plates like the ordinary E.T. battery. It is built into a very attractive containing case.

"Drivermu" transformers are available in various types, and are suitable for use with any type of "driver" valve or "Class B" output valve.

A "Class B" input transformer should have carefully balanced secondary windings, and the D.C. resistance must be kept down to a low figure, otherwise distortion is liable to occur.

Moreover, a high primary inductance is necessary, and this has to be maintained when the steady current is passing through the winding.

Add to these essentials the need for high overall efficiency, together with a suitable matching ratio, and you will see that the design of "Class B" transformers is a job for specialists.

The R.I. "Drivermu" fulfils these requirements admirably, and performs its duties with marked efficiency.

For the output circuit there is the variable ratio output choke which provides an effective coupling between the "Class B" valve and the loudspeaker.

We can vouch for the suitability of these R.I. components for "Class B" circuits, and the makers are Radio Instruments, Ltd., Purley Way, Croydon, Surrey.

Full technical details of the "Drivermu" transformers and coupling chokes, as well as helpful information concerning the conversion of existing sets to "Class B," are obtainable from the above address.

Garrard Record Changer

We have recently had one of the new Garrard automatic record changers on test in our laboratories. Garrard turntable motors are, of course, too well known to need any introduction, but this latest addition to the maker's range is a noteworthy step and a real boon to the enthusiast.

The record changer is available in a universal type suitable for D.C. or A.C. mains, and there is also a synchronous A.C. model for A.C. mains owners.

The power consumption is low, being in the neighbourhood of 16-20 watts.

(Please turn to page 108)

FOR CHASSIS MOUNTING



The latest Clix chassis type valve holder for the new seven-pin valves.

FRANKFURT CALLING



MY first glimpse of the huge Frankfurt aerial masts was from a height of about 2,000 feet!

I came up from Munich to Frankfurt, and decided to go by air, not only because commercial flying is cheap in Germany (it is only £5 18s. all the way from Frankfurt to London), but because this particular air trip takes you over Nuremberg and a long way up the River Main till you get to Frankfurt, an exceedingly picturesque journey.

British Reception

Frankfurt is actually the first broadcasting station I have seen from the air, and I should have missed it had it not been for the steward who drew all the passengers' attention to the white spot in the middle of a bright green field.

It was the *Gross-Rundfunksender Frankfurt!*

A few minutes later the roar of the engines stopped.

"Er hat wahrscheinlich ausgeschaltet, um nach dem ersten Landungsplatz hinunterzuleiten" (or something like that), explained a man who was sitting next to me, and almost immediately we started the circling glide (not half so terrifying as a rapid descent) down to the aerodrome.

Within an hour I was, by the kindness of Lorenz friends, at the Frankfurt station discussing the new transmitter and its effect on the British reception of German stations. As in the case of Munich, the engineers, under the control of the State Post Office, at Frankfurt are only too anxious to know how the transmissions are reaching out to other countries, and especially to Great Britain.

As Frankfurt is only working with 17 kilowatts, it is not, of course, so big a station as Leipzig or Mühlacker.

But in many respects it is a unique transmitter, and although the power is lower the aerial arrangements are better, so that there is still a strong signal.

Externally, Frankfurt is very different from any other station in Germany.

It is modernist, as is Leipzig, Breslau and the rest, but it is not

That intriguing German station, so close to London National on your dial, and so difficult to separate if you live in London—what is it like?

It radiates well enough to disturb London listeners in spite of its lower power, and in this entertaining article Our Special Correspondent tells you about this recent addition to Germany's Regional Scheme.

just a plain, rectangular, single-storey building.

It has, in point of fact, a very big "upstairs," most of which is given over to the staff, and the building as a whole is much more like a private house than a broadcasting station. The photographs will probably convey a much better idea of the shape to you than I can describe.

Modern Features

The top of the "house," where you would expect to find the chimney stack, is taken up by a brick structure which carries the aerial lead-in arrangements, porcelain insulator, lightning safety switch, and so on. The second floor of the building is mainly the upper part of the machine-room, while the transmitter proper is on the ground floor, and is in the single-storey part of the building which projects as a sort of annexe from the main part.

At this end, and about 20 feet away from the transmitter house, is the wooden water tower reminiscent of

the cooling towers at power generating stations. The Frankfurt tower is for the valve-cooling water.

It took me about half an hour to inspect the aerials, water tower and so on at Frankfurt, and one of the engineers went to a deal of trouble to explain how they have managed to get a good radiation on the rather poor wavelength of 259.3 metres. The masts are much taller than is usual. A high aerial forms part of the scheme.

An Impressive Sight

It is a T aerial with only a short top part carried between the masts. Most of the radiation comes from the down-lead which runs straight down to the Frankfurt building below and approximately at the electrical centre of the aerial.

Both the aerial and the down lead are flat and not cage-shaped, there being three spreaders in the top part of the aerial. The masts at Frankfurt are of metal. Wooden masts of this height would have been too clumsy, though two of the other German regional stations have them.

As usual, I was invited to see the station from the top of one of the masts, and as usual I declined! Anyhow, they insisted on me going up to the little door half-way up the water-cooling tower in order to watch the huge spray falling down with a roar to the cold pond below.

An impressive sight, and one which reminded me forcibly that even in a 17-kilowatt station there is plenty of heat developed in the water-cooled valves, which has to be got rid of in some way.

And so inside, first to the transmitter which was just being started up after a brief interval before *Mittagsessen*, and then to the power-house.

The transmitter itself, as I have said, is in the low room at the end of

The Machine Room is Equipped with a Crane!

the building. There is a row of narrow windows rather high up, and through one side of these (they run round three sides of the room) you can see the base of the water tower.

In the transmitter room the furniture is simple. There is the control desk in the centre, the tuning circuits of the initial valve stages in a cabinet to the left, the water-cooled valves on stands in the right-hand corner, the final tuning circuits in safety-cabinets on the right, and a frequency meter down in the right-hand corner.

Clean Appearance

The last of the big panels on the right carries the output circuits, and I noticed that two copper leads came off the top of this box and disappeared through the roof—going, presumably, to the lead-in arrangements on the top of the building.

Lorenz engineer soon showed the differences.

Duplicated Meters

The control desk at Frankfurt is grey, with inset black lined insulated panels. On the metal framework in front are the usual six peak-volt controls. Up on the flat part to the left are the subsidiary grid and filament voltage controls, while indicator lights are to the right. On the raised part in front are three frequency meters, five meters are to the right, together with a small panel full of relay buttons, and six meters to the left.

All the big meters on the sloping part of the desk show voltage or current in the anode circuits of the various stages. On the left, for instance, three of the meters are voltmeters.

I was told that some of these meters

I need hardly say that the relay buttons and master switches on the desk enable the control engineer on duty to switch off the power in the unlikely event of a water failure.

As there is likely to be a bit of bother over Frankfurt's wavelength, there is also a regular daily check-up of frequency. Hence the frequency meter actually in the control room.

Interesting Power Supply

For a 17-kilowatt, the machine room of Frankfurt is surprisingly large. It even has a traveller crane installed to handle the generators if one should have to be lifted from its resilient bed for repair. Somebody at Frankfurt has obviously been to see how the B.B.C. does these things!

Anyway, all joking apart, the crane is a wise provision, for even if the generators are not massive, the six-phase transformers and rectifiers are too bulky to be handled in the ordinary way. This part of the equipment, incidentally, is shielded off by head-height glass partitions.

On the other side of the room are the meter panels and the power rheostats. All the machines are controlled from these panels. They are labelled *Ladung*, *Lademaschinen*, etc.

I was a bit surprised at first to see that there were no big generators for the final valves' H.T. Then I noticed that the six-phase leads coming through stand-off insulators on the wall facing the control panels went down to mercury-arc rectifiers. Frankfurt has two of these, one acting as a standby.

Excellent Results

I have seen what excellent results they get at Beromünster, and I was interested to see that the German engineers are trying arcs. The B.B.C. still remains faithful to rotary converters.

The station is not entirely without its machines for power supply, naturally. There are eight rotary converters for the H.T. on the small valves, and for bias on the water-cooled valves.

Before I left I was allowed to "listen-in" on the programme lines from the studio and to Cassel, which relays the Frankfurt programme on 245.9 metres. The major part of the evening programme comes from Berlin, and then the new Frankfurt becomes simply a high-power relay of Witzleben.

CENTRALISED CONTROL



The imposing array of meters on the control desk at the Frankfurt station tells the engineer-in-charge exactly how the transmitter is working without his having to inspect each part of the apparatus.

There is something very clean-looking about the Frankfurt transmitter. The ceiling and floor are light-coloured, while the lower part of the walls is covered in a kind of tile-work.

At first glance, Frankfurt looks like Leipzig and Breslau. It has the same type of panels and control desk, but a short chat with a

are duplicated by the meters actually on the valve stands, but that they are put on the desk so that the engineers can truthfully say that the control man can make his daily test log without getting up from the desk.

Readings are taken of all main meters periodically during the day. This has been done ever since Frankfurt opened.

A revolution as wonderful as the coming of "1/2 watt" lamps

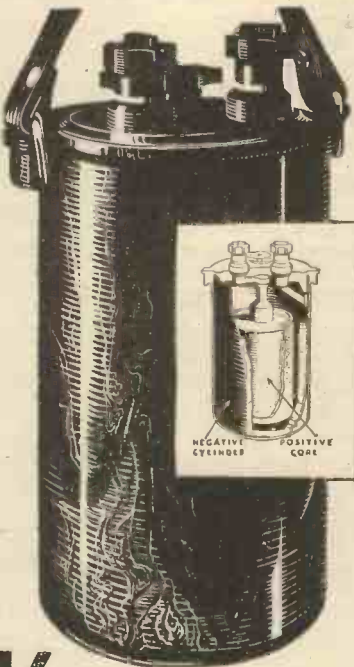


Do you remember when "1/2 watt" lamps appeared—giving twice the light for the same electric current? They changed the faces of our cities. To-day there is a revolution, no less startling, in accumulators —

double capacity accumulators

- ① No weight-wasting plates — just a core inside a cylinder (itself the acid container.)
- ② Far more thorough action (the plate-grids used to cause interference.)
- ③ Total result—twice the capacity per lb. weight!

AT present you use a 40 a.h. accumulator? Now you can have one that lasts twice as long per charge, for little more. And instead of a lumbering glass case — just a neat cylinder of lovely bakelite! See your dealer at once!



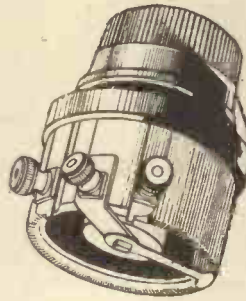
BLOCK plate-less accumulators

2. 80 AMP. 11/6^D.
v. HRS.

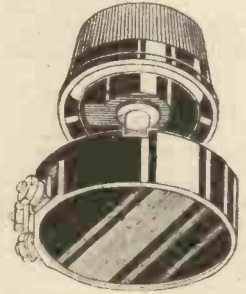
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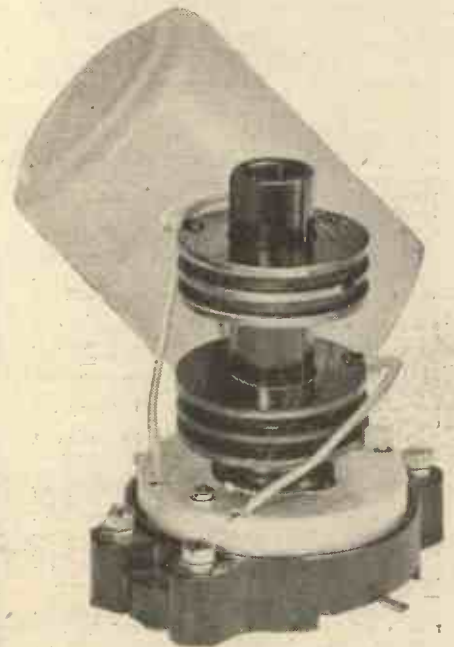


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REMEMBER THESE NEXT TIME!

SUFFOLK.—"Having never previously written to any journal with regard to matters therein, in spite of having been a reader of various publications since 1924, I hope you will take this abstinence into account and let it add weight to the fact that I am writing this now. The more I use 'S.T.400' the more imperative it seems that you should receive some expression of appreciation and thanks for having made such a receiver available to us home constructors. To attempt to describe the performance of this outfit is too much of a task for me. Never since I started 'listening-in' with a crystal have I managed to get so much satisfaction—downright satisfaction—from any set. Of course, as soon as you went 'one better' than the 'S.T.300,' I changed over immediately and, as already stated, it is the most satisfying set in every way I have ever handled, and I was an S.N.U. I think it is a safe bet that very few who make it will have anything but feelings of the greatest gratitude."—W. J. Coy, The Poplars, Thorndon, Eye, Suffolk.

EBBW VALE.—"I have a very good gramophone and have always held that most wireless sets could not give the same all-round quality of reproduction of music. But the 'S.T.400' does this most decidedly. It is a wonderful set and is all that is claimed for it in THE WIRELESS CONSTRUCTOR. All who have heard it and have 'twiddled' it are charmed and determined to become makers of it. Please accept my congratulations."—B. Lougher, Tredegar Road, Ebbw Vale, Mon.

MANCHESTER.—"I have built your 'S.T.400,' and can honestly say that it is the finest four-valve I have heard. In the first half-hour after switching on I obtained forty-two stations, all at excellent strength and quality. Selectivity is wonderful, I can separate König's Wusterhausen from Radio Paris and Daventry with ease and still have König's Wusterhausen at full strength. Kaunas and Lahr are good signals. Rabat and the little Toulouse (P.T.T.) on 255 metres are easily heard.

Performance is just as good at the top as at the bottom of the medium waveband, both as regards selectivity and sensitivity. I built your 'S.T.300,' but the 'S.T.400' is far above it. May I advise all readers to look to their wave-change switches by twisting the spindles occasionally to ensure clean contact."—B. Scott, Cringle Road, Levenshulme, Manchester.

DONEGAL.—"The 'S.T.300' was a big improvement, but nothing compared with 'S.T.400.'"—Jas. McCurdy, Co. Donegal.

COLCHESTER.—"I am very pleased with the results obtained from the 'S.T.400' in conjunction with a Marconiphone moving-coil speaker."—H. G. Thomson, Colchester.

LAND'S END.—"I have now converted my five-valve set to your 'S.T.400,' and am very pleased indeed with it. My log is 64 stations to date. All of these I have been able to identify; there are others, but I cannot name them. Seven American and one Mexican stations are in this list, all of which I have heard on the loudspeaker; two of these I have identified as WCAU and WABC.

"The WCAU station has been tuned in as early as 10.15 p.m. and can be received from 11 p.m. to 12 midnight with ease on almost any evening, the strength at times being too great for the output valve. The valves I am using are Mullard P.M.12, P.M.1A, P.M.1L.F., and P.M.2A, these being two years old.

"I might add that the above list of stations has been logged without interference, and in the presence of witnesses. In conclusion, if you care to publish this letter I should be only too pleased to demonstrate my 'S.T.400' to anyone in this district who contemplates building or purchasing a wireless receiver. After hearing this set, all doubt, if any, of its capability would vanish."—A. Thomas, Chy-an-als, Land's End, Cornwall.

TRURO.—"With regards to my 'S.T.400' built with relatively cheap parts (and with distributor differential wrong way round), the set is very good. I certainly don't agree with the

Cornishman from Helston [Mr. Blake]. If his set is a 'wash-out,' he has himself to thank. I get whatever station I want. There is also an 'S.T.400' at Goonhavern, Perranporth, which is giving even better results than mine."—R. R. Munn, Callestick, Truro, Cornwall.

THE LIZARD (Cornwall).—"You say other Cornishmen may care to write about their 'S.T.400' results. I cannot qualify as being a Cornishman, but I can certainly qualify as being the proud possessor of an 'S.T.400' in Cornwall. I have built four 'S.T.400's,' so I can truthfully say that the set is the finest I have ever heard for tone, reproduction, selectivity, volume and economic battery consumption. The 'S.T.400' I possess will log at between 80 and 90 stations on the medium waveband alone, and all at tremendous volume; in fact, I dare not move my controls more than 'normal' as the power is too great. The owners of the other three 'S.T.400's' also say that they are the finest sets they ever had. One of them can log more stations than that shown on the test by yourself. These four sets are the first I have ever made, although I have possessed many, so I speak from experience. I have also heard very expensive sets, but give me the 'S.T.400.' I may say that I have kept to the parts specified."—T. W. Chubb, 10, Beacon Terrace, The Lizard, Cornwall.

Here is another selection of enthusiastic letters from builders of the "S.T.400." The letters published here and in previous issues are but a fraction of the thousands which have been received and which have testified to the success of Mr. Scott-Taggart as a designer.

Meanwhile "S.T." enthusiasts will be delighted to hear that Mr. Scott-Taggart is now conducting intensive research work in connection with his new designs, about which he will tell readers of "The Wireless Constructor" at the earliest possible moment.

PENZANCE (Cornwall).—"If the complaint from Cornwall had come from Bodmin—where, I believe, the mental home is—one could understand it. If Mr. Blake reads the CONSTRUCTOR every month he will find plenty of reports from Cornwall to satisfy him. I converted my 'S.T.300' to 'S.T.400,' and have found it most satisfactory, so much so that it takes me all my time to keep volume down. I get many stations in broad daylight on the loudspeaker, which is what several superhets I have heard cannot do, and this in Cornwall, which is supposed to be a notoriously bad district. So Mr. Blake can take courage; perhaps he forgot to switch on his aerial, although I can get results with only a yard of wire from aerial switch to set. Also, I get excellent results on an inside aerial round the room and along the passage—all on the loudspeaker."—E. O. Puddephatt, 6, Sea View Terrace, Newlyn, Penzance.

FAREHAM.—"I am myself a new hand at this game of wireless. I have put up with factory sets since 1924, so I thought I should like to have a shot at making one. I decided to build yours. Thank you for a splendid and selective set. London Regional and Mühlacker are clear, thanks to those precious knobs. It has been money well spent."—C. Hunt, Gordon Road, Fareham, Hants.

BIRMINGHAM.—"I have had the 'S.T.400' working a week. It is the best set I have built, owned, or heard. I may say it has replaced a six-valve superhet. Before that I had a four-valve (2 S.G.) set with your 'S.T.300' adaptor in front of it. With the 'S.T.400' I can tune in station after station, one at a time, with wonderful strength and quality which leaves nothing to be desired.

I have read all the letters in the CONSTRUCTOR about this wonderful set, and can well believe them. Thank you very much for producing such a circuit."—Albert Elliott, Bruntton Road, Small Heath, Birmingham.

DUBLIN.—"Some time ago a friend asked me if I had heard the 'S.T.400,' I had not. He asked me if I should like to and I told him I didn't mind in a rather offhand way, as I was satisfied with my own set. He said he would leave it with me for a week-end. Well, before he called for it I had made my own 'S.T.400,' because I could not attempt to hook up my old set after hearing the 'S.T.400.' I then asked one of my friends, who was very proud of his set, to come and hear my set. He also has an 'S.T.400' now! Since then I know three other people who have heard the 'S.T.400' and are now listening to their own 'S.T.400's.' It is really a wonderful set."—Patrick V. Young, O'Curry Road, Dublin.

NORTH SHELDON.—"I have built your A.C. version of the 'S.T.400' and think it is a very fine set. The power is amazing, and the selectivity is very fine; there are very few stations on your chart that I cannot get. I get Newcastle, Cork and Fecamp clear of each other. The tone is wonderful, and it is every bit as good when used as a radio-gram."—

SOUTH WOODFORD (E.13.).—"I am extremely grateful to you for having enabled me to build such a really worth-while set. It is a vast improvement on my former set."—Roy S. Jenkins, Alexander Road, South Woodford, E.18.

KILLARNEY (Irish Free State).—"Out of sheer fulness of heart I am writing you my thanks for the 'S.T.400.' You're tired of such, I'm sure, but I would not be satisfied if I did not voice the feeling that is in me, akin to one's gratitude for the sun, the green of springtime, a bright smile. I'm away west here in a deep between the Kerry mountains, remote from all transmitters, and I have tried many receivers to get satisfactory programmes. Yours alone has succeeded, and I am happy."—J. O'Connor, Fossa, Killarney, Kerry.

BEARDSDEN (Scotland).—"Our delay in not writing sooner about your set, the 'S.T.400,' is due to the fact that, in our opinion, the performance of a set cannot be judged in days or even weeks as some constructors seem to think. Your 'S.T.400,' now having passed our exhaustive tests, has come through with flying colours. The 'S.T.400' tops the list in performance of all the sets we have built, which is no small number.

"Not so long ago we constructed a 6-valve superionic heterodyne (complete to designer's specification) which had six tuned circuits with band-pass tuning. Your 'S.T.400' had more power, better tone, but was not quite so selective. The outstanding feature of this set (the 'S.T.400') was the absolute freedom from background noises as compared with the superhet's roar. We have logged with the 'S.T.400' every station on your list, plus six more, and how any of your correspondents fail to get good results is beyond us. It is undoubtedly one of the simplest sets to build and operate. Thanking you for such a marvellous set; it will certainly be a permanent fixture in our wireless den until your next big set comes along."—C. Kirkwood and A. Kirkwood, Station Road, Beardsden, Scotland.

DOWLAIS (Wales).—"I think the 'S.T.400' is a wonderful set, the best I've ever handled—and I may say I've built some scores."—T. Williams, Garth Terrace, Dowlais, Glamorgan.

WOKING.—"Please convey my appreciation to Mr. J. Scott-Taggart for his wonderful 'S.T.400,' which leaves nothing to be desired as regards volume, quality, and selectivity. I have converted from the 'S.T.300'; I can say no more than it was like killing one friend and making another, but this time a bosom pal. Again thanking you for such a wonderful circuit."—A. E. Lewington, Boormans Cotts, near Woking.

HERTFORD.—"I have constructed several 'S.T.400's' and have found this the best set of its class for this district."—Geo. Dittou (Wireless Dealer), St. Andrew St., Hertford.

SOME CONTROVERSIAL COMPONENT QUERIES

by VICTOR KING



WHAT are the "burning questions of the day" so far as radio is concerned? Are there any? A few years ago the whole of the country would have been brightly illuminated if every "burning question" had been an actual conflagration.

Do you remember them? "Is H.F. Worth While?" "Grid Leak versus Anode Bend," and so on. But they all seem rather dim now, don't they?

Not that there are no subjects of controversy nowadays, but they don't "burn" fiercely, and their protagonists don't get so hot under their collars about them.

A Friendly Vein

One can, indeed, say that with the gradual building up of standards of values based on a solid foundation of proved theory, the heated debates of pioneering days have given way to friendly, reasoned arguments.

And it is in that vein that I propose to discuss a few questions, concerning

From the earliest days, reception technique has provided for its thousands of amateur devotees subject-matter for heated debate. Modern methods are less controversial, but still leave plenty of scope for discussion as to the merits or otherwise of this or that new development.

more and it necessitates the use of matched coils.

In the Balance

It is also advanced by some that however carefully the method is applied, there must be a serious loss of efficiency as compared with the use of separate tuning controls.

This is really the whole crux of the matter. Considerations of cost, appearance, operation and installation are easy to catalogue in a kind of balance sheet; their pros and cons can be weighed up by anyone for himself.

But if there is to be an unknown

up to that specification are obviously sub-standard.

But let us confine ourselves to the good ones. These will be so excellently designed and so beautifully made that their individual sections will be extremely closely matched.

"Peak" Point

Nevertheless, in practice, perfect matching all round the dial cannot be achieved. You couldn't make them give you the results of a team of separate condensers each fitted with a first-class slow-motion dial.

So that "sitting on the peak of tuning," which is an element of record reception on relatively small, "hotted-up" receivers, will not be possible, at least, on all the long- and medium-wave stations.

However, it is difficult to calculate the loss in general terms. And, personally, I think it would be rather waste of time trying to do so.

I believe we are tending to move away from "hotted-up" radio, and thereby at the same time removing the cause of an incipient controversy!

With the more efficient circuits and components and valves at present available, we need not fight for sensitivity with knobs for our weapons. And we need not struggle for our stations on the edge of reaction.

This brings me to another point. Is efficiency necessarily "goodness"? When, for example, you see an L.F. transformer described as "good," what does that convey to you?

(And what exactly is meant when something is said to be "too efficient"?)

MUCH DISCUSSED

Few components have been so much the subject of controversy as the L.F. transformer. The excellence of the present-day transformer, however, leaves so little to be desired that argument about it is comparatively rare.



components, which arise out of my correspondence.

First, there is the matter of ganged versus separate tuning condensers from the point of view of the home constructor.

The advantages of ganging are obvious. A ganged condenser is simple to operate, and it has a better panel appearance.

Its disadvantages are that it is more difficult to mount on a panel, it costs

degree of efficiency loss, then where do we stand?

I say "unknown" because we are generalising. Obviously, it would be impossible for anyone to give a ganged condenser a "figure of merit" without stipulating hard and fast circuit conditions.

What can be done, and what is done, is to lay down a technical specification for a ganged condenser, and all "gangs" which do not come

Too Efficient?

Well, I fancy that a "good transformer" is popularly supposed to be one having a "straight line" characteristic—i.e. is able to handle practically all audio frequencies equally well.

But do we always want an efficient response of that nature?

This is a question that I have briefly referred to in a previous article, and

Two Wrongs Don't Make a Right

the present is a good opportunity to go farther into the matter.

It really is important because the "straight-line" idea can easily become a fetish. It already is doing so to some extent, but is at the same time defeating its own end.

Apt Analogies

I'll illustrate this with an analogy.

Supposing the bricks which run at the ground level of a house had to be made of some very special material. And supposing no method of making them absolutely rectangular had been invented and that the best that could be done was to produce an irregular wedge shape.

Would a builder fanatically stick to principles and lay ordinary good,

handed one with a hole in the middle, you'd be annoyed, and the shopman's explanation that "Professor Manganese finds the pattern perfect for his new distillation apparatus" would fail to appease you. Quite rightly, too, because by asking for a dinner plate you had intimated that the article was required for a specific purpose for which the type with an aperture would be rather unsuitable.

A Dangerous Idea

But the idea that because a component does not give good results in one or even a number of applications it must be good for something else is a dangerous idea.

This is particularly the case with L.F. transformers. In many circuits

hardly likely to maintain a constant degree of inefficiency.

If there is to be compensation it must be carried out in an orderly, scientific fashion. The special compensating transformers are "good" transformers for the simple reason that their deliberate departure from the "straight line" is exactly controlled.

You know its degree of compensation and you know that this will be duplicated by every one of the thousands of the particular make concerned. Therefore, it is possible to design a circuit in which the device will perform its special functions with as much relative efficiency as a transformer of orthodox design.

More Factors than One

No, I do not think there can be any argument in favour of the use of "cheap" transformers. *Special* transformers, obviously yes; but if it so happens that the characteristics of some badly-designed and made transformers tend to offset general set failings of an opposite character, that should be regarded as an example of "two wrongs which don't make a right"!

You see, there are other factors beyond the mere shape of the amplification curve to take into account, even when this is consistent and controlled.

There is, for instance, the question of saturation. A transformer to be "good" must be able to handle H.T. without saturation intervening unless specifically designed for shunt-fed circuits.

Concerning Reliability

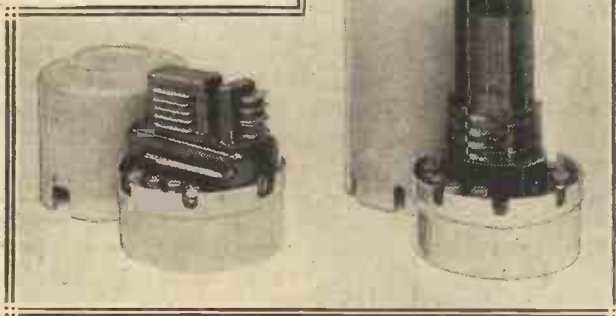
Then what about reliability? First-class materials, skilful design and winding are necessary if the transformer is to have a long life.

Transformers used to break down at about the rate of one per listener per year, and the fact that you don't hear so much about transformer failures to-day is entirely and obviously due to the increasing percentage of "good" transformers that are being manufactured.

And that happy state of affairs will continue so long as no case is made for "cheap" transformers.

In conclusion, let me make it plain that I have used the word "cheap" in its special significance, and that I am fully aware that there are comparatively good transformers of low price,

COMPACT COIL EFFICIENCY



It used to be thought that a coil had to be big to be good. And how strongly we discussed the pros and cons of wavechange switching! It would be difficult to criticize such modern coils as these from the point of view of efficiency, and yet they are extremely small.

well-shaped bricks straight on top of the warped ones?

Certainly not. He'd probably shape the next row of bricks, deliberately distort them in fact, so that they neatly compensated for the irregularities, with the result that the completed house would stand "four square."

If we have in radio certain things which are, and inevitably must be, misshapen bricks in the structure, why shouldn't other of the parts be made to provide compensation even if to do this they must be pushed off that rigid straight line?

The argument against this is, that perfection will never be achieved unless we set up definite standards and work to them all the time.

A good argument as far as it goes, but it won't bear close analysis. Suffice it to say that the perfection of a whole renders its fractions perfect—for their task.

If you went into a shop and asked for a china dinner plate and were

it is extremely desirable that the L.F. transformer should have as straight a response as possible.

But, on the other hand, there are circuits in which there is a considerable and fairly calculable loss of high notes. These are to be found among the superhets and circuits incorporating peak tuning and heavily applied reaction.

It is for such that compensating transformers have been developed.

I am dead opposed to the idea that such circuits constitute opportunities for the use of "bad" transformers, by which is meant cheap transformers that drop bass.

The Unknown Quantity!

To look to these for the required compensation is a retrograde step. The characteristic of a "bad" transformer is an entirely unknown quantity. It may, and probably does, differ greatly from one to another of the same make, for the concern which can't make a "good" transformer is



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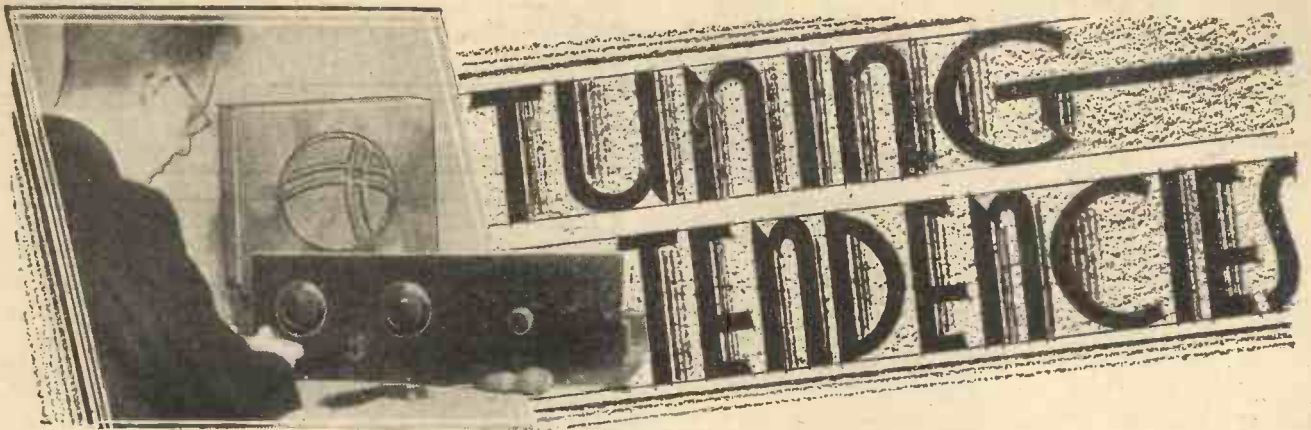


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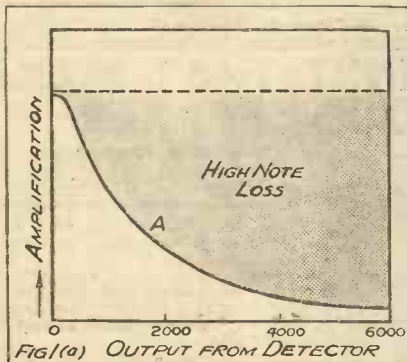
THE last ten years have seen more erratic and violent changes in the design of the tuning coil than in that of perhaps any other radio component. Do you remember the huge solenoid coils of the earlier crystal sets, and the complicated spider-web and honeycomb coils of the first valve receiver?

Then plug-in coils revolutionised coil design for a time, in turn being pushed into oblivion, for all but short-wave reception, by the dual-range coil. Although at first over bulky and elaborate, the latter has been gradually compressed and simplified into the successful "canned" component now so widely used for all kinds of receivers.

Fantastic Ideas

At various periods in the history of the tuning coil we have had sudden crazes for "low-loss" construction, and some of the ideas tried out on the poor constructor were indeed fantastic. On the other hand, those large-diameter solenoid coils wound with Litzendraht, which became so popular just before the advent of the dual-range coil, were without

EFFECT ON QUALITY



Curve A shows how a very sharply tuned circuit can produce a serious loss of high notes, which must be compensated for if faithful reproduction is to be achieved.

doubt the most efficient coils ever designed.

Demand for Screening

But the coming of the S.G. valve sounded the death-knell of the bulky coil. This new idea in H.F. valves, quickly reaching a remarkable degree of efficiency, demanded better and still more screening of the H.F. components. Thus the big diameter coil, needing an impossibly large metal box, had to give way to the compact "canned" coil with its inevitably

In this article our contributor, Mr. J. English, interestingly traces the developments in tuning-coil design over the past few years. The present trend, he points out, is to employ sharply tuned H.F. circuits and then to compensate for any high-note loss by using a suitable tone control.

higher losses—and now we "can" all we can in the H.F. end of the set!

The latest jump in tuning-coil design, the novel Ferrocart coil, combines a low-loss inductance in a very compact fully-screened form. This development, which at one time would have been considered an impossibility, is quite a big jump in the right direction, and one which is likely to influence considerably the future design of the more ambitious type of receiver.

High-Note Loss

Now the primary rôle of the tuning coil is to act as a station selector. The more efficient it can be made in this respect the more selective the receiver. This necessitates a "low-loss" inductance, because the smaller the coil losses the sharper the tuning and, at the same time, the bigger the signal build-up in the H.F. stage.

Unfortunately this is not all the story: if it were, the set designer's

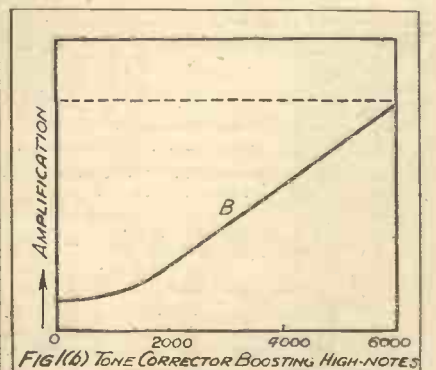
lot would indeed be an easy one! The snag is "sideband cutting," the well-known effect on high-note reproduction producing muffled and boomy speech and music when the tuning of a straight H.F. circuit is made really sharp, by means of reaction, for instance. The diagram of Fig. 1A gives some idea of how the high-note loss of a selective tuned circuit affects the overall frequency response.

We used to get some degree of automatic compensation for this "tuning distortion," if not too pronounced. Both the L.F. amplifier and the loudspeaker were not so very efficient at either amplifying or reproducing the lower register, thus masking the excessive bass-note output from the detector.

A Solution

With improvements on the L.F. side, however, the poor tone response of the average receiver, especially on distant stations, began to show up so much that the chief consideration nowadays is to get improved high-note reproduction without which both speech and music lack life and realism.

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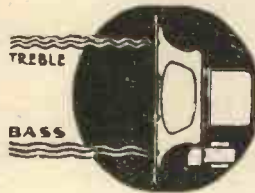
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The Input Transformer, D.P.40

(1) gives good amplification of low notes because of its high primary inductance.

(2) prevents grid current distortion by employing a low-resistance secondary.

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D.P.40

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Maximum primary current: 6 m/A. Secondary resistance: 100 ohms on the 1.5 to 1 ratio and 145 ohms on the 1:1 ratio. PRICE **15/-**

Including Royalty.

The Output Choke D.P.42 gives a choice of three ratios, making the matching of the Class B valve and loud-speaker an easy matter.



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Tuning Tendencies—continued

One solution of the problem of getting adequate selectivity without sacrificing quality is the band-pass tuner. In theory it has a nearly square-topped resonance curve passing the high-note modulation of the carrier wave with a sharp cut-off on each side to exclude transmissions on adjacent wavelengths. But it is a complicated device not easy to adjust for the full practical realisation of this theoretical performance. At present we use it more as a preliminary station selector before the H.F. stage without bothering too much whether it tunes square-topped over the entire wave-range of the receiver.

Correcting the Response

The alternative solution is "straight" tuning circuits of high selectivity with tone correction on the L.F. side. This line of development is fast increasing in popularity, so much so that the up-to-date receiver would seem rather crude without tone control in some form or other.

Recent investigations show that if we make the H.F. circuits tune very sharply and then intensify the much weakened high notes by "faking" the response of the L.F. stage, we can achieve a high standard of quality as well as eliminate all interference except heterodynes and static noise. Provided the latter are not troublesome, it should be possible to receive a distant station from out of a crowded ether with almost the same strength and quality as the local transmissions.

The accompanying diagram illustrates the process involved. In Fig. 1(a) you see the output from the detector with very selective tuning, much weakened for frequencies above 500, an intolerable state of distortion. Fig. 1(b) shows the response curve of

AUTOMATIC TONE BALANCE



The high-note losses due to reaction can be compensated for by using the A.T.B. scheme. With this method the adjustment of reaction automatically corrects the tone, enabling distant transmissions to be tuned in free from "reaction distortion."

the post-detector tone corrector, the precise form of which does not concern us here.

Notice that the response increases sharply as the frequency rises, so that after the signal has passed this stage

in the set the drooping curve of Fig. 1(a) has been lifted up to a more or less level response curve. This being the input to the L.F. or output stages, which themselves are, or should be, straight-line amplifiers, we have thus achieved high quality reproduction in spite of highly selective tuning coils.

In the practical application of this scheme we find it distinctly advantageous to use a variable tone corrector, such as the special L.F. transformer with its associated variable resistance or condenser, whereby we can intensify at will practically any part of the frequency scale to counteract deficiencies in the L.F. stages or the speaker itself.

Providing High Selectivity

I have purposely emphasised the part played by tone control with the object of showing that the effect of the tuning coil on quality is no longer of importance. Consequently we can make use of the new low-loss coils to provide high selectivity and signal build-up.

Now the modern H.F. stage is so efficient that we generally find we can get more H.F. amplification from it than we really need. We can, therefore, afford to exchange some of this amplification for more selectivity.

Thus the rôle of the tuning coil in modern set design becomes more and more that of a high-efficiency station selector alone, considerations of amplification and quality taking a back seat.

COMPARING two L.F. transformers is an easy matter if a quick change from one to the other can be made.

Removing one transformer from a set and fitting another in its place takes too long. Impressions are lost while the change-over is being made, especially if there is little to choose between the two components.

How to Connect

Instantaneous changes from one to the other can be made with a double-pole change-over switch. The connections are the same whatever the circuit.

Join the "G" terminals of both transformers together and wire to the usual point. Do the same with the "P" terminals.

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COMPARING
*
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TRANSFORMERS
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*
A simple method of obtaining a
*
rapid change-over.
*

Take the lead that normally goes to "H.T.+" on transformer to one centre switch contact, and the lead normally connected to "G.B." on transformer to the other centre contact. Now, for simplicity, label one transformer No. 1 and the other No. 2.

Join "H.T.+" of No. 1 transformer to one outside contact that connects with the "H.T.+" centre contact when the switch is operated.

Join "H.T.+" of transformer No. 2 to the opposite outside contact.

Join "G.B." of No. 1 transformer to remaining outside contact on same side of switch as "H.T.+" of No. 1 transformer is wired. The remaining unconnected switch contact goes to "G.B." on No. 2 transformer.

Switch Control

With the switch over one way No. 1 transformer will be in use, and with it over the other way No. 2 will come into play.

Operating the switch two or three times will enable you to decide quickly which transformer has the greater "mag.," which gives the more pleasing tone, or which better suits your receiver.

A. S. C.

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★ **Mark Hambourg on MY THOUGHTS ABOUT BROADCASTING**

"BETTER RADIO"

A practical and entertaining feature which will help you to a better understanding of your receiver, better results from your listening and a better enjoyment of radio in general. More and more listeners are reading and benefiting from "Better Radio" every month.

CHOOSING A RADIOGRAM MOTOR

A radiogram motor has an apparently simple job to perform, just turning a record round. But if good reproduction is desired there are several points to watch in choosing and maintaining an efficient motor.

A RADIOGRAM motor has one object only, whether it is driven electrically or by a spring, and that is to supply energy to the needle of the pick-up. It is no economy to purchase a cheap motor, as it will most certainly cost much money for repairs and many hours of annoyance.

Always buy a motor manufactured by a reputable maker and pay as good a price as you can afford—perhaps even just a little more—as it will certainly pay you in the end.

Examine it thoroughly to see that it is a “cleanly” made piece of mechanism and give particular attention to the following points.

Points of Purchase

Ask your dealer to place the motor on the counter, or to suspend it between two supports if it has not a flat base. After the turntable has been placed in position and the “stop” released, slowly turn the winding handle until the resistance shows that the springs are fully wound—the “feel” of the wind should be smooth, the turn of the spring-boxes easy, and the whole action almost noiseless.

A spring motor should always be wound whilst running, with the pick-up on its rest and not on the record. In order to avoid any possibility of accidental overwinding, the rate at which the handle is turned should be slowed down towards the completion of the operation.

Turntable True?

See that the turntable runs smoothly without appreciable wobble; it is almost impossible to obtain perfection in this respect, but in good modern motors the turntable should not be more than $\frac{1}{32}$ nd of an inch out of true. Whilst the motor is running freely, place the hand on the counter (or on the top of the boxes in the case of a motor having other than a flat base), and satisfy yourself that there is little or no vibration; listen closely to the running of the gear wheels and appreciate the “sweet” running of a well-made machine with cleanly cut gears.

Notice carefully whether there is a discontinuous “thump”—if there is, reject the motor at once, for either the governor mechanism is poor or it is out of adjustment (the fault *can* be rectified, but it should not be there in a new motor).

After bringing the turntable to rest, press gently on each side and see that the main spindle is free from side-play—a fault of this description is fatal and can only result in poor reproduction. There should be a *little* up and down movement of the main spindle, but no side-play.

Even Speed

Evenness of speed is essential to good reproduction and any appreciable variation causes a most disconcerting change of pitch. The standard speed is 78 revolutions per minute.

If you are buying an electric motor, most of the hints given above will apply, but, in addition, you must make sure that the voltage is suitable for your supply mains, and whether the supply is D.C. or A.C. If the latter, it will be necessary to indicate the frequency. It is well to remember that a synchronous motor cannot be

used with D.C. For those purchasers who are expecting a change in mains supply from D.C. to A.C. in the near future, a “Universal” motor is recommended.

No Exception

Every machine, from a watch to a generator in a power station, requires proper care and maintenance if its life is to be a long one, and if its full functions are to continue unimpaired; your radiogram motor is no exception to this rule. Every part of the motor should be kept quite free from dust and damp and periodical lubrication must not be overlooked.

With many types, both spring and electric, precise instructions on this matter are given by the manufacturers and these should be carefully followed. The leading makers recommend two types of lubricating oil, a fairly heavy oil for the main bearings and gear wheels and a very light oil for the delicate governor and worm-wheel mechanism.

Special Attention

It is necessary to oil the governor mechanism and bearings about once in three months and the main bearings about once in six months. The governor pad and disc should receive special attention, as these are the vital spots of the whole machine.

Never adjust the governor with the motor running, as you will almost certainly ruin the delicate gears, and, in any case, this is more properly a job for the expert mechanic.

“GETTING THEIR MAN” BY WIRELESS



Police authorities everywhere are developing fresh uses for radio in curbing the activities of criminals. A recent innovation is the installation by the Paris police of a special transmitter capable of sending by wireless photographs of wrong-doers, together with impressions of their finger-prints.



OUR NEWS BULLETIN

Gross turnover for the year, at retail values, is given as £36,627,425. Of this total £4,000,000 represented imported goods.

Some 1,436,849 factory-made receivers of all classes were sold during the year, equalling a cash value of £19,323,198. Other important figures, which show how the public spend their money on radio entertainment, are £9,000,000 (accumulators and batteries), £5,000,000 (components and accessories), and £2,854,425 (valves, apart from those supplied in sets).

French Radio Finance

In future all owners of receiving sets in France are to pay the following annual taxes:

On crystal sets—3s. 9d.

Valve sets (any number of valves)—12s. 6d.

Sets in public places—£1 5s.

When a charge is made for admission to such places—£2 10s.

There is also to be a 15 per cent tax on the sale price of valves.

Amongst the corresponding advantages will be the abolition of all advertisements in the programmes of the State stations. Private broadcasting companies, however, will continue to derive a large part of their income from the publicity announcements which are so trying for the listeners' patience.

Sir Charles Carpendale

Rumours that Admiral Sir Charles Carpendale is shortly to retire from his position as Controller of the B.B.C. and from the International Broadcasting Union have been authoritatively denied.

It is expected, however, that when the International Broadcasting Union meets next month, Sir Charles will not again sit for re-election to the presidency of the Union—a post which he has held since the Union was founded in 1925. He will continue to represent Great Britain at the discussions as an ordinary delegate.

The Union is the organisation of all the European broadcasting authorities controlling wavelengths and other

(Continued on page 104)

Licences Still Going Up

WIRELESS receiving licences issued by the Post Office during March numbered approximately 450,000.

Allowing for those which expired, the total number in force at the end of the month was 5,498,700, a net increase of 71,000.

During the same month 155 prosecutions for wireless offences were successfully undertaken.

Scotland's Director

The B.B.C. Regional director for Scotland, Mr. D. Cleghorn Thomson, has resigned his post owing, it is officially stated, to a difference from the B.B.C. authorities on questions of policy.

Mr. Cleghorn Thomson has announced that his resignation was due to his "unreadiness to continue working in the face of obstacles which had proved insuperable."

"The B.B.C. has accorded me very generous treatment," he added, "and I am leaving on the best of terms with the great majority of my colleagues and associates, to take up an entirely new sphere of activity in London."

The Moscow Giant

What is claimed to be the most powerful radio broadcasting station in the world has been completed at Noginsk, some forty miles from Moscow. Its aerial capacity is rated at 500 kilowatts, which greatly exceeds that of any other radio broadcasting station in Europe. The station is completely mechanised, and can be operated by five men. The total cost of construction has amounted to approximately £750,000.

Good News

A new high record in the year's trading was set up by the radio industry in 1932, according to figures published in the "Wireless and Gramophone Trader."

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Exact to Specification

'B'ESTECTOR SUPER

(Described this month.)

<p>KIT "A" Author's Kit of specified parts, including ready-drilled panel, but less valves and cabinet. Cash or C.O.D. Carriage Paid. £7-17-6</p>	<p>SEND ONLY 14/5 Balance in 11 monthly payments of 14/5</p>
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Set of 6 specified valves, including Westector W.4	£ 3 10 3
1 Peto-Scott panel, 21" x 7", ready drilled, and baseboard, 21" x 10"	17 6
1 Set of J.B. variable condensers (1 2-gang, 1 single), completely screened with disc drives	1 9 0
2 Lewcos coils, as specified	1 0 6
2 Colvern coils, as specified	1 5 0
1 Lissen Class "B" driver transformer	12 6
1 Varley Class "B" output choke	16 6

PUSH-PUSH FIVE

<p>KIT "A" Author's Kit of specified parts, including READY-DRILLED PANEL, but less valves, cabinet and speaker. Cash or C.O.D. Carriage Paid. £5-14-6</p>	<p>SEND ONLY 10/6 Balance in 11 monthly payments of 10/6</p>
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<p>KIT "B" As Kit "A" but with valves only. SEND ONLY 16/6 Balance in 11 monthly payments of 16/6 Cash or C.O.D. Carriage Paid £9, 0-0</p>	<p>KIT "C" Complete with valves, cabinet and combined shelf and baffle, but LESS speaker. SEND ONLY 18/7 Balance in 11 monthly payments of 18/7 Cash or C.O.D. Carriage Paid £10-3-0</p>
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NOTE: The R.I. D.Y.35 Choke has not been included in the Kit Prices. If required, add 12/6 to each Cash Price or 1/3 to each monthly payment.

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OUR NEWS BULLETIN

—continued from page 103

important questions. Its offices are at Geneva, where Mr. Arthur Burrows is secretary.

Sir Charles, who was knighted last June for his broadcasting work, reaches the B.B.C. retiring age at the end of this year.

Lucerne and Listeners

The Prague wavelength plan is to be revised at Lucerne in May, and it is likely that in sixteen months' time the new Droitwich station will supersede Daventry, using a power of 100 kilowatts.

A complete reshuffle of wavelengths throughout Europe, to reduce interference, is probable at Lucerne.

The new plan may increase wavelength separation from 9 to 11 kilocycles, even though this will reduce the number of available channels.

The Chief Engineer

Mr. Noel Ashbridge, chief engineer of the B.B.C., recently stated that a plan had been prepared as a basis for discussion at the Lucerne meeting of representatives of about 30 European

countries, but he was unable to particularise. There was, however, every hope of agreement at Lucerne, with a consequent improvement.

Mr. Noel Ashbridge, in an interview, stated: "Anyone purchasing a new receiver should see that it covers the whole band allocated to broadcasting." (This, with certain gaps, extends from 200 to 2,000 metres.)

Radio Exchanges

A survey by the "Broadcaster" of the relay exchanges in operation shows that the present 250 licensed by the P.M.G. are distributed over 150 towns.

With the subscribers at the moment amounting to 80,000, this means an average of 320 subscribers per relay, and something over 500 in every town affected.

The growth of relays is shown in the following quarterly returns for three years:

1930 Mar.	10,913	1931 Sept.	32,872
" June	12,172	" Dec.	43,889
" Sept.	15,485	1932 Mar.	51,740
" Dec.	21,677	" June	58,354
1931 Mar.	26,219	" Sept.	65,350
" June	30,149	" Dec.	82,690

Sunday Programmes

It is reported that during the last few weeks the B.B.C. Board of

Governors have asked Sir John Reith, the Director-General, to submit a report concerning Sunday broadcasting programmes.

Various ideas for improving them have been suggested time after time, but until recently there was little or no change in the rigid policy of keeping entertainments well to the background in Sunday programmes.

The Public Opinion

There is no doubt that opinion is getting stronger and stronger in favour of less solemn Sunday broadcasts. Recently various new Sunday programme experiments have been carried out, and there is every sign that twelve-hour Sunday broadcasts will become a regular part of the B.B.C.'s policy.

A Radio Pioneer

Few listeners know of M. Edouard Branly, who is regarded in France as the father of broadcasting.

M. Branly is eighty-nine years of age, and he is one of the few surviving pioneers of wireless.

He invented, among other things, the coherer. M. Branly is reported to hate two things—publicity and wireless sets. A little while ago a number of manufacturers wanted to present M. Branly with a first-class set, but nothing would induce him to have a loudspeaker in his house. However, he eventually accepted the set because his family pressed him to, but on the first occasion on which it was switched on M. Branly put on his hat and walked out of the house.

Almost a Magic Bottle

The use of electrons as electric pencils for delineating the form of electric forces, moving at 12 miles a second, is described in a report on Cathode Ray Oscillography just issued by the Department of Scientific and Industrial Research.

It is claimed that with the Cathode Ray Oscillograph, which has "become almost a magic bottle," the pencil can draw separate pictures of a wireless signal received along the ground from the transmitting station, and of the echoes of that signal reflected from the upper atmosphere. This it does, although the time between the signal and its first echo is only 1/15,000th of a second, and the time between two echoes may be less than 1/3,000th of a second.

The report also describes how the Cathode Ray Oscillograph is likely to prove invaluable in navigation by sea and air, in wireless receivers, and in relay devices generally.



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Both models complete with disc drive and fully screened.

FROM MY ARMCHAIR

—continued from page 78

inkstrain. At least, the Editor has it in his safe—or his junk-box ; I'm not sure which.

Of course, the inkstrain is getting of greater "antique valuer" every day. But meanwhile, Carlos wants his complete kit of parts, mains units, valves, etc., etc. He says :

As haven't heard the consequences and resultations of the auction announced in the November issue, if you permit me (but I don't like to do anything wicked, so could you think it an offence), I would like to ask how much amounts the balance due. I shouldn't like at that you would put out from your own pocket without receiving the equivalence.

I remain anxious that you will not excuse me for my question, and I submissively beseech you will concede your clement pardon for having wrote in such seeming grousiness.

Your grievous admirer,
CARLOS

Well, Carlos, old boy, the consequences and resultations of the auction were that not a single reader of this paper offered even half a peseta for your inkstrain. The nearest approach was an offer from Morecambe to exchange half-a-dozen used razor blades.

Carlos, by the way, wishes to point out that the mansion which forms the background to his photograph is that of the British Consul at Setubal.

A Character Reading

Talking about photographs, a reader from Brixton, S.W.9, has studied mine and sends me the following character delineation :

Strong-willed, fluent and accurate, artistic and of a very high intellect. [So far, a very accurate delineation. —J. S.-T.] You have a streak of cruelty, but curiously have also moments of chivalry which arouses in you the desire to protect things that are weak and helpless. This you try hard to suppress, dubbing it as sloppy sentiment. You would like to be considered level-headed and practical, but your eyes tell me you are a dreamer of things of which your most intimate friend would not credit you. There is also a certain sadness that seems to say that you failed to get something or someone you really wanted. This probably arose through your being misunderstood. Rather conceited, you assume indifference towards the other sex, knowing this attracts them all the more. A good friend, but a

very bad enemy. For heaven's sake, shave that horrid little moustache off—it annoys me.

The last irrelevant sentence came as rather a shock, as though this clairvoyante had suddenly come out of her (yes, it's a she) trance.

As a matter of fact, except for one brief relapse in Switzerland, I have not worn even a wisp of a moustache since the days when I was ordered to grow one to frighten the Germans.

Police Protection?

I have had a letter from the police. Mortlake, to be precise, S.W.14.

My correspondent says policemen should definitely come second to busmen as the keenest radio enthusiasts. "I live," he says, "near a bus garage, and know all the busmen that are wireless enthusiasts. They outnumber us by about 20 to 16, but there are far more experienced policemen. I belong to a crowd called speed-cops, and out of our crew of nine, there are three owners of 'S.T.400's,' four owners of 'S.T.300's,' and one is getting the parts for your latest set."

If eight out of nine speed-cops at Mortlake have built my sets, I ought to be pretty safe treading on the gas in that district. Although you never know. Probably one of them has a differential wrong way round and would be glad to have my address.

News from the broadcasting centres :

Viipuri.—A window-cleaner aged 73 has applied for a divorce. He has been married fifty-one years and has seventeen children. The grounds for the application are incompatibility of temperament.

Mr. F. C. Blake, of Helston, has been well answered, by the way, by fellow-Cornishmen. See the letters published in this and the previous issue.

True Collaboration

A word of thanks to Mrs. K. M. L., of S.W.8, for photos of the "S.T.400" set she and her husband have built. "How we enjoyed making it up." It is very delightful to hear of wives who admit they were wireless widows but have now become collaborators.

It is one of life's mysteries why any girl, with her eyes (and her ears) wide open, ever marries a wireless fiend. Love may be blind. Apparently it is also deaf.

!! ? * * * ! ! ? ? ? ! * * * ! * * !
[I have just been hit by that ***** football !]

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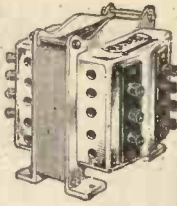
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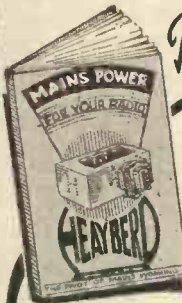
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A VISIT TO ATHLONE

—continued from page 64

the signal lights will give sufficient warning to prevent the valves from being damaged.

"Don't forget that the transmitter was brought over *en bloc* from Chelmsford last June, and work was rushed through for a temporary opening in time for us to broadcast the scenes at the Eucharistic Congress. The transmitter was shipped over a little more than three weeks before the emergency opening date, and we worked night and day to get it going!"

Unfortunately, there wasn't time to visit the studios, but the station engineers told me of latest developments.

Versatile Musical Director

They hope to make elaborate studio arrangements in a few months, but at present the existing Dublin studios are used. These are in the G.P.O. building, O'Connell Street, Dublin.

Here there is a very keen body of men under Dr. Vincent O'Brien, who is the present musical director and who has been given an honorary degree by the National University of Ireland on account of his broadcasting work. As well as augmenting the Dublin studio orchestra, he has done some useful work in vaudeville programmes.

The technical side is all under the control of the Free State Department of Posts and Telegraphs, and Mr. Monaghan, the engineer-in-chief, is the guiding spirit.

Programme Control

Owing to the sponsored programme interests, the Moydrum engineers have nothing whatever to do with the landline switching, or with control on the music circuits. The studio lines are connected to booster amplifiers in the modulation section of the Moydrum transmitter. All the switching is done at the Dublin end.

Although De Valera did not arrange the official opening until February, Athlone has been putting out tests before that. One of Mr. Monaghan's right-hand men told me that they had reports from Newfoundland, Iceland, and even from India.

Good reception of Athlone's transmissions has been reported from many parts of England. The wavelength is 413 metres and is therefore 27 kcs. above the Midland Regional—sufficient separation to ensure freedom from interference.

THE "BESTECTOR SUPER"

—continued from page 71

first one and then the other backwards and forwards until the station is at its loudest. Slight readjustment of the condenser's main dial should be tried during the process.

When you are satisfied the positions of these trimmers cannot be bettered, transfer your attention to the levers on the intermediate transformers. These have to be moved backwards or forwards to the positions of loudest results also.

Tuning Not Critical

Should you find the station gets very loud during these adjustments, leave them as far as you have gone, but tune to another weaker station and start the adjustments over again. This will ensure maximum sensitivity.

Finally, try adjusting the voltages on H.T.+1 and +2. When you are getting the best results you can, tune in a station at a widely different part of the left-hand dial and check over the settings.

You will not find the trimmers on the "gang" condenser very sharp, neither will the tuning of this dial be critical.

Double-Channel Effect

On some stations you will find there are two tuning positions on the right-hand dial. This is caused by the usual double channel effect of a super-het. Choose the reading which gives best reception.

Further adjustments will not be needed when you change over to the long waves, so I will leave you now to get on with the making of your set.

.....

HOW IS YOUR SET BEHAVING NOW ?

If you are troubled by a radio problem, remember that, "The Wireless Constructor" Technical Queries Department is fully equipped to help you.

Full details of the service, including scale of charges, can be obtained on application to the Technical Queries Department, "The Wireless Constructor," The Fleetway House, Farringdon Street, London, E.C.4.

SEND A POSTCARD, on receipt of which the necessary application form will be sent by return.

LONDON READERS, PLEASE NOTE. Enquiries should not be made by telephone, or in person at The Fleetway House or Tallis House.

.....

"CLASS B" AMPLIFICATION

—continued from page 62

it as definite that some quiescent system will be regarded as ultimately essential to every powerful battery receiver, and no battery user need develop an inferiority complex.

As regards the *general* idea of quiescent systems, I humbly and diffidently put myself forward as the first to suggest both the desirability and the solution. In 1918 I published the first comprehensive paper on the theory and practice of valve characteristic curves based on an investigation involving hundreds of measurements taken (December, 1917) while I was Instructor in Wireless to the 1st Army in France.

Published in 1921

The conclusions were reproduced in my book, "Thermionic Tubes," published in 1921.

The following suggestive paragraph is of interest:

It will have been noticed that when we are dealing with uni-directional pulses it is not necessary to make the valve function near its midway point. In fact, if we do this, we will be using a curve twice as high as is necessary and half the curve will never be

used. This means we are needlessly wasting current from the lighting accumulators and perhaps from the high-tension battery. . . . The suggested arrangement is almost as efficient and far more economical than using a higher curve. Similarly, when we arrange for the grid always to receive positive pulses, we should, for reasons of economy, use the bottom part of the steep, straight portion of the curve.

Fifteen Years Ago

The last sentence describes exactly what happens in "Class B" amplification, and the curve I recommended is the same as that of a "Class B" valve—i.e. it lies to the right of zero grid volts and corresponds to positive grid voltages.

If you recall that these were my recommendations fifteen years ago (I was twenty years of age, and probably many modern radio engineers had not then even heard of a valve), you may agree with me that here was quiescent amplification described, and with full emphasis on its merits of economy.

The highly developed and practical arrangement described in this article represents modern technique at its best, and there is no doubt that quiescent amplification has come to stay. Let us welcome it and "get acquainted."

SPEEDOMETERS FOR YOUR RADIOGRAM

—continued from page 81

turntable and the number of lines or sectors on the disc.

With most stroboscopic discs there are 77 uniformly-spaced black sectors or lines. A disc of this nature, when viewed under a 50-cycle A.C. illumination, will appear with its sectors or lines stationary when the turntable revolves at a speed of 78 revolutions per minute (the usual playing speed).

Reason? Well, when the stroboscopic disc is being revolved at 78 r.p.m., this means that a black line or sector will be moved in 1/100th second to the place last occupied by the adjacent black line or sector. But during this change-over the light itself is extinguished.

Persistence of Vision

Consequently you do not perceive the change. And when the black line or sector next following up has got into the position of the foregoing one, the light comes on again. It is really

a sort of cinematographic action, in which the eye's persistence of vision plays its usual rôle.

Seventy-eight r.p.m. = 1.3 r.p.s., you see. $1.3 \text{ r.p.s.} \times 77$ (the number of black lines or sectors on the disc) works out at 100.1. Hence, each black line moves to take up the position of the preceding one in 1/100th sec., thus giving, under the illumination of a 50-cycle alternating current, a stationary effect.

Amazing Ingenuity

A simple calculation of this nature will enable you to determine the number of lines or sectors which are necessary for the construction of a stroboscopic disc whose lines are to remain stationary at any required speed; 75 black lines or sectors, for instance, will be required for a stroboscopic disc whose lines have to remain apparently stationary at 80 r.p.m.

You may, perhaps, find the matter a bit complicated. When you think it out, however, it becomes very simple indeed, and you are struck with the amazing ingenuity of the whole thing.

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AN ALL-PURPOSE METER

—continued from page 66

Some of the possible uses in this respect are as follow :

To make comparative measurement of signal strengths.

As a resonance indicator in tuned circuits.

To plot frequency response curves for L.F. transformers.

As a volume level indicator in L.F. amplifiers.

Fig. 7 describes a simple half-wave rectifier circuit making use of a fixed carborundum crystal, arranged as a high-frequency resonance indicator. This means of rectification, while limited to low power, on account of the crystal, is very suitable for high frequency work.

For Audio Frequencies

The circuit of Fig. 8 utilises full-wave rectification which is obtained by the use of a rectifier consisting of four copper oxide discs arranged in the four arms of a Wheatstone bridge circuit and the meter connected in place of the usual galvanometer.

The discs are so arranged that both halves of the A.C. wave pass through the meter in the same direction. This system is not suitable for

A BRIDGE ARRANGEMENT

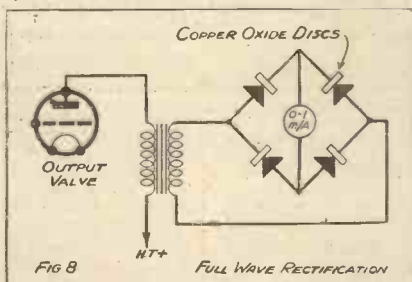
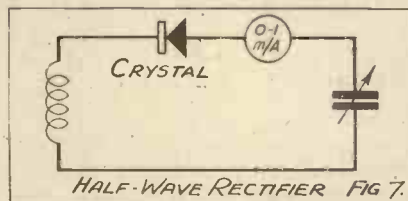


FIG 8 This is the circuit for measuring "speech currents" with the aid of four dry rectifiers.

measurements at high frequencies, but is quite good at audio frequencies. The diagram illustrates how receiver signal strength may be measured. The coupling transformer shown should, in most cases, be of a step-down ratio.

Due to errors introduced by frequency, wave-form, temperature and the fact that the resistance of the rectifier varies with the amount of current passing through the discs, it would be extremely difficult to calibrate the instrument in definite terms.

CRYSTAL RECTIFICATION



An ordinary crystal detector can be pressed into service for obtaining relative measurements.

For the purpose of this article, therefore, it is simply recommended as a means of reading comparative values.

In closing, it may be well to stress the importance of using only good resistors as multipliers and shunts, for upon their degree of excellency depends the accuracy of ultimate readings.

Wire-wound resistors, with a guaranteed accuracy of one per cent, are obtainable and recommended for this purpose.

AS WE FIND THEM

—continued from page 90

In action, this Garrard record changer is truly robot, the machine taking eight 10- or 12-inch records at one loading. The pick-up is first class and the reproduction excellent in every way.

During our tests there were never any signs of failure, the mechanism functioning in an eminently satisfactory manner.

The results, in fact, were up to the high standard one has learnt to expect from Garrard productions. The makers are The Garrard Electrical Engineering Co., Swindon.

W.B. Valve Holder

The advent of the "Class B" and other "double" valves has made it necessary to produce a new type of valve holder with sockets arranged to accommodate the extra valve pins.

The "Class B" battery valve needs six pins, but seven have been provided—one of these is not connected internally—so that the same base can be employed for the new double diode valves.

A seven-socket valve holder is therefore necessary. There are various difficulties which the designers have to overcome, one of them being the necessity for ensuring satisfactory contact at all seven points.

That progressive firm, Messrs. Whiteley Electrical Radio Co., Ltd., Mansfield, Notts, have recently sent us samples of a baseboard mounting valve holder for seven-pin valves which the firm have gone into production with.

It is a nicely-finished component, the sockets are accurately spaced, and both terminals and soldering tags are fitted.

NEXT MONTH

Our July issue will contain further striking articles by

JOHN SCOTT-TAGGART
A.M.I.E.E., F.Inst.P.

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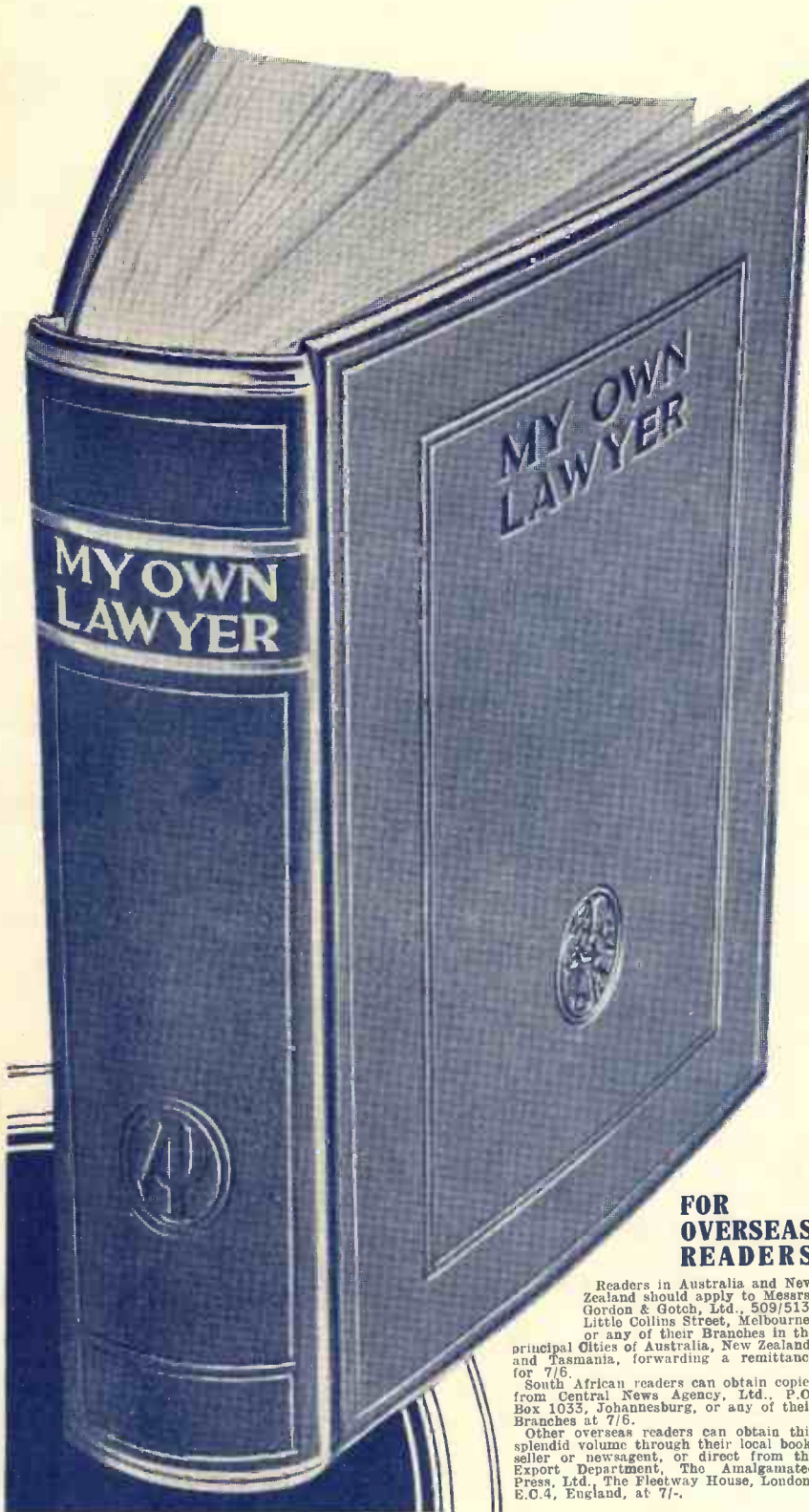
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