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For those who require superlative radio plus the finest electrical reproduction of records, the remarkable bargain of this season is the Superhet Radiogram Seven, Model 523, priced at 39 gns. No one who has not yet possessed a radiogram can appreciate the delights of owning one of these '2-in-1' instruments. Just a turn of the knob and the instrument is converted from a highly selective wireless receiver, into an electrical-reproducing gramophone which reveals entirely unsuspected detail and depth in your records. The tone on both radio and records is one of uncanny realism. Priced at 39 gns. or by hire purchase. Write for full particulars to The Gramophone Company, Ltd., 98 Dept M.W.) Clerkenwell Road, E.C. 1.

Model 523

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"TRUE-TO-LIFE"

RADIO

The Gramophone Co., Ltd., 98 (Dept. M W.) Clerkenwell Road, London, E.C. 1

(Prices do not apply in I.F.S.)

MODERN WIRELESS

Vol. XX. No. 83. BRITAIN'S LEADING RADIO MAGAZINE November, 1933

The Great Success of the K4—A Powerful Superheterodyne Receiver.

THE outstanding success of Mr. G. P. Kendall's K4 receiver, which was exclusively described in last month's MODERN WIRELESS, will be further reflected in the interest which will inevitably be aroused in the valuable details concerning his set published in this issue.

Mr. Kendall, on another page, discusses the use of the new battery H.F. pentodes, and the biased type of Class B valves. He also goes into the question of the use of suitable mains units and of the calibration of the receiver.

Readers will note that he gives a list of stations which he has succeeded in getting in the comparatively short period of only one hour's listening.

Many of the points covered by Mr. Kendall in his article in this issue have arisen through a gratifyingly large correspondence which he has received in connection with his K4 receiver, and readers are asked if they have any further queries to put to Mr. Kendall to address their letters to him personally c/o this office.

The "M.W." Super 5

FOR those who have A.C. mains, the "M.W." Super 5 described in this issue will solve all questions of combined power and selectivity.

The Super 5 is the latest superhet, and its design embodies single dial control of a particularly simple type. Readers will also note the ingenious method of volume control which is incorporated in the receiver—a form of control which prevents all possibility of overloading, in any portion of the receiver, no matter how near one may be to a broadcasting station.

Permeability Tuning

MUCH has been said lately about permeability tuning, and we are sure that our readers will be interested in the special two-valver which we have designed for full description in this issue and which incorporates one of the first of the new permeability tuners to come on to the market.

This particular two-valver is outstanding not only because of a completely new type of tuning control which is employed, but because it does away with the use of the variable condenser and also because it incorporates one of the latest aids to inexpensive listening—our H.T. Battery Economiser.

Although capable of providing an output of about 1,000 milliwatts, the H.T. consumption of this receiver is only 50 per cent of that which is normally required for such an output, although perfectly ordinary valves (not Class B) are employed.

Writing of valves reminds us to draw your attention to the special six-page comprehensive valve supplement, which is included in this issue of MODERN WIRELESS. In this supplement you will find a survey of the latest types of battery and mains valves, and we are sure that this supplement will be of particular value to set constructors who are thinking of building modern receiver designs, or who are contemplating converting their old sets to something more up to date.

The B.B.C.'s Television Tests

AS we go to press with this issue, details are available of the B.B.C.'s official plans for television experiments. Two series of tests are to be made with the ultra-short wave transmitter at Broadcasting House, in order to obtain greater detail and better definition in the televised pictures.

The first series of tests will be made with apparatus installed by the Baird Television, Ltd., and will continue until the end of the year; but in January the second series of tests will begin, apparatus being supplied by Electric and Musical Industries, Ltd.

It is likely that other companies interested in television will be given opportunities of demonstrating their systems, and it is also probable that very shortly Baird Television, Ltd., will begin a series of experimental television broadcasts on ultra-short waves from a special transmitter erected on one of the towers at the Crystal Palace.

Our Radio Serial

IN this issue you will find another long instalment of "Death at Broadcasting House," the new radio novel written by Val Gielgud and Holt Marvell, and here published for the first time—as well as a résumé of last month's instalment for the benefit of new readers.

As we said last month, the introduction of a serial story into MODERN WIRELESS is certainly an innovation in radio journalism.

There can be no doubt now that it has been a success. The fact that the authors are both experienced writers, as well as being officials of the B.B.C., has ensured that their story is a thrilling one from start to finish, but, apart from this, we have received many letters approving wholeheartedly of the idea of introducing a full-length novel in serial form into our pages.

Meanwhile, we suggest that you turn to page 454 and continue the hunt for clues.

HOW TO GET THE LAST OUNCE

Practical details which will enable you to get the revolutionary results that Britain's first Tone-levelled Step-System receiver gave in the hands of its designer.

LAST month I had one continual anxiety and pre-occupation: could I make people realise how important was the Step System, and what a genuinely revolutionary set was the K4? If I failed to do that I should have felt that I had failed in my first and most obvious duty to my readers, for what would be the use of producing an important invention like this without making certain that its merits were fully understood by the people whom I intended it to benefit?

Immediate Recognition

Apparently I might have spared myself much worry, for my old friends showed just their accustomed form. The remarkable jump in circulation last month, and the reports I have received from trade circles, all go to show that their recognition was immediate.

I rather fancy now that if I had confined myself to a bare technical explanation of the new system and of the set the result would have been just the same. That is why writing for MODERN WIRELESS is always such a pleasure to me; there is no need to labour one's points, for one is addressing an audience which grasps them as quickly as they are presented.

Anyway, it is a relief to know that the set has received its due measure of recognition, and there is no further need for me to bang metaphorical drums in its honour to make sure that the importance of the occasion is fully understood.

As One User to Another

The set is now being built in sufficient numbers all over the country to ensure that its extraordinary standard of performance will become completely known without further effort on anybody's part, which is again a relief to me, for I do hate this business of having to make a lot of claims of results in order that the reader may be able to compare them with those of other sets.

It's not that I mind the immense amount of work that has to be done in order that one can be confident that such claims are correct down to their smallest details, because that would have to be done anyway for my own satisfaction.

What I do dislike is the way one cannot help writing in a boastful sort of strain when once started on this tack, for that seems to be so far removed from the dispassionate and purely scientific account which I should prefer to give.

However, it is all done so far as the K4 is concerned, and I now have the satisfaction of knowing that a goodly proportion of my readers are on the road to proving for themselves that none of my claims has been too strongly worded.

That being so, I may now perhaps be permitted to go on and talk about the set in plain, sober terms as one user to another, and tell you how to get the very best from it, adapt it to your own particular requirements, and so forth.

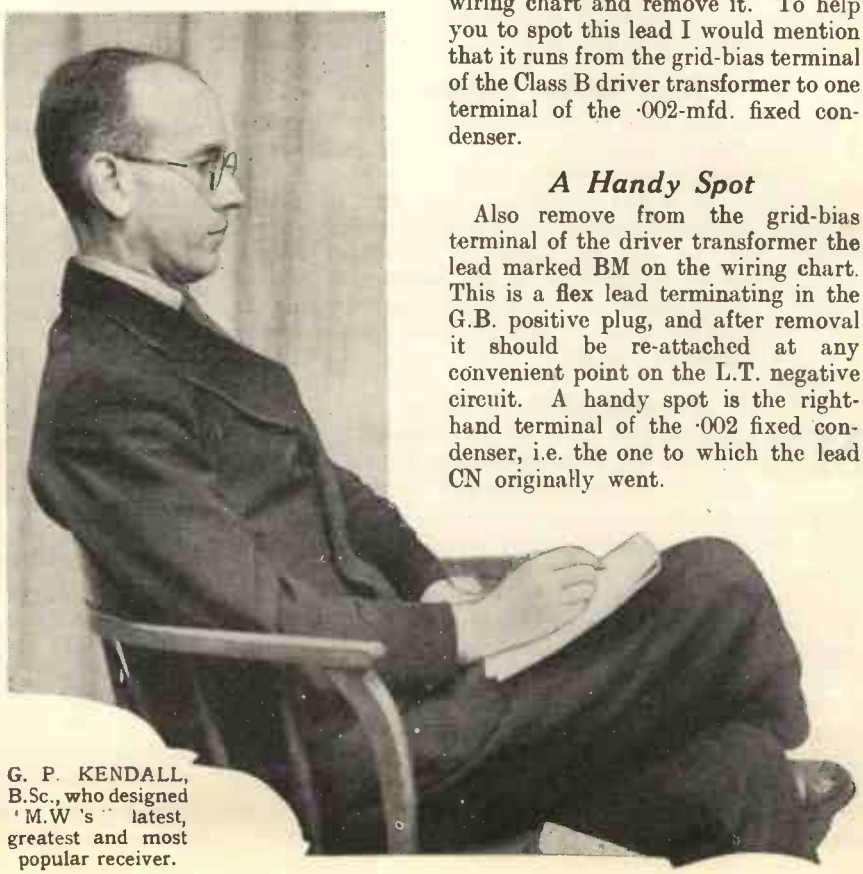
Biasing the Class B Valve

First, there are certain questions of special valves with which it was obviously impossible for me to deal last month. For example, there is now at least one type of Class B output valve available which requires to be provided with a small negative bias on the grids for the best results. This is the Marconi or Osram B.21, and to use it in the K4 in place of the earlier types of B valves which work with grids at zero you need to make a slight alteration in the wiring, so that the needful negative voltage may be applied.

This is what has to be done: first identify the lead marked CN on the wiring chart and remove it. To help you to spot this lead I would mention that it runs from the grid-bias terminal of the Class B driver transformer to one terminal of the ·002-mfd. fixed condenser.

A Handy Spot

Also remove from the grid-bias terminal of the driver transformer the lead marked BM on the wiring chart. This is a flex lead terminating in the G.B. positive plug, and after removal it should be re-attached at any convenient point on the L.T. negative circuit. A handy spot is the right-hand terminal of the ·002 fixed condenser, i.e. the one to which the lead CN originally went.



G. P. KENDALL, B.Sc., who designed 'M.W.'s' latest, greatest and most popular receiver.

FROM The K4 BY G.P. KENDALL B.Sc.

Now attach to the grid-bias terminal of the driver transformer a new flex lead bearing on its free end a battery plug which will now be the G.B. negative point for the B stage. It should be inserted in the grid-bias battery at a point to give the correct operating voltage for the particular valve you have chosen, a figure which you will find in the data slip accompanying the valve.

Minimum of Complication

The special advantages claimed for this type of B valve, by the way, include still lower H.T. consumption, and the ability to give better quality of reproduction, more particularly on comparatively weak signals. It certainly gives very excellent results, but I do not want to imply by this that the more familiar type leaves much to be desired, for it actually does its job well with the minimum of complication.

Don't forget, by-the-by, that if at any time you should make a change in the type of B valve in use it will quite likely be necessary to make an alteration in the output circuit ratio before the best results are again obtained. This is one of those easily forgotten points which are actually of very great importance in Class B work.

The H.F. Pentode

The other possible special type of valve which the K4 user may want to try is the so-called H.F. pentode in place of the variable-mu screened-grid valve. The H.F. pentode is one of the latest of the newcomers, and it is only just beginning to appear in battery form, but I was fortunately able to try one of the original laboratory specimens and so to see that the design of the K4 was such as to permit the valve to be used later on if desired.

ACCESSIBILITY. If you wish to try another resistance, it is but the work of a moment, owing to the unique accessibility of components mounted on the Kendall Step System.

Very briefly, the H.F. pentode gives still higher amplification than the normal screened-grid type, yet with the same inherent stability, and with certain special good features in its characteristics which may well lead to its very general use ere long.

Quite frankly, I think the K4 is a set in which the benefit of the new valve will not be felt so strongly as in many others. The fact is that this set makes such good use of the normal S.G. valve that under practical conditions one feels that there is little need for any higher magnification.

Stability in Reserve

However, the lure of still more amplification is always hard to resist, so I have taken pains to see that it can be indulged in in this particular direction if desired. The main requirement is simple: the set must be designed with such a margin of stability that the greater "mag." of the pentode cannot cause trouble, and this I found specially easy to arrange in the K4, by virtue of the very perfect layout rendered possible by the Step System.

It was very largely because I had the pentode in mind that I went to the trouble of adding a little screening to the set, for this is not strictly necessary with the ordinary S.G. valve. With such a good reserve of stability you will find it a very simple matter to change over to the pentode should you so desire.

It is really only a matter of fitting the new valve, making such readjustments of "screening" electrode voltage as may be called for by the particular pentode used, and making slightly different use of the volume control.

Normal and Healthy

This latter follows merely from the fact that you may find that when the control is turned right round to what would be the position for maximum volume with an ordinary S.G., the set will be either on the verge of self-oscillation or just gently oscillating, without the use of reaction at the detector stage.

This is a quite normal and healthy condition, but it means that for

THE K4—which is "at home" in almost any type of cabinet the constructor may choose

A1 Performance from the K4

proper results, and to make effective use of the detector reaction, the volume control must first be turned a little way to the left. Actually, it is a point which hardly arises in practice, simply because one so rarely uses maximum volume in any case.

With a specially lively, i.e., efficient, screened-grid valve of normal type a somewhat similar effect may sometimes be noticed, although it is unlikely that you will succeed in producing actual self-oscillation without the use of reaction. What you are more likely to observe in this case is only that you may get slightly better results by reducing the mag. a trifle on the volume control and then applying a shade of detector reaction.

Using the Mains

This, of course, is a normal part of the procedure in exploiting the tone-levelling system, and I only mention the point in passing, so that it may not be thought that the effect is peculiar to the H.F. pentode. Actually, it is a consequence of the presence of a certain minute but carefully controlled regenerative effect which I have provided in the H.F. stage of the K4. This is a very favourite trick of the commercial designer, and it often permits very striking results to be obtained from a single H.F. stage.

Of course, for the pentode it will be necessary to replace the present 4-pin holder with one of the new 7-pin type. This should be connected up as follows: Join No. 1 and No. 3 together and to earth or L.T.—. Nos. 4 and 5 are the filament terminals, No. 2 is the ordinary or "signal" grid, while No. 7 is the screening grid. These points are naturally joined up exactly as before.

Then there is the question of using the set with a mains H.T. unit, which, I suppose, a good many readers will desire to do. It can, of course, be done, but I must warn all concerned that to work *any* Class B set from a mains unit is not so simple a matter as it used to be with Class A output.

The continual heavy fluctuations in the anode current of the B valve presents the mains unit designer with a very difficult problem, which he has not always solved in a really satisfactory manner.

The type of unit which you require, then, is one specially intended for Class B work and, further, is provided with an adequate number of separate positive tappings. This last is also important, the actual requirements being as follows: one tapping point must give about 120 volts for the anode of the S.G. valve (H.T.+2), and there must be another giving variable voltages round about 60 to 70 for the screening electrode (H.T.+1).

REACTION AND TONE LEVELLING—should be operated together as explained by Mr. Kendall this month.

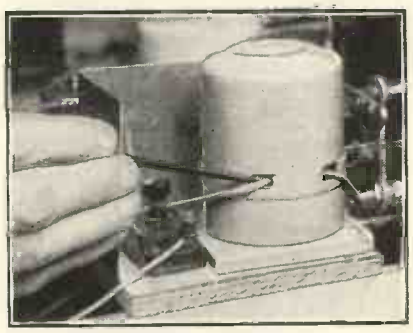
The illustration to the right is a reminder that when pulling on insulated leads which pass through screens, care must be taken not to cut the insulation.

The top knob controls reaction, the adjustment of which has no effect on quality if simultaneous levelling of tone is effected by the lower knob.

Providing Separate Feeds

Another tapping giving similar voltages for the detector is an advantage, but it is not essential. Where it is not available the detector can be supplied from one of the higher voltage taps through a decoupling filter as explained pictorially on these pages.

In most cases it will be advisable to provide separate feeds for the driver and B valves, which is very simply done; just remove the wire which joins the + H.T. terminal of the driver transformer to the centre terminal of the output choke, which lead is marked BT on the wiring chart. Attach a new flex lead to the centre

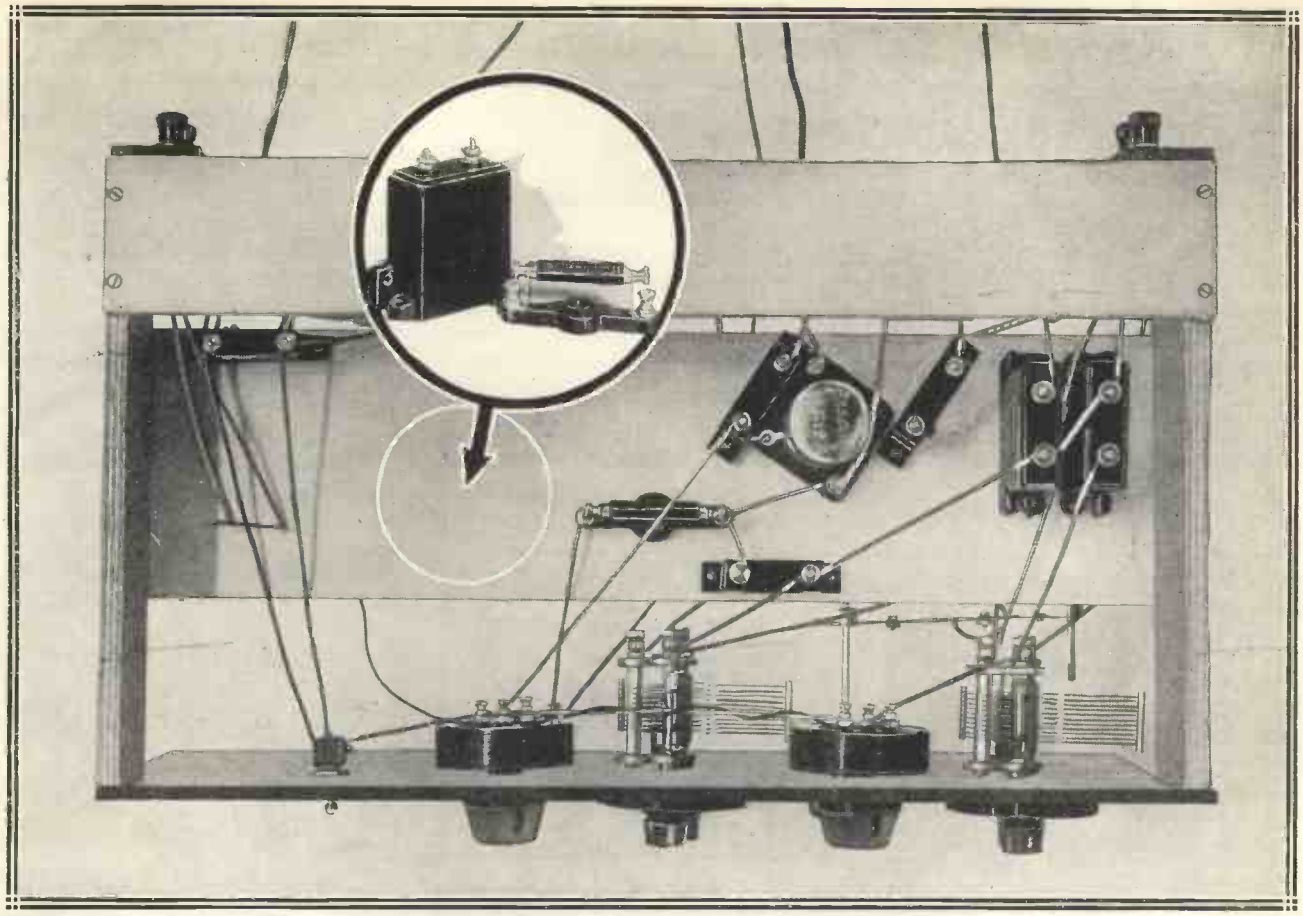


terminal of the output choke, which will then be the H.T. feed point for the B stage. The "H.T.+4" plug now feeds only the driver valve, and wants about 120 volts from a *separate* tapping on the mains unit.

The Chief Requirement

With these arrangements you should have no trouble; but, of course, everything depends upon the nature of the decoupling in the mains unit. If you *should* get motor-boating, on no account allow it to go on for more than a few seconds if it is at all strong. Switch off at once, for violent motor-boating is bad for the B valve. Add the decoupling filter in the detector lead to which I have already referred, and the trouble should stop.

The chief requirement, as you will now realise, is that the unit should be well provided with separate output



DETECTOR DECOUPLING. After mounting the components in the position indicated by the circle, the 20,000-ohm resistance is wired to be in series with the H.T.+3 lead. One terminal of the 2-mfd. condenser goes to H.T.+ on transformer, while the other goes to any L.T.— connection.

tappings. It may help if I summarise them, thus :

Tapping No. 1, for S.G. anode, 120 volts.
" No. 2, for screening electrode, variable.
" No. 3, for detector, variable. Desirable but not essential.
" No. 4, for driver, 100 to 120 volts.
Tapping No. 5, for Class B valve, 120 to 150 volts.

On a Large Scale

Now I want to say a few things about the apparently simple little matter of "calibrating" your K4, for the reason that, nowadays, it is no longer so simple as it looks. The difficulty arises from the fact that stations are crowded so close together on the wavelength scale that the old type of graph, with every division representing, perhaps, 5 metres, is no longer of the slightest use.

To be any real help, you simply must have a scale big enough to permit you to read off even the major fractions of a metre. Using the normal graph paper, divided in inches and tenths, this means that you should construct your scale so that every tenth of an

THESE COMPONENTS WERE USED IN THE K4

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 pair Ferrocart coils on separate bases	Colvern F.10 and F.3	—	1 500-ohm resistance and holder	Graham Farish "Ohmite"	—
1 Compensating transformer	Varley type D.P.35	Telsen, R.I.	1 2-meg. grid leak (wire ends)	Lissen	Telsen, Dubilier, Igranic
1 Class B driver do.	Ferranti A.F.17C	(See Author's remarks in October number)	3 4-pin valve holders	W.B.	Benjamin, Telsen
		ditto	1 7-pin valve holder	Benjamin	Wearite, W.B.
1 Class B output choke	Sound Sales	Graham Farish	1 3-point on-off switch	Bulgin Q.M.B./S87 (with "on-off" indication plate)	—
1 Screened binoc. H.F. choke	Telsen W340	Telsen, Bulgin, Wearite			
1 Screened H.F. choke	Graham Farish H.M.S.	Polar, Utility	4 Indicating terminals	Igranic	Belling-Lee, Bulgin, Clix
2 ·0005-mfd. tuning condensers (air dielectric)	Graham Farish "Zelos"	Igranic	7 Wander plugs	Belling-Lee	Clix, Bulgin
2 Dials for same	Ormond R/360	Polar, Graham Farish, J.B	2 Accumulator spades	Belling-Lee	Clix, Bulgin
1 ·0003-mfd. reaction cond.	Telsen W354	Wearite, Igranic, Lewcos	1 S.G. anode connector	Belling-Lee	Bulgin
2 50,000-ohm wire-wound potentiometers	Graham Farish		1 Coil switch coupling link	Telsen W217	—
1 ·0003-mfd. Preset compression condenser	Telsen W151	Igranic, Polar	1 K4 framework	Peto-Scott	—
2 ·5-mfd. fixed condensers	T.C.C. 50	Dubilier, Telsen, Lissen	1 Panel, 18 in. × 7 in. and 2 terminal strips, 3 in. × 1½ in.	Peto-Scott	Becol, Permcol
1 ·002-mfd. do.	T.C.C. 34	Telsen, Dubilier, Lissen	1 K4 screen, 7½ in. × 3½ in.	Peto-Scott	—
1 ·0005-mfd. do.	T.C.C. 34	Dubilier	6 yds. 20 or 22-gauge tinned copper wire	Goltone	Lewcos
1 ·01-mfd. do.	Dubilier 620	T.C.C.	5 yds. insulated sleeving	Goltone	Lewcos
1 ·0002-mfd. do.	Dubilier 620	T.C.C.	Flex, screws, etc.	Peto-Scott	—
1 ·0003-mfd. do.	Dubilier 620	T.C.C.	1 Wander fuse	Belling-Lee	—
			Few inches screened wire	Goltone	—

Correctly Balanced Tone on All Programmes

inch division represents 1 metre. Such fractions as a ¼ or ½ metre can then be estimated in plotting the curve.

If you want to make a graph covering from, perhaps, 200 to 550 metres, this means a scale 35 inches long and a rather unwieldy sheet of paper, but there is no way out if you want a calibration curve which will be of any real use to you. Treat the sheet like a map or plan, and roll it, and you will find that it is not nearly so awkward as it sounds.

On the horizontal (dial reading) scale I, personally, use two tenth-inch divisions to represent 1 degree on the dial, since this makes it easy to record the fractional readings one sometimes encounters. It also keeps the shape of the whole graph to the desirable roughly square form.

With the actual methods of curve plotting I must assume that the reader is familliar, but the illustration on one of these pages will be helpful to those who have not had much previous experience of the work. The photograph shows exactly how to plot each point, and the way they should afterwards be joined up with the smoothest line possible to form a continuous graph.

Wandering Stations

By the by, if some of your points fall right off any possible line, don't conclude too hastily that you have necessarily made a mistake in taking your readings; it may quite well be that the station concerned is doing a bit of wandering, so just ignore it in curve plotting.

Now there is a little tip I should like to give you in connection with the actual manipulation of the controls in performing the operation of tone levelling. I will put it this way: first tune in your station and note the quality of reproduction and the presence or absence of interference; also decide whether the volume is adequate.

If you are satisfied on all these points, of course, there is no more to be said. I will suppose, however, that you find, first, that the tone is too bright or too low, the other factors being satisfactory. To meet this condition, you have only one control to deal with, and its use is obvious.

Then imagine that the volume is below the required level, but tone is normal and there is no appreciable interference. Here you have the choice of two methods of increasing volume: first, you can turn up the volume control itself, which will presumably have been set somewhere below its maximum position; and. secondly, you can apply reaction.

Preserving Tone Balance

The first method should be used where there is no chance of interference being brought in by the increase in mag. without a corresponding gain in selectivity. Wherever there is such a chance, it is better to try first the effect of reaction. Don't forget that when you have made this adjustment, you should make a check on the setting of the tone-levelling control to see that it is giving such a tone balance as suits the new reaction adjustment.

Finally, there is the case of adequate strength accompanied by interference, which really brings me to the point I want to make. In this instance the procedure is to reduce volume on the normal control and then bring it up

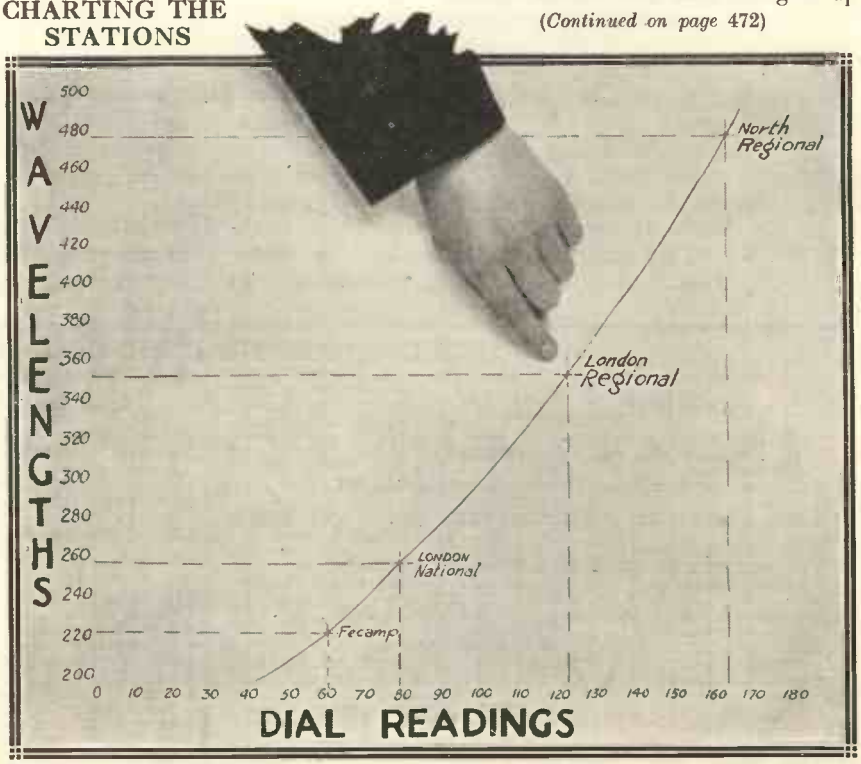
(*Continued on page* 472)

ONE CROWDED HOUR WITH THE K4

All these stations were positively identified in a sixty-minutes' test, using a good outdoor aerial, at Mr. Kendall's home in Surrey.

STATION	Dial Reading	STATION	Dial Reading	STATION	Dial Reading
Beziers	51	Hilversum	96	Toulouse	136
Cork	57	North National	100½	Leipzig	137½
Fécamp	60½	Bordeaux Lafayette	101½	Midland Regional	140
Kiel	63	West Regional	103	Sottens	141½
Bordeaux	66	Genoa	105	Katowice	143
Belfast	70	Göteborg	108	Athlone	145
Trieste	73	Breslau	109½	Moscow	147
Barcelona	74½	Poste Parisien	111½	Stockholm	153
Gleiwitz	75	Milan	113	Rome	154½
Hörby	76½	Brussels No. 2	116	Milan (Vigentino)	157
London National	79	Brno	117½	Beromünster	159
Bari	83	Barcelona (E A J 1)	120	Langenberg	163
Turin	86	London Regional	123	North Regional	164
Heilsberg	87	Algiers	126	Florence	171
Bratislava	88	Hamburg	130	Brussels No. 1	173½
Scottish National	92	Scottish Regional	132	Vienna	175
Viborg	94				

CHARTING THE STATIONS



How are you going to identify all the stations that the K4 brings in? It's really very easy. Use a big sheet of graph paper, and mark in the exact readings of all the easily identified stations, as shown. A pencilled curve joining all the dots together will then link up all the other dial readings and wavelengths.

CURING HUM in A.C. SETS

A PRACTICAL ARTICLE

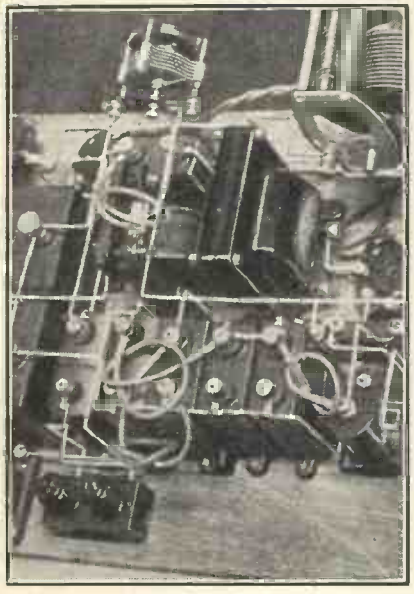
By G. W. DAVEY

Even with an efficient and properly smoothed H.T. supply, hum is sometimes experienced on a mains receiver. Readers troubled with such a residual hum will find the suggestions in this contribution of special interest.

THE old fallacy that A.C. mains sets are difficult and dangerous for experimenting with by the home constructor, time has definitely exploded. Provided a reasonable amount of care is taken, of course, they are as easy to make and use as battery-operated sets.

The one drawback that some amateurs find is a certain amount of hum, which, though generally drowned by the programme, is, all the same.

A GOOD LAYOUT



The section of a mains receiver shown to the left illustrates how a careful layout enables the wiring to be spaced in a manner which avoids the introduction of hum. On the right a constructor is seen fitting double screened wire for the valve heater connections to reduce hum.

to some extent objectionable. I propose, therefore, giving some of the causes I have, in the course of much experimenting, found to produce hum, and, although once the cause is known the remedy is generally obvious, also give some hints on obtaining that perfectly hum-free background which I know by experience is obtainable.

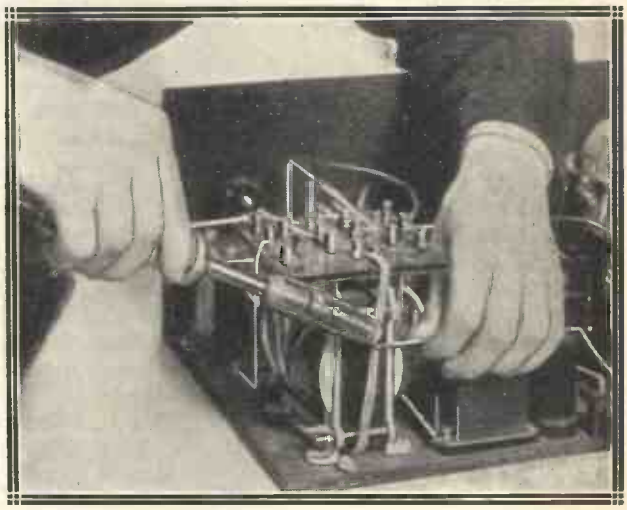
By mains sets, of course, I am referring to sets which are all-electric—i.e. using indirectly-heated valves. H.T. from the mains and generally, too, automatic grid bias. We will deal firstly with the filament, or heater, circuit, which uses raw A.C. usually at 4 volts, each valve taking 1 amp.

As the current supply is raw A.C. care must be taken that hum is not induced into the circuit by the leads carrying it to the valves. To obviate this it is usual to use twisted flex to carry the 4 volts to the heaters. Personally, I have found an objection to this in that the resistance of the flex tends to drop the applied voltage (after all, where 2 or 3 amps. are flowing the smallest amount of resistance is liable to produce a serious voltage drop), and I have used with much success ordinary lead-covered twin cable such as is used for house wiring.

This has the further advantage that the lead covering acts as a shield and may be earthed if desired. Special shielded cable is, I believe, sold now for this purpose. Special care must be taken that no hum is introduced into the detector circuit as, obviously any hum here will be magnified by the succeeding L.F. stage or stages.

Keep your heater wiring away from the grid leak and also the wire connecting this latter to the valve holder grid terminal. Keep this wire as short as possible.

SCREENED LEADS FOR THE HEATERS



An Important Rule

Let us now discuss the grid circuits. Keep all leads going from a component to a valve holder grid terminal as short as possible. This rule applies, in fact, to all sets whether mains or battery-operated.

If heater wiring must go near this wire, try and keep it at right angles to it, and not parallel. Where automatic grid bias is used, decoupling is sometimes found necessary. Personally, I have not found any more than a large condenser across the grid bias resistance is required.

(Continued on next page)

TRY THESE TIPS

Quick mounting for components—Independent checking for H.F. circuits—Tilting the set for convenience.

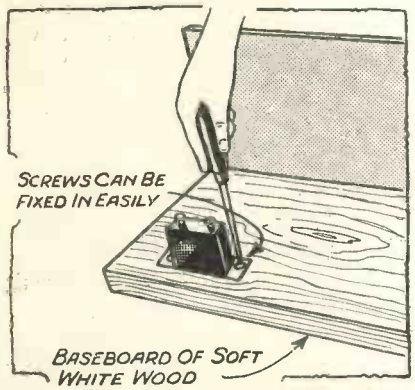
Experimental Baseboards

THOSE constructors who are keen on trying out new circuits and experimenting with different ideas, usually put the schemes together roughly on a panel and baseboard for convenience in operation. But anything which saves time in this assembly is very welcome.

One of the biggest items is the screwing of the components to the baseboard, for a small hole has to be made before screws can be inserted into the ordinary plywood baseboard.

But if a piece of soft white wood is used for this purpose instead, the screws can be forced in direct with the screwdriver and the necessity for making starting holes is obviated.

TO SAVE TIME



With a baseboard of soft wood no gimlet or bradawl is needed.

A Useful Tester

A very useful circuit tester can be made by wiring one of the permanent type of crystal detectors in series with one lead of a pair of phones. The phone leads can be terminated with test prods for convenience.

Then the unit can be used to test the tuning of each circuit. Where ganged H.F. stages are employed the device is particularly useful.

The signal can, in effect, be traced from the aerial to the detector, whereas it cannot be easily traced by any other simple method.

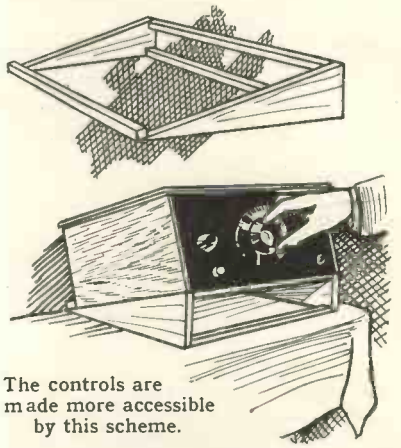
Comfortable Tuning

Where fine and accurate tuning is necessary for long-distance reception, the disposition of the controls plays a big part in the operator's comfort. For instance, plain tuning dials near the bottom of the panel are none too accessible.

A scheme which can be applied to any receiver, and which greatly increases the ease of operation, is to tilt the set back so that the panel is sloping and raised from the table. The best way to effect this is to prepare a wooden cradle.

This may consist of two triangular shaped pieces of wood joined together with three cross members, two in the front and one at the back. The arrangement makes it possible for elbows to be rested on the table, if desired, while tuning is carried out.

A RADIO RACK



The controls are made more accessible by this scheme.

CURING HUM IN A.C. SETS

—continued from previous page

Make this condenser as large as possible, however. The modern low-priced electrolytic one of high capacity is useful in this respect.

Now let us turn to the anode circuit. I am assuming here, as all through, of course, that the mains unit used is of reputable make or, if home-made, of good design, so that any hum will not be due to a badly designed unit. When working "all-mains" I have found that too much decoupling cannot be used.

Try Decoupling

One cause of so-called "hum" is actually caused by the receiver being unstable, and wonders can in this case be worked by proper decoupling. Decouple, therefore, if it is not already done, as it should be, the detector anode circuit.

If a screen-grid H.F. valve is used, decouple its anode and screening grid circuits. Decouple the screen of a pentode valve, if any, and whether pentode or power output valve be used, see that you have an output filter. Besides acting as a decoupler, it renders the set quite safe by isolating the H.T. from the loudspeaker.

Two L.F. Stages

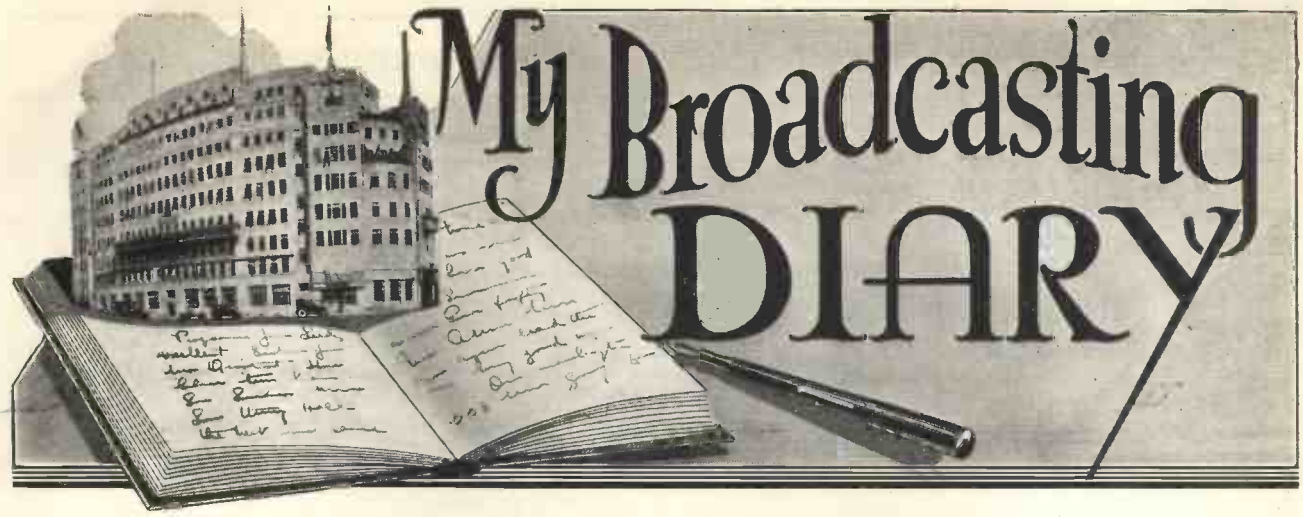
Place all transformers and chokes as far away as possible from each other, and with their cores at right angles. Do not use two transformer-coupled L.F. stages; it is a great job getting them quite stable, and even then a loud hum is very audible. If you must use two L.F. stages, use R.C.C. followed by transformer, with plenty of decoupling, not forgetting an H.F. stopper of about 100,000 ohms in the lead to the grid of the first L.F. valve.

If one of your stages employs parallel-feed transformer-coupling, try reducing the value of the coupling condenser. It sometimes happens that this condenser causes a resonance around the frequency of the mains. This resonance would, of course, cause the hum to be magnified, and a reduction in the condenser value, while not noticeably affecting quality, often helps in reducing a hum.

It sometimes happens that a certain amount of H.F. from signs, tramways, etc., gets on to the mains and causes a hum. This type of hum can generally be detected by the fact that it only becomes audible when a powerful local is tuned in. Two ·01-mfd. condensers of high test voltage, connected in series across the mains input to the set with the mid-point connected to earth, generally obviates this.

Use a Good Earth

Mention of the earth reminds me that one of the best means of keeping down hum is to ensure a really good earth. Although many consider an earth unnecessary with a mains receiver, it is my opinion that the provision of a good low-resistance earth is the first step in attaining a hum-free A.C. receiver.



Keeping a critical eye on the affairs of the B.B.C., Our Special Correspondent comments frankly and impartially for the benefit of listeners on the policies and personalities controlling British broadcasting.

Christmas is Coming!

SOMEONE at Broadcasting House has remembered that —don't laugh !—Christmas is coming !

The outcome is great activity in the Variety Department, which (and not the Children's Hour) is responsible for pantomimes.

Gerald Cock, of the Outside Broadcasts, is also busy on plans for "something special."

Last year Mr. Cock's department received a suggestion for doing a relay from Bethlehem, but the telephone system was not then suitable. I wonder whether Mr. Cock has remembered that the Palestine radio-telephone is now open ?

Wireless Exchanges

Wireless exchanges are again a topic of discussion at Broadcasting House. Sir John Reith is known to be interested, and I predict that before long some decisive move will be taken. The Post Office is, of course, the deciding factor—and ultimately the Government. Fleet Street, I gather, is not altogether disinterested, so between the various parties there should eventually be some fireworks !

The Programmes Listeners Prefer

Apropos wireless exchanges, the B.B.C. is still interested in the charts provided by certain organisations. These charts, compiled by the managers of big exchanges, indicate exactly the programmes for which listeners switch on. The plain evidence that they provide is almost impossible to explain away. Dr. Boult, Mr. Siepmann, and others, cannot get round the fact that only five per cent of listeners switch on for the "proms," and the majority of listeners in many districts will readily "listen" to silence but switch off immediately a talk comes on !

On the light entertainment side a great deal of consideration is given to the evidence supplied by wireless exchanges, mainly because such evidence is favourable. The "highbrows" prefer to ignore it.

The Empire Service Progress

Empire Service programmes under the able direction of Mr. C. G. Graves, are making excellent progress, but on the technical side there is little advance. This is exactly as foreseen long before the Service was begun and is in no sense a reflection upon the methods or apparatus employed by the B.B.C. The plain fact is that science is not sufficiently advanced to be able to give the Empire 100 per cent efficient broadcasting service.

The various changes on the technical side—exclusively forecast in MODERN WIRELESS—were made last month, but no outstanding improvements have resulted.

A Heavy Expenditure

The unfortunate fact is that so long as the Dominions are faced with a service which is in the slightest degree "doubtful," they will not feel disposed to contribute to the cost of the transmissions. The Empire Service is already a heavy drain upon the B.B.C.'s resources, and it is clear that expenditure cannot proceed unchecked and unaided.

"ROMEO AND JULIET" ON THE RADIO

Miss Sylvia Sydney, a film star, and Mr. Ion Swinley during the broadcasting of a scene from the popular Shakespearian play

The Latest Phase in Announcing

That the programmes are appreciated is beyond all question, and there is a very natural desire at Broadcasting House to continue them through thick and thin. Nevertheless, a little financial gratitude would be appreciated.

A Problem at Headquarters

The latest phase in announcing is specialisation. At headquarters, in particular, it is becoming increasingly evident, and I predict that the B.B.C. will soon be faced with a knotty problem. Junior announcers are already complaining that they have thrust upon them the least interesting of announcing tasks, while the seniors protest that they do not always receive the jobs for which their voice and temperament are most suited.

The settlement of such disputes should be the particular pigeon of the Programme Presentation Department; but any decision—one way or the other—will cause a lot of discontent.

The B.B.C. and the Gramophone Companies

Nothing is more remarkable in broadcasting politics than the recent change of attitude between the B.B.C. and the gramophone companies. At one time there was almost open hostility between the two interests, but to-day the relationship shows signs of steady improvement.

The fact is that the Governors of the B.B.C. at last realise that they have—if they so care—a powerful ally in gramophone companies which offer remunerative contracts to innumerable artistes.

AMERICAN FAVOURITES BEFORE THE "MIKE"

Among this happy group broadcasting from an American studio are "Bing" Crosby and Eddie Cantor, the well-known artistes. They are on the right, Eddie being next to the microphone.

It is gradually dawning upon the B.B.C. that of the three big entertainment interests—the theatres, the gramophone and broadcasting—one alone cannot hope to stand out against the other two. At the moment it seems likely that the gramophone people hold the balance of power, and if they play their hand carefully they will rapidly increase the strength of their position.

Political Talks

Political talks are still a delicate subject, and Mr. Ramsay MacDonald's broadcast on Thursday, November 9th, is likely to bring them into the news again. Mr. Winston Churchill itches to be at the microphone; so, too, does Mr. Lloyd George. They will both get there in the end—but not until it is convenient to the Board of Governors!

Forthcoming Items

Light entertainment under the brilliant guidance of Mr. Eric Maschwitz is gradually being pulled out of the rut.

There are to be plenty of high spots this month, but there are many experiments to be made before Mr. Maschwitz is really satisfied that his department is permanently running at a higher level.

On November 20th, The Roosters Concert Party returns to the microphone, and it is a foregone conclusion that the broadcast will be "a winner." Mr. Maschwitz will always be on safe ground when he engages The Roosters.

On November 23rd, that successful combination—C. Denis Freeman and Mark Lubbock—is putting on another revue entitled "Consequences."

Another noteworthy night for light entertainment will be Monday, November 13th, when A. P. Herbert's "La Vie Parisienne" comes on.

A New Development

A development in music this month is the engagement of Sir Granville Bantock to introduce recitals of gramophone records and explain them. On Friday, November 10th, for instance, he will deal with The Development of the Orchestra, playing over a series of records to illustrate his talk.

Then on November 24th he will broadcast another series of records illustrating a subject which is yet to be chosen, but which will probably concern brass bands.

There is speculation in some quarters as to whether Sir Granville's popularity may ultimately rival that of Sir Walford Davies in the field of musical talks.

The Radio Drama Festival

Some criticism has been levelled at the Productions Department on the grounds that the Radio Drama Festival, extending over several months, consists entirely of revivals. Val Gielgud has already given a most effective answer—by making undoubted successes of the first few plays of the Festival. So long as they prove acceptable to the vast majority of listeners, what does it matter whether they have been broadcast before?

"Obsession," by Dulcima Glasby, is the next outstanding play to listen for—on November 20th.

A Recital by Pouishnoff

Thursday, November 23rd, will be looked forward to by those who worship the piano, for there is to be a recital by Pouishnoff on the National. His playing will be interspersed with songs by Esther Coleman, soprano.

Class B Mains Units

L. C. B. (Sundridge Park).—"Although I am aware that the Class B method is primarily a system for battery users, I understand that it is also possible to employ Class B in conjunction with an H.T. mains unit. Is an ordinary mains unit suitable or does it have to be one specially designed for the job?"

There is nothing unusual about the mains unit except that unless it has abnormally good regulation it is advisable for it to incorporate some form of voltage-stabilising device, such as a neon tube stabiliser.

The stabiliser is joined across the smoothed output from the unit and maintains the voltage at a substantially constant value in spite of the large fluctuations of current which are a feature of the Class B system.

The effect of the neon stabiliser is to keep a steady load on the circuit, passing more current as the voltage of the unit tends to rise and less current when the voltage of the unit falls. The result is that a steady voltage is applied to the terminals of the set, and the scheme is perfectly satisfactory in practice.

Decoupling Condensers

W. L. (Poole).—"I have on hand two 1-mfd. fixed condensers and I want to use them for decoupling in a screen-grid circuit. A friend tells me that they are of old type and not of non-inductive construction. He says that they will not work satisfactorily on the H.F. side of the set, although they should function quite well as L.F. by-passing condensers. Will you please say whether my friend's advice is correct?"

Your friend is perfectly correct. Condensers used for H.F. by-passing must be of non-inductive type, otherwise they are quite useless for the purpose. Inductance acts as a barrier to the passage of high-frequency currents, hence the existence of this factor in a condenser merely serves to nullify its effect as a by-passing device.

The purpose of an H.F. decoupling capacity is to provide an easy path to earth for the high-frequency currents in the screen-grid or anode circuits of the S.G. valve. The effect of the inductive construction is equivalent to inserting an H.F. choke in series with the condenser capacity and so neutralising the ability of the condenser to permit a free flow of the H.F. currents back to the "earth line."

On the low-frequency side a small amount of inductance in the condenser is not of such great importance because the currents are of much lower frequency than those on the H.F. side. The effect of a given inductance at radio frequencies is very many times greater than at the low frequencies which go to make up speech and music.

TECHNICAL QUERIES DEPARTMENT

Are You in Trouble With Your Set?

The MODERN WIRELESS Technical Queries Department is in a position to give an unrivalled service. The aim of the department is to furnish really helpful advice in connection with any radio problem, theoretical or practical.

Full details, including the revised scale of charges, can be obtained direct from the Technical Queries Department, MODERN WIRELESS, Fleetway House Farringdon Street, London, E.C.4.

A postcard will do. On receipt of this all the necessary literature will be sent to you, free and post free, immediately. This application will place you under no obligation whatever. Every reader of MODERN WIRELESS should have these details by him. An application form is included which will enable you to ask your questions so that we can deal with them expeditiously and with the minimum of delay. Having this form you will know exactly what information we require to have before us in order to solve your problem.

London Readers, Please Note: Inquiries should not be made in person or by 'phone to Fleetway House or Tallis House.

Screening Modern Circuits

H. N. (Sittingbourne).—"How is it that modern receivers use such thorough screening when a few years ago hardly any screening was employed at all?"

The modern valve has superior characteristics to its equivalent of a few years back. Hence the amplification given by the modern H.F. stage is considerably higher than its predecessors. The smallest amount of "feed-back" due to coupling between two coils or condensers is sufficient to upset the stability of the circuit. This entails a reduction in the amplification given by the high-frequency stage, otherwise the set becomes uncontrollable.

In a ganged circuit, or one in which more than one S.G. stage is employed, both the coils and condensers need shielding. Screening, incidentally, enables a more compact layout to be used.

Choosing a Transformer

R. R. M. (Bedford).—"I have two L.F. transformers, one having a primary inductance of 50 henries, and the other a primary inductance of 90 henries. I want to use one of these transformers immediately following the detector in a three-valve set I am building. Does it matter which instrument I use?"

The fact that the two transformer inductances are given as 50 and 90 henries respectively conveys nothing unless these values are maintained at the currents met with under normal working conditions.

For instance, the transformers may be intended for parallel-feed connection, in which case their inductance values would only hold good when joined in this way.

Assuming them both to be of this type, then the one with higher primary inductance is preferable.

On the other hand, if the transformers are suitable for direct connection in the anode circuit of the valve, you should choose the one which has the higher inductance value at the current normally taken by your particular detector valve.

High inductance is essential for faithful reproduction.

FIVE POUNDS WORTH

£5

Wagner tops the list of records suggested on these pages with seven individual numbers. He is seen in the fine photograph to the left.

Below is a charming study of an opera enthusiast listening to one of the "His Master's Voice" Superhet Radiograms.

SUPPOSE I were an Opera enthusiast setting up a gramophone for the first time, what records should I buy with my first five pounds?

As I should be keen on interesting my family in my new purchase, I should not buy the records of a full opera. *I* might enjoy that, but *they* might prefer something different. I think I should buy one or two numbers, the more familiar ones, from each of several operas, for a beginning.

Making a Start

I possess two excellent gramophones and a big stock of records of all sorts, but I am trying to remember which actually were my first opera records. Some of them lie before me as I write.

Let us begin with those two really jolly songs by Riccardo Stracciari, a first-rate baritone, "Largo al Factotum," Figaro's merry plaint from the *Barber of Seville*, and the "Toreador's Song" from *Carmen*. This is a Columbia record, L2129, and its price is six shillings.

As a perfect contrast to this, let us have the Preludes to Acts 1 and 2 from *La Traviata*, played by the New York Philharmonic Symphony Orchestra, conducted by Toscanini. This sad but very lovely music is recorded on H.M.V. D1672, and also costs six shillings.

There is a beautiful record from *Aïda* which must certainly be included in our list—the two famous songs of the heroine, sung by Elisabeth Rethberg: (1) "O Patria Mia" (My native land), and (2) "Ritorna Vincitor" (Return victorious). The number of this record is D1451, of H.M.V. production, and costs six shillings.

There are some sorts of records of which one never grows tired, and those of the fine songs and music from the operas are undoubtedly among them. But there is such a wealth of operatic records that this guide to making a first selection will be welcomed by all lovers of good music.

Another excellent orchestral record which it would be well to include is the overture of Weber's *Der Freischütz*, performed by the Berlin State Opera Orchestra and conducted by Dr. Leo Blech. Its number is D1249, of H.M.V. production, and its price is six shillings.

One of the loveliest records recently produced is H.M.V. D2002, the famous quintet from *Die Meistersinger*, conducted by John Barbirolli of Covent Garden. The singers are Elizabeth Schumann, Friedrich Schorr, Melchior, Gladys Parr and Ben Williams, the last two being British artists. On the reverse side of this record is a song from the same opera sung by Schorr. The price is six shillings.

A Contribution from Mozart

Although it means three items from one score, I think it is quite impossible not to include the "Prize Song" from *Die Meistersinger*, and this can be had from Columbia DB9924, sung by Francis Russell, or from H.M.V., sung by McCormack (DB329), or by Joseph Hislop (H.M.V. DB1351). The former is four shillings. I am not sure about the price of the latter.

I think Mozart's *Don Giovanni* should contribute one number to our first list, and I would suggest "Il Mio Tesoro Instanto" (Cheer thee, my soul's best treasure), sung by Heddle Nash. This is a Columbia

OF OPERA RECORDS

by the VISCOUNTESS SNOWDEN J.P.

record, DB9880, and its price is four shillings.

Alexander Kipnis is one of the finest of living bass singers, and I would suggest a contribution from him in the song "The Calf of Gold," from Gounod's opera *Faust*. This can be had for four shillings from Columbia (DB5044).

Up to the present we have laid out exactly two guineas and we still have two pounds eighteen shillings to spend.

Caruso's Exquisite Singing

No first library list would be complete without at least one record from Caruso, and although it is a little hackneyed, as all very popular things must become in time, I would recommend "Vesti la Guibba" (On with the motley), so exquisitely is it sung. This record is H.M.V. DB1802, price six shillings. On the opposite side is a song from the opera *Marta*, also sung by Caruso.

Our distinguished contributor (whose portrait you see above) is the possessor of a large stock of records from which she has made the excellent selection detailed in her article.

Frieda Leider, the magnificent Wagner prima donna, might supply us with the next record, the "Liebestod" from *Tristan und Isolde* (H.M.V. DB1545), price six shillings. A song from *Parsifal*, "Ich Sah Das Kind" (I saw the Child) is on the other side.

Worth Including

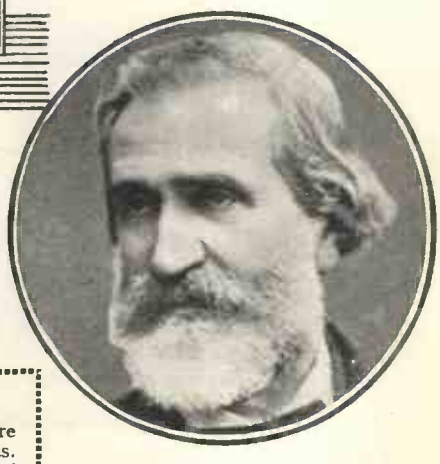
Edna Thornton (H.M.V. D282) and Maria Olszewska (H.M.V. D1465) have both made a record of "Softly Awakes My Heart" from *Samson and Delilah*, and I think it is worth including in a first list. The price in either case is six shillings.

The London Symphony Orchestra has recorded the Overture to *The Magic Flute*, conducted by Sir Thomas Beecham, than whom there is no greater living conductor of Mozart. The price of this record is six shillings, and it is produced by Columbia, L1001.

"Lohengrin's Narration," sung by Walter Widdop, who is a first-rate English operatic singer, must not be forgotten, and can be had from H.M.V., D1353, price six shillings. The same song at the same price can be had from Columbia, DB9127, sung by Heseltine.

A Contrast

Madame Butterfly should contribute one number, and Margaret Sheridan sings "One Fine Day" for H.M.V. on record DB981, the "Ave Maria" from *Otello* being on the other side. The price is six shillings.



TWO FAMOUS COMPOSERS

Mozart (left) and Giuseppe Verdi (right) are two composers who have written operas. Popular excerpts from their works are included among the suggestions contained in this article.

The Overture to *The Flying Dutchman* will serve as a contrast to the sober melodies of the last two or three singers, and for six shillings can be had on H.M.V. D1290.

One song from *La Bohème* is inevitable. The famous number "Your Tiny Hand is Frozen" is recorded on H.M.V. DB979, price six shillings.

Signor Caruso, whose recorded rendering of "On with the Motley" is recommended.

Sung by Galli-Curci

I should like to give a place to the "Waltz Song" from Gounod's *Romeo and Juliet*, and this can be had from H.M.V. DB264, sung by Galli-Curci, or from Columbia, DB9193, sung by Johnson. Six shillings is the price.

As a sort of dignified finale I would suggest a song by Norman Allin,

(*Continued on page* 480)

AN INTERVIEW WITH

THE ANNOUNCERS OF BELGIUM

In a special visit to the French-speaking station—INR—at Brussels.

LET me introduce you to an Italian, a friend of England and of London, the head announcer at the French-speaking Brussels station, Brussels No. 1, on 509 metres. May I? Yes? Here you are—*Mr. Bracony!*

Monsieur—I suppose I ought to say Signor—Bracony is a singer. He has spent most of his life outside of his own country, and long association with France and then with Brussels has made him as near a Frenchman, or good Belgian, as can be. I first met Mr. Bracony in 1928. I found him in a small and draughty studio close to the Porte de Namur in Brussels. At the time he was chief announcer and general studio manager of Radio-Belgique, the big private Belgian broadcasting company before the days of the I N R of the present National Institute. In between announcements he took me into a small cubby-hole, his own sanctum, and showed me the walls covered with signed photos of friends and colleagues.

SIGNOR BRACONY—by birth an Italian—is in charge of the running of the INR station at Brussels.

Further Meetings

The next time I met Mr. Bracony was in the new studio of the I N R some time ago. It was a different Bracony. He seemed younger but, I am sorry to say, slightly stouter, too. He remembered my first visit, and while he was supervising the orchestra, playing in the fine big studio close to the former premises, he told me of his work. His announcements, his gramophone "concerts" of disks selected by himself, of his work in the production of radio drama, and of the many letters he has had from listeners all over Europe.

And the third time I met him was in the same control room adjoining the large studio. The evening concert was in full swing, but I found Bracony merely supervising everything. A young lady, Madame Charbonnier, was doing the announcing. But Bracony smiled when he heard my query if he was soon going on pension. "Mme. Charbonnier only comes in and announces for the Roman Catholic broadcast transmissions which take place once a week." So for nearly a full day in every week Bracony sits and supervises, and the charming Charbonnier announces the items. Bracony then takes over again for the "neutral" broadcasts such as the news bulletin, etc.

MADAME CHARBONNIER takes over the duties of announcing from Signor Bracony during the weekly Roman Catholic broadcast.

A Friendly Smile

I wonder what will have changed by the next time I am in Brussels. One thing seems pretty certain, I will find friend Bracony his usual self, with a friendly smile and wearing his workmanlike white coat.

A. A. G.

SIMPLE REMOTE CONTROL

An idea which you can quickly apply to any receiver

SWITCHING a receiver on and off at a point remote from the set itself usually entails a relay control of some sort. But if the distance is not too great, and a spare accumulator is available, it may be done in an extremely simple manner.

The diagram makes the method quite clear. The two accumulators are joined in series together with a variable resistance and the ends of a piece of twin flex that is to be used for the extension leads. The remote ends of the twin flex is connected to an on-off switch of some sort.

The object of the extra accumulator is to overcome the resistance of the flex and still provide two volts across the filament terminals. In order to adjust the rheostat accurately to obtain the correct filament voltage, a voltmeter must be connected across the L.T. terminals.

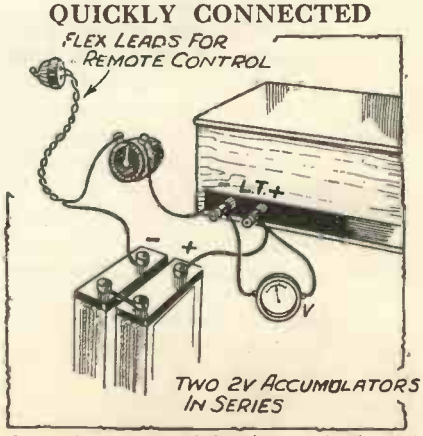
A Useful Idea

This scheme is particularly useful in the case of a sick person who wishes to control a receiver without moving while in bed, or in cases where the speaker is used in the next room to the set, when it will save running backwards and forwards to switch the set on and off.

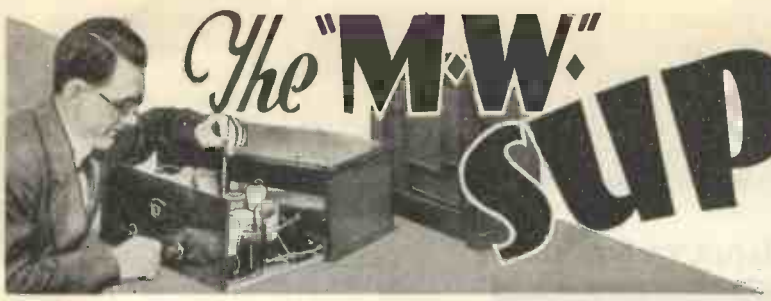
If good quality flex is used which has a low resistance, and particularly when the set's L.T. consumption is small, quite long leads may be used.

A. S. C.

QUICKLY CONNECTED



An extra accumulator is required, and it is connected as shown in this diagram.



The "M·W" SUPER 5

WITH the rapid approach of winter the problem of obtaining adequate selectivity springs up anew. As a matter of fact, it is more difficult to solve than it was last winter—not that stations are coming over better due to any alteration in the ether conditions, but because many transmitters on the Continent have greatly increased their power, and several new arrivals are to be had, among them being our Western and Scottish Regional stations.

The Selectivity Problem

As with the arrival of better reception conditions (and stations are simply rolling in now), we have to consider what we are going to do to improve our listening, and the question of selectivity at once crops up.

It is not very difficult to restrict the receptive powers of a set to the picking-up of the locals, or of the more powerful transmissions, nor is it particularly difficult to provide ample selectivity for such a set, for its inherent insensitivity goes a long way towards the furtherance of our aims.

This design is the very latest in all-mains superhet receivers. It combines good quality, powerful results and all the advanta es of the superhet principle, to an unprecedented degree.

Among the many fine features are single-knob tuning, band-pass input, on-off switch combined with volume-control and extremely straightforward construction. Run from a separate power-pack, this set is both selective and sensitive enough to give highly satisfactory results under almost any conditions.

By the "M.W." Research Dept.

The provision of good selectivity in a set that is sensitive is a far more difficult problem, especially if the control of the set is to be easy. The solution of the problem is much more easily found if a multiplicity of controls is allowed.

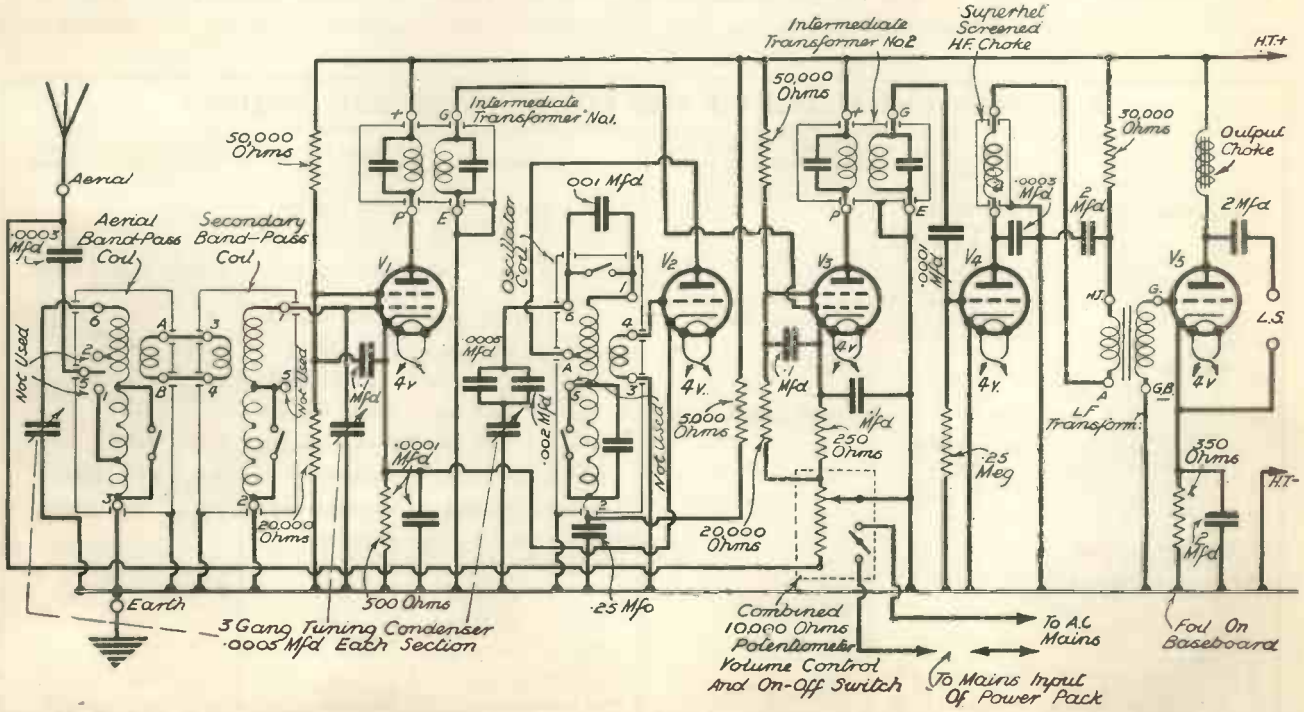
The unfortunate fact remains that selectivity and sensitivity are deadly enemies, and increase of selectivity inevitably means decrease of sensitivity, unless additional stages of amplification are employed.

Multi-Stage Difficulties

These stages, moreover, should preferably be added to the H.F. side of the receiver, so that besides increasing the receptive powers of the set they will act as frequency selectors, and so add to the selectivity. The unfortunate part of this is that such an arrangement is liable to be complicated, (1) to build, and (2) to operate.

The difficulty of construction is not merely that of the actual mechanical work, but the scientific placing of the parts, their choice and the prevention and feed-back through the H.F. stages, and the consequent instability that is prone to occur.

High-Efficiency Valves Linked by Modern Circuit Schemes



The first valve in the chain of five is a screened-grid mixer, coupled via its cathode circuit to the second valve, the oscillator. After this follow the multi-mu S.G. intermediate valve, the detector, and transformer-coupled to it the output power valve.

Linked closely with (1) is (2), for it is essential if a set is to give of its best when not handled by an expert that it should be easy to control.

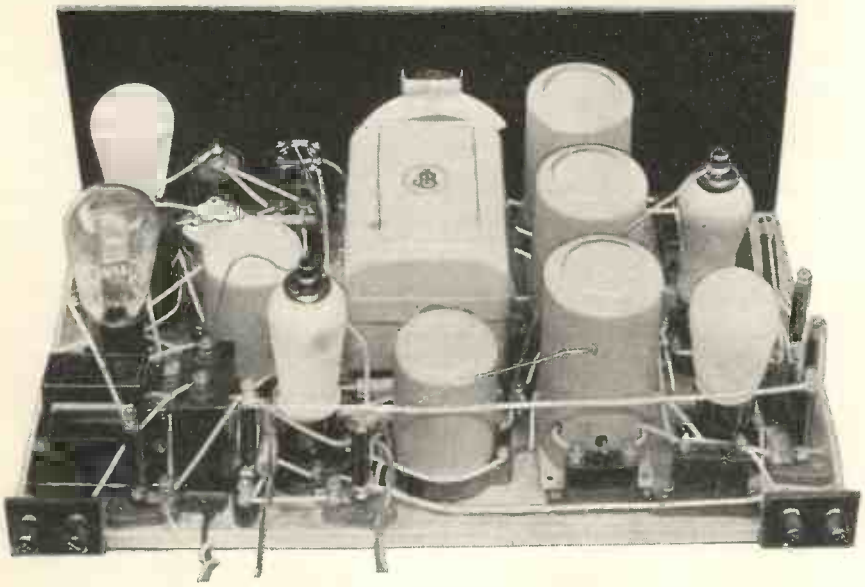
This entails the minimising of inter-dependent controls, and the definite operation of those that remain. There must be no need to twist and turn in order to find the best position. Such would be the ideal set—where every knob (and there could be several) did a definite job, and did it without throwing out any other control setting.

Though perhaps the ideal has not been reached, it has been approached in the superhet receiver which we present for your attention this month. Here we have an all-mains set designed with three ends in view: selectivity, sensitivity, and ease of control.

It is a single dial tuning set, an advance in home construction that has only recently been made really practicable. It enables stations to be picked out with the greatest of ease, with a certainty that is amazing, and without any annoying juggling while two or more dials are synchronised. The station required is either there first go or else it is unobtainable because it is not transmitting, or is so far away as to be outside the range even of this remarkable receiver.

Perfect control is a claim that can rightly be put forward for the "Super Five," while the fact that it is an all-mains receiver ensures that the very most is obtained out of each stage. The result is a really hot-stuff receiver that can be counted upon to pull its weight in the ether.

PERFECT SCREENING GIVES ABSOLUTE STABILITY



All interaction of high-frequency fields is rendered impossible by the metal screening. Gang condenser, coils, intermediate transformers and H.F. choke all have cans, and the baseboard is covered with copper foil in addition.

The Limit of Simplicity

On even a smallish indoor aerial the "Super Five" will take its toll of transmissions, bringing them in with remarkable ease at full loudspeaker strength. As a matter of fact, it is but rarely that the ultimate amount of its amplifying powers are required, for with the sensitive mixing valve and the high amplification of the intermediate multi-mu S.G. valve, the full loading of the detector and output valves is very rapidly obtained.

There are but three controls all told—tuning, wavechange, and volume-cum-on-off, so that there could not easily be a more simple set, unless the on-off was ganged with the wavechange and perfect automatic volume control was achieved.

Triple-Purpose Control

As a matter of fact, the volume control does three things. It controls the mains on-off switch, it controls the aerial input to the set, and it varies the mutual conductance of the multi-mu intermediate S.G. valve.

This is obtained by an ingenious method of using the control, and

A CONVENIENT GUIDE TO THE COMPONENTS YOU REQUIRE

Component	Make used by Designer	Alternative makes of suitable specification recommended by Designer
1 Triple-gang ·0005-mfd. tuning condenser	J.B. "Nugang" type A	—
1 Triple-gang superhet coil unit	Colvern K61, K62, K63	—
2 Intermediate frequency transformers	Colvern type 110	—
1 L.F. transformer	R.I. "Hypermu"	Lissen, Varley, Igranic
1 Output choke	Ferranti type B3	R.I., Bulgin, Varley
1 Screened superhet H.F. choke	Bulgin "Superhet"	—
1 10,000-ohm wire-wound potentiometer with 2pt. on-off switch	Lewcos	Bulgin
1 ½-megohm grid leak with wire ends	Lissen	Dubilier, Igranic, Telsen
2 50,000-ohm resistances with vertical holders	Graham Farish "Ohmite"	—
1 30,000-ohm resistance with vertical holder	Graham Farish "Ohmite"	—
2 20,000-ohm resistances with vertical holders	Graham Farish "Ohmite"	—
1 5,000-ohm resistance with vertical holder	Graham Farish "Ohmite"	—
1 500-ohm resistance with vertical holder	Graham Farish "Ohmite"	—
1 350-ohm resistance with wire ends or terminals	Dubilier 1 watt	Graham Farish
1 250-ohm resistance with vertical holder	Graham Farish "Ohmite"	—
2 2-mfd. fixed condensers	Dubilier type 9200	—
1 2-mfd. fixed condenser	T.C.C. type 80	Dubilier, Ferranti
1 ·25-mfd. fixed condenser	Telsen type W229	—
2 ·1-mfd. fixed condensers	T.C.C. type 250	Dubilier
1 ·1-mfd. fixed condenser	Telsen type W231	—
1 ·002-mfd. fixed condenser	Dubilier type 670	—
1 ·001-mfd. fixed condenser	T.C.C. type 34	Dubilier, Lissen, Telsen, Graham Farish, Ferranti
1 ·0005-mfd. fixed condenser	Dubilier type 670	—
1 ·0003-mfd. fixed condenser	T.C.C. type M	Dubilier, Igranic
1 ·0003-mfd. fixed condenser	Lissen type LN11	T.C.C., Dubilier, Ferranti, Telsen, Graham Farish
1 ·0001-mfd. fixed condenser	Dubilier type 670	—
1 ·0001-mfd. fixed condenser	Dubilier type 665	Igranic, T.C.C.
5 Five-pin valve holders	Benjamin	W.B., Telsen, Lissen, Ferranti
4 Indicating terminals	Belling-Lee type R	Bulgin, Clix, Igranic, Eelex
2 Terminal strips, 2×1½ in.	Peto-Scott	—
1 Sheet copper foil, 18×10 in.	Peto-Scott	—
1 Ebonite panel, 18×7 in.	Peto-Scott	Permcol
1 Baseboard, 18×10×½in.	Peto-Scott	—
1 Cabinet to suit above	Peto-Scott	—
6 yards insulating sleeving	Goltone	—
9 yards 18 S.W.G. tinned copper wire	Goltone	—
2 Anode connectors	Belling-Lee	—
Flex, screws, etc.	Peto-Scott	—

Overloading Obviated by Double Volume Control

was first employed in the "M.W." Research Laboratories. A study of the theoretical circuit will show at once what happens.

The third valve is the multi-mu intermediate frequency amplifier, and in common with all multi-mu valves the mutual conductance is varied by means of variation of the grid bias. This is achieved by a variable resistance in series with the cathode earth connection.

A fixed resistance determines a minimum bias point, and then the bias can be increased by increasing the value of the adjustable resistance in series with it.

Bias Variation

In the case of the "Super Five" this resistance is a potentiometer whose slider is connected to earth, and the position of which slider determines the amount of bias applied to the grid of the valve.

As the slider approaches the end of the resistance remote from the cathode, so the bias increases and the amplifying powers of the valve decrease.

To carry this out, all that is necessary is to connect one end of the potentiometer to the cathode lead and the slider to earth. The third terminal can be left unconnected.

Input Control

But it will be noticed that this third terminal, connected to the remaining end of the potentiometer, is not so disused. It is joined to the aerial, forming a sort of by-pass circuit to the aerial feed to the set, which takes place through a fixed condenser.

The result is that we have a circuit from aerial to earth through the potentiometer and its slider, in parallel with the aerial-condenser-tuning coil circuit.

Thus the resistance between aerial and earth can be varied by means of the slider, and can be so reduced that energy is by-passed from the tuning circuit. In other words reduction of the resistance will reduce the "signal" input to the set—it will decrease the volume.

That is what we require, for, although we have succeeded in controlling the amplification provided by the intermediate S.G. valve, we have not provided a means of preventing overloading by strong stations of the first valve—the "mixer" or frequency changer.

This possibility of overloading is very real, even though no H.F. amplification is used before the valve, and on local reception it would be badly overloaded if some means of preventing it were not taken. And an overloaded first valve cannot be remedied by decreasing the amplification of succeeding stages—the damage is done.

Aerial Shunt

Thus the fact that volume control of V_3 is achieved would avail nothing on very strong reception, though as long as V_1 was not overloaded it would be perfectly efficacious. So it was decided to control V_1's input as well, and the circuit we have described was developed as fulfilling the requirements without the need for separate controls or ganged components.

As we have arranged this, the increase of resistance in the cathode lead due to movement "downwards" of the slider (knob turned anti-clockwise on set) is accompanied by decrease of resistance in the shunt aerial circuit. Thus two birds are killed with one stone, for the bias increase of V_3 (resulting in reduced amplification) is accompanied by reduced "signal" input into the tuned circuits of the set, and therefore reduced load on the grid of V_1.

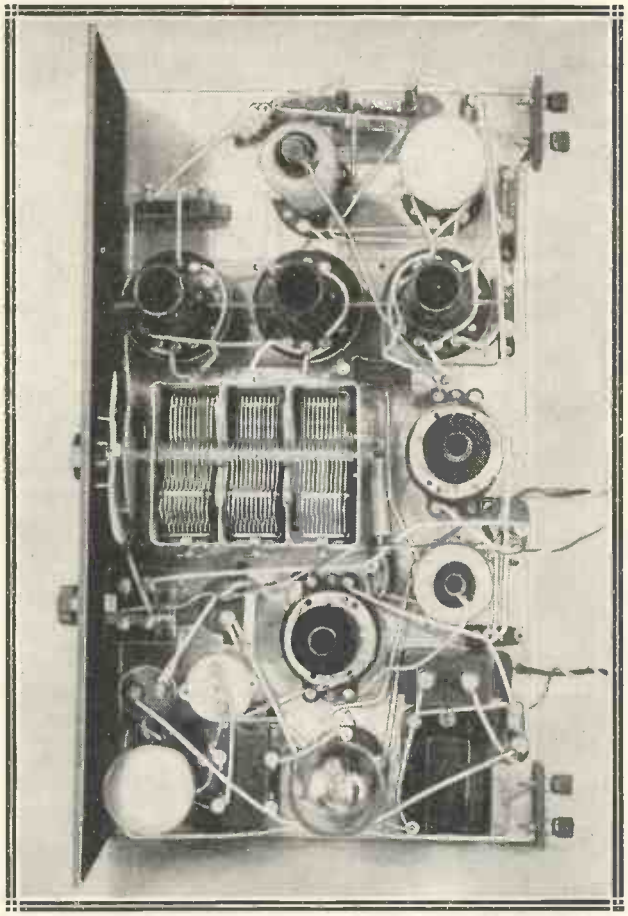
The Tuning Circuits

Furthermore, when the minimum volume is reached the control movement is up against on-off switch, and further movement results in the set being switched off. Thus there is no crash in the speaker when the set is silenced, for the programme is automatically faded out as the control is turned.

The tuning circuits of the set comprise a band-pass aerial input to the "mixer" valve and, of course, a tuned oscillator. The band-pass coils and the oscillator are matched and tuned by a three-gang ·0005-mfd. tuning condenser.

The oscillator is designed for gang tuning without special superhet

THE CAREFULLY PLANNED LAYOUT



Taken from above, this photograph clearly shows the arrangement of the components. Their disposition has been specially thought out so that all vital leads are kept short and direct.

VALVES WHICH WILL ENSURE GOOD RESULTS

Make	1st Det.	Oscillator	Inter.	2nd Det.	Output
Cossor	41M.S.G.	41M.H.L.	M.V.S.G.	41M.H.L.	41M.P.
Mullard	S.4.V.A.	354V.	M.M.4V.	354V.	—
Mazda	A.C./S.G.	A.C./H.L.	A.C./S.G.V.M.	A.C./H.L.	—
Osram	M.S.4B.	M.H.4	V.M.S.4	M.H.4	—
Marconi	M.S.4B.	M.H.4.	V.M.S.4	M.H.4	—

condenser plates, a loading condenser system being switched in or out of circuit as the waveband is changed, and this scheme gives parallel frequency change with the band-pass tuning coils together with a ·0005-mfd. gang variable condenser.

The band-pass coils are inductance linked, and the whole gang coil assembly is screened. The oscillator tuned coil is the anode coil, the grid coil being untuned and fixed in size.

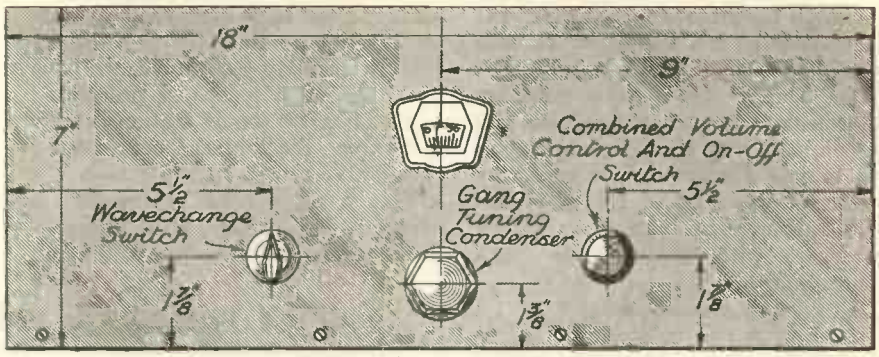
Anode Bend and Leaky Grid

Cathode injection is used for the "mixer" valve, the cathode circuits of the "mixer" and oscillator valves having a common bias resistance. This system is particularly simple and very effective.

Anode-bend rectification for the "mixer" valve is employed, and as the anode currents of the "mixer" and oscillator valves are both passed through the same cathode resistance, its value is less than would be expected as requisite for the type of valve used as the "mixer."

Leaky grid rectification of the intermediate frequency is employed, the detector being resistance-coupled to an intervalve transformer preceding the output valve. The transformer can either be of the ordinary type or of the new compensating variety. The choice can be left to the individual constructor, for it will depend largely on his loudspeaker which type of transformer is the better.

SIMPLE OPERATION IS AN OUTSTANDING FEATURE

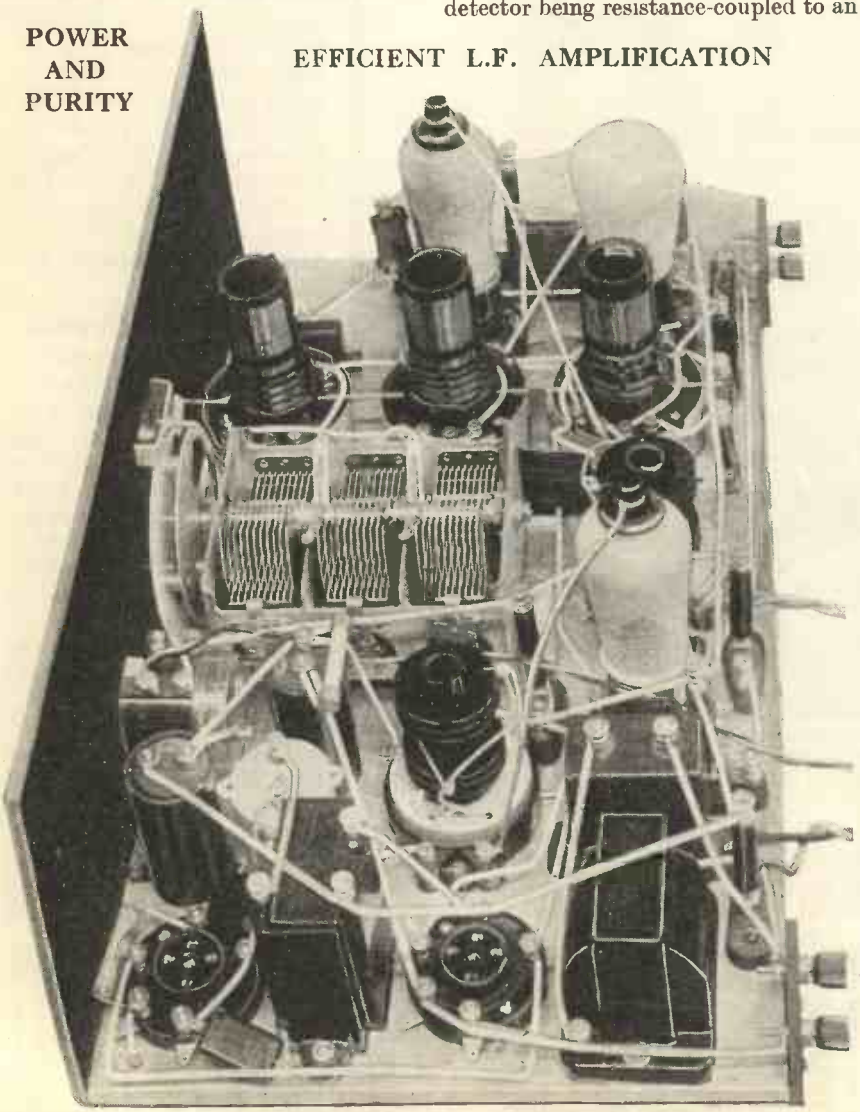


Panel Layout

There are **only** three controls on the receiver, and they are arranged in the pleasing manner depicted on this diagram from which the positions of the holes for them may be obtained.

POWER AND PURITY

EFFICIENT L.F. AMPLIFICATION



Not only does the "M.W." Super Five receive dozens of stations, but having picked them up it amplifies their programmes without distortion and reproduces them in a manner really worth hearing.

Choosing a Transformer

If the loudspeaker is not too efficient in high-note reproduction, the compensating transformer, such as the R.I. Varitone, will probably be found to be best. As a matter of fact, this will be best with most loudspeakers of the average moving-coil type, for it must not be forgotten that a superhet is prone to be slightly lacking in high-note reproduction due to the very sharp tuning it entails.

On the other hand, if the loudspeaker is on the "brilliant" side it may be better to use an ordinary transformer. The choice is one that must be left to the constructor.

The output valve is a triode, being one of the high-slope Cossor valves, the 41M.P. It has an output of 1 watt, and needs but a small grid input to achieve this power. The result is that the set is remarkably successful, for a great number of stations can be received at sufficient strength to load fully the output valve.

Single H.T. Feed

The "Super Five" is constructed with the idea of using a separate power pack, so that there is no smoothing or any of the mains apparatus save the on-off switch incorporated in it. The pack must be capable of providing 200 volts at 50 milliamps., and 5 amps. of 4-volt low tension. It need have but one H.T. tap, the maximum, for all the valves in the set are operated from the same feed point.

Station Selection with One-Knob Tuning

The on-off switch is connected directly in series with the mains supply to the power pack, one lead of which is taken via the switch and the other direct to the mains. By this means the switch on the set controls the whole supply.

Baseboard Link Conductor

The construction of the "Super Five" is carried out on the panel and baseboard principle, a metal-covered baseboard being employed for the purpose. This metal cover, which may be either copper foil or the special sprayed surface known as "Metaplex," is used to a great extent as a return or link conductor.

That is to say, that it is made use of, say, for the anchoring of most of the earthed points in the set, making the foil act as the common earth return. Most of the earth connections are taken to it, such as the earthing of coil screens, intermediate transformer earth points, tuning coil returns, and so forth, greatly simplifying the wiring and efficiently "anchoring" the set.

Avoid Unwanted Earths

When a metallised baseboard is used, however, care must be taken that no unwanted earths occur. Valve pins, when driven well into the holder sockets, must not protrude and touch the foil, nor must any condenser or resistance tag, or any "blob" of solder on a valve holder connection, should you use soldered links, though the whole set can easily be made without soldering.

As a matter of fact, the construction is so easy that there is really nothing more concerning it that need be said, except that the wiring should be kept well above the surface of the metal foil except in such cases as earth leads, when proximity to the foil will not matter.

Loudspeaker Connections

The joining up of the power pack has really been explained previously, for with the on-off switch breaking one input lead from the mains to the pack, the maximum H.T. going to H.T. on the set, and the L.T. winding joined to the valve heaters, and H.T.— correctly connected, nothing remains to be done but to switch on.

An ordinary aerial is required, either of the outdoor or indoor type, and the usual earth. The loudspeaker should preferably be a good one, of the moving-coil variety with its own transformer incorporated. This should be set for "power valve" and the input connected to the two loudspeaker terminals of the set.

FOR YOU TO CHOOSE

LOUDSPEAKER.—R. & A., W.B., Blue Spot, Rola, Magnavox, Celestion, H.M.V., Marconiphone, Amplion, G.E.C., Ormond, Atlas, Ferranti, Epoch.
MAINS UNIT.—Heayberd.
AERIAL AND EARTH EQUIPMENT.—Electron "Superial." Goltone "Akrite." Radiophone "Receptru" down-lead. Bulgin lightning switch. Graham Farish "Filt" earthing device.

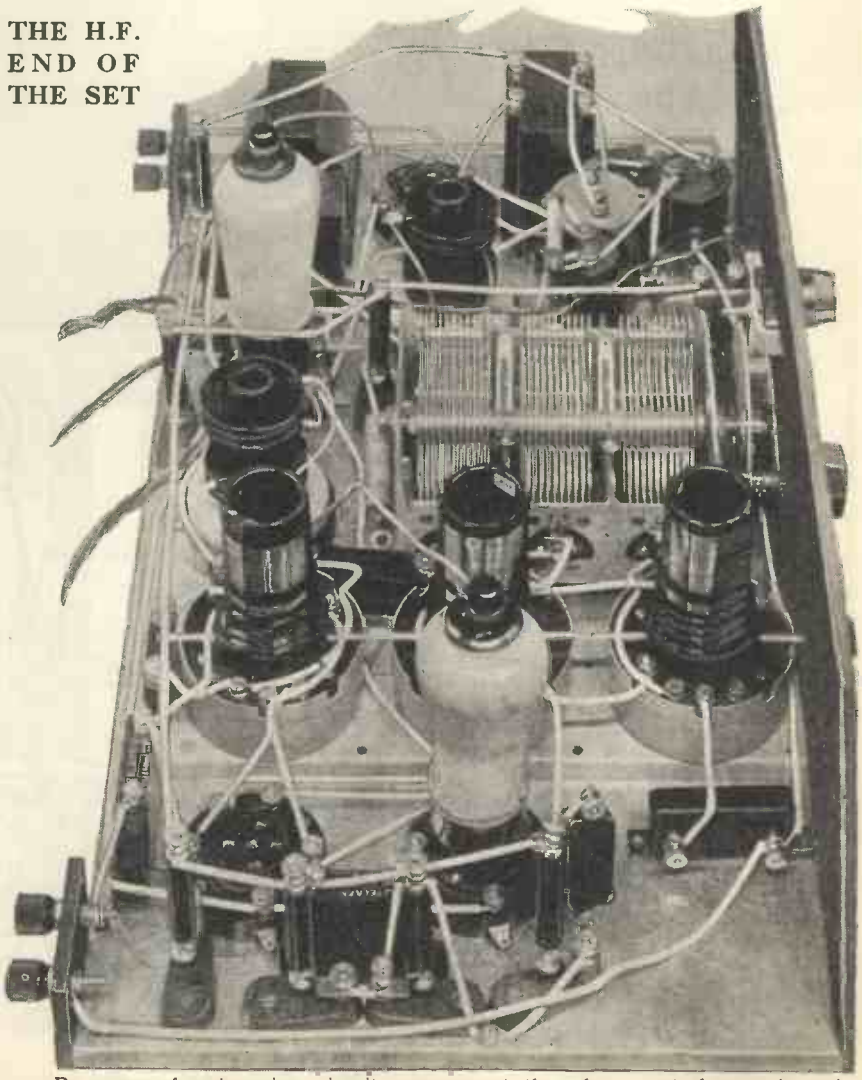
The valves are placed in position in accordance with the list: S.G. in V_1, H.L. type in V_2, multi-mu S.G. in V_3, H.L. type in V_4, and the power valve, in V_5.

The first thing to do now is to switch on and listen for sounds of "life," not necessarily broadcast reception, but the "aliveness" that can be heard in the loudspeaker as soon as the half minute or so required for the valves to warm up has been passed.

Trimming Adjustments

After this test switch off and get ready to set the trimmers of the three-gang condenser and to adjust the intermediates. These are sent out with the coupling of the coils adjusted for best normal operation, so this feature should not be altered until after the set is working well, and if it is desired to try different coupling. What should be done now is to push

THE H.F. END OF THE SET



By means of an ingenious circuit arrangement, the volume control not only varies the magnification of the multi-mu intermediate valve, but also simultaneously and automatically adjusts the strength of the input to the first valve.

The Last Word in Superheterodyne Receivers

all the adjusting levers on the intermediates to a central position.

Then screw up the three trimming wheels fully, followed by a slacking off of one complete revolution. The preliminary setting is now complete, and with aerial and earth connected the set can be switched on.

Turn the volume control three-quarters to the right and rotate the tuning dial. Search for a station as low down the medium-wave scale as possible. You will know when you are on medium waves by the fact that the flat portion of the Colvern wave-change switch rod will be in a horizontal plane. It is in a vertical plane when the coils are switched to long waves.

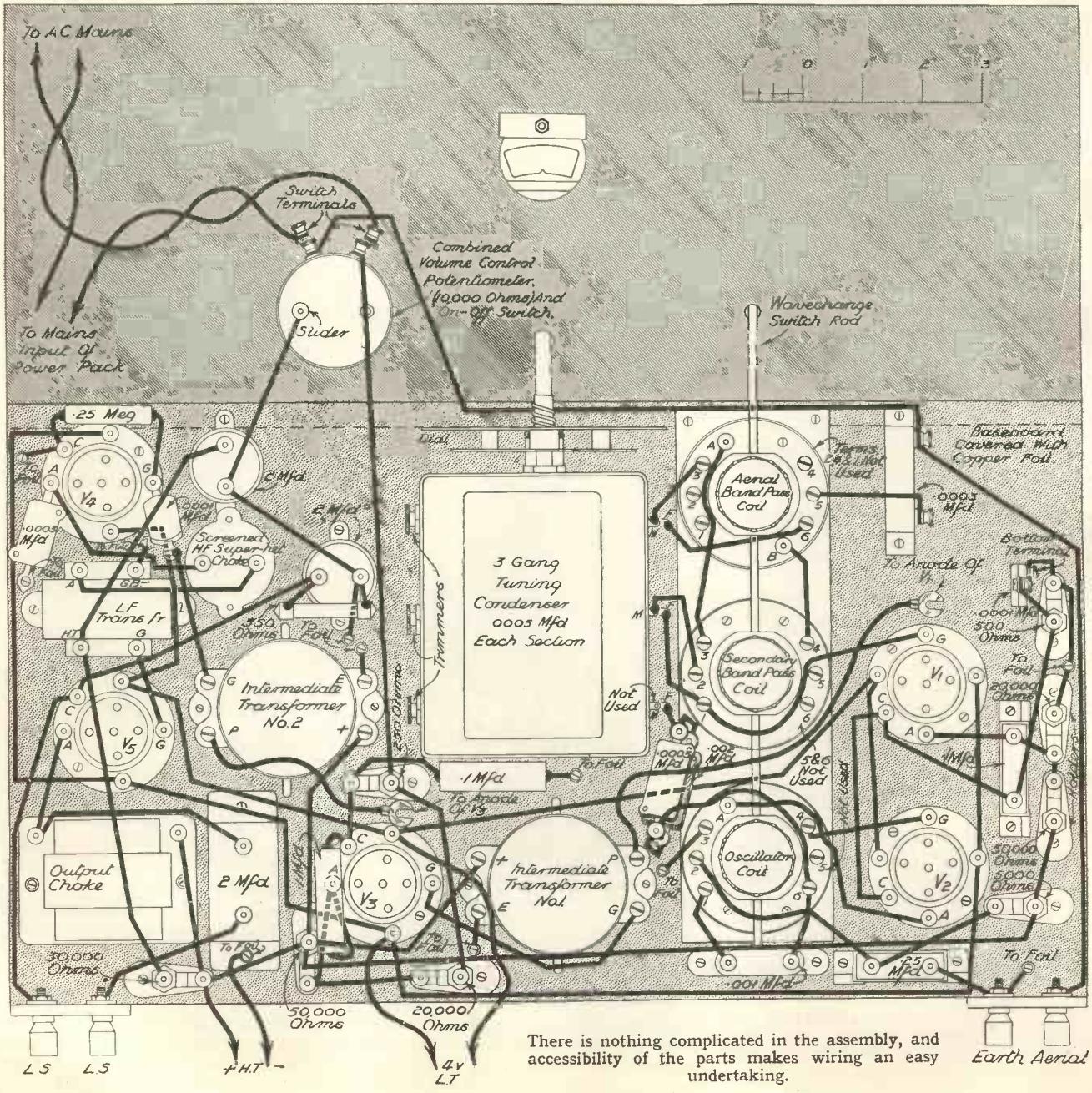
For Permanent Results

After finding the station, reduce volume to just comfortable audibility and rotate the two front (nearest to panel) trimmers slowly to get the positions of maximum strength. If necessary, reduce strength by volume control after each adjustment to keep the level of volume down to a reasonable limit. Do not alter the adjustment of the trimmer farthest from the panel.

When the tuning here is complete, switch over to the long waves and trim the intermediates—on, say, Radio Paris or Daventry—until best results are obtained. The trimmers on the gang condenser are not touched during this procedure.

It pays to carry out these trimming operations carefully, as once done properly, they are set for ever.

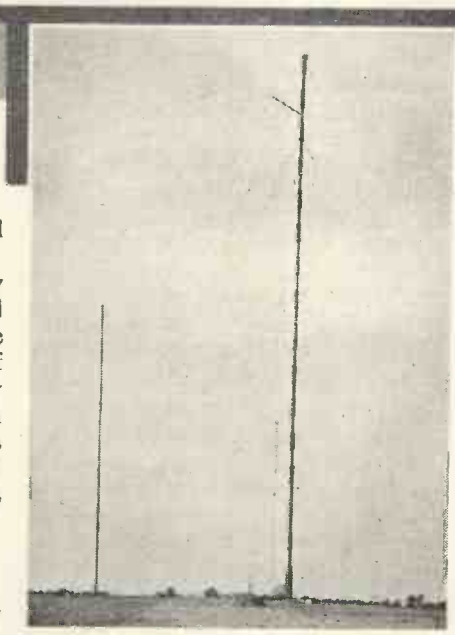
A HOME-CONSTRUCTOR DESIGN THROUGHOUT



There is nothing complicated in the assembly, and accessibility of the parts makes wiring an easy undertaking.

DAVENTRY

THE HOME STATION OF EUROPE



We are a modest people. We should never dream of boasting that our radio programmes are regularly heard and enjoyed by thousands of foreign listeners. That such is definitely the case is shown here, in an account of a recent tour of Europe by

PHILIP CAUSTIN

NOT long ago the Fleet Street Choir, consisting of twenty-five women and twenty men connected with British journalism, paid a visit to Denmark, where they broadcast a concert from the new Concert Hall of the Danish Broadcasting Council.

This bald announcement, which may in itself be the cause of some justified satisfaction on the part of patriotic Englishmen, hides a romance of broadcasting which is not generally known. For the visit of a British choir to the studios of Denmark is but the culmination of many years' experience of British entertainment enjoyed by the people of Scandinavia.

Do You "Go Abroad"?

What are the reasons which prompt the average listener to tune to a foreign station? Does he "go abroad" for pleasure, for "swank," or just because there is nothing he likes at his local station?

The third reason is, probably, the most prevalent. It accounts for those who, almost automatically, tune to Radio Paris or Luxembourg or Fécamp on a Sunday afternoon. It accounts for those dance music enthusiasts who conscientiously follow their favourite tunes around the studios of Europe. It accounts for those who must, at all costs, have music, music and still more music from the air from seven in the morning to twelve at night.

To such people Europe is a vast fairground which offers swing-boats when they are tired of the roundabouts, and provides coconut-shies when the joys of rolling pennies on to black squares are beginning to pall. Ask such people what they have listened to and they will hum and haw and generalise for hours. Ask them whether they have enjoyed themselves and they will give you an enthusiastic affirmative. They listen all day—but they very seldom hear.

Long-Distance Listening

Then there are those who find in long-distance listening a fine opportunity for showing off. Usually (let it be said to their comparative credit) they are content to show off to themselves, patting themselves on the back whenever a new station is heard. Sometimes, alas, their friends must be dragged into the fray to be shown "what a clever fellow I am."

A Berlin family tuning-in to a Queen's Hall Symphony Concert from Daventry.

To such as these foreign listening is one long competition with a new call sign as a prize, and familiar announcements as landmarks on the way to the winning-post. Programmes mean nothing except the chance to hear a new language. Music is, frankly, a nuisance, since it delays the announcement of the station's name.

Real Amusement

Finally there is that third class, those paragons of listeners, who choose their programmes as carefully as they choose their homes, but who extend their choice to the boundaries of Europe instead of confining it to the boundaries of their own small island.

These are the people who get all the fun out of listening. Unfortunately, in this country, they are *raræ aves* indeed.

But a very different picture presents itself on the Continent. Not long ago I set out on a tour of many of the European countries; of France and Switzerland and Belgium, of Italy, Austria and Luxembourg, of Germany, and the brave little republic of San Marino on its hill in the midst of Italy. It was, by force of circumstances, a brief tour; but it was made by car so that villages as well as cities, hamlets as well as towns were visited and often explored.

Radio Everywhere

And everywhere we went there was wireless, *radio*, *rundfunk*. Everywhere were aerials and batteries and, more often, mains sets. What an opportunity, we thought, as we stopped each night at some inn where a loudspeaker graced the wall of the parlour, what a not-to-be-missed opportunity for hearing the best programmes of Europe under ideal conditions.

Sometimes as we travelled we stopped to visit an opera house or a concert. We saw the company of La Scala play "Rigoletto" in the world-famous theatre at Bolzano. We heard a Mozart concert under the stars in the old Imperial Palace at Munich.

British is Best—in European Radio

We were honoured by a special performance by the village band as we dined in the open air in the south of Italy. On each of these occasions we learnt something more of the national entertainment of the countries we visited.

But it was when we did actually listen to those wireless sets that we received our greatest surprise. We heard, of course, the concerts of the Vienna Symphony Orchestra (in those

days it was not linked with broadcasting as it is now, and listeners had to be satisfied with relays). We heard quite a lot of the local station orchestras playing local airs. We heard, close to as it were, the cuckoos and the metronomes and the bells which, while we were still in England, had heralded the romance of a foreign programme.

But we heard more than that.

That Familiar Voice

I remember how the first time we went into an hotel and heard the loudspeakers playing Tchaikowsky's Fifth Symphony. The music ended. A strangely familiar voice announced: "That is the end of the Promenade Concert from the Queen's Hall. The news will follow almost immediately."

That was our first introduction to the romance of British radio, and it was from that that the title of this article is taken.

"We tune in to your Daventry most evenings of the week," said mine host. "We are very fond of your Daventry. It is, perhaps, the home station of Europe."

We thought we had come across a strange case. The man who, surrounded by what has always been considered the best music in the world, listened to British programmes for pleasure. Shades of the grumblers' page in the "Radio Times"! We looked at our host with a certain reverence and removed our hats. He looked surprised.

"But why?" he protested. "We all listen to your programmes. Not your talks, perhaps, because your speakers are too quick for us. But your music and your jazz bands and, above all, your choruses."

Daventry Reigns Supreme

It was a new point of view. It left us determined to pay more attention to our own programmes when we got home. For this was not an isolated instance of a town in sympathy with

In the sunny coast towns of the south of France, in the smoke-begrimed mining towns of Germany, in the lazy villages of Spain, the voices which delight a million homes in Britain's hamlets and cities are heard and enjoyed by everyone.

British art. We came across home after home where Daventry reigned supreme from eight o'clock to midnight. Not just put on in our honour, but a regular institution.

These people took no particular pride in being able to tune to the distant stations of Great Britain. They were not even tired of their own programmes, which they praised and defended with a genuine loyalty and patriotism. No, they listened to Daventry because it brought them real enjoyment.

The home station of Europe! They even, some of them, knew the names of the announcers. Mr. Hibberd was almost a personal friend (how many of you, I wonder, know the name of Rome's charming announcer?)

A Rude Awakening

Pride came before a fall. Filled with our national importance, convinced that British programmes were the best in the world, we travelled to the wilder parts of Calabria in the south of Italy.

"And how do you like the British wireless programmes?" we asked at one of the inns.

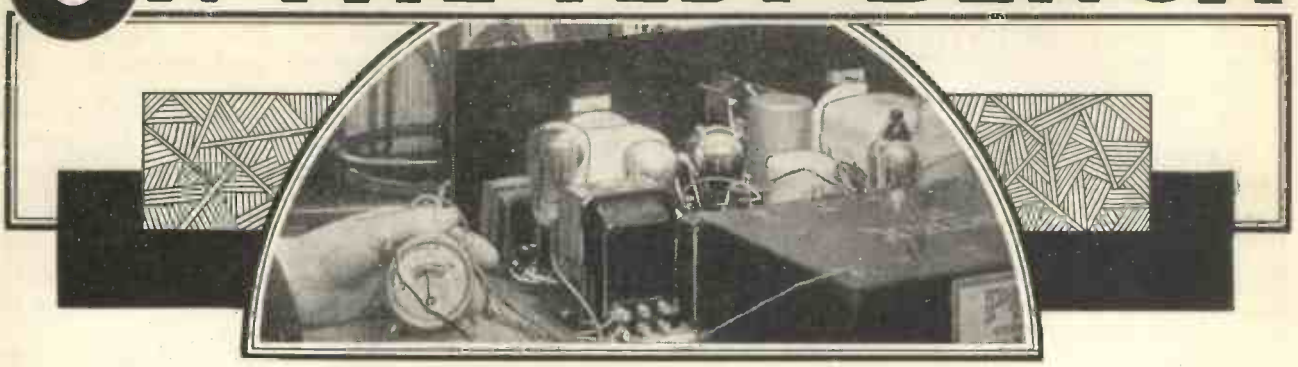
"What is this wireless?" asked our host. But we felt that this was neither the time nor the place for an exposition of the researches of Marchese Marconi. (Incidentally, they had never heard of him, either, so things weren't quite so bad!)

. . . .

Those of you who *do* listen to foreign programmes for the pleasure you get out of them will have found much to entertain you on your travels. Perhaps it will add to your enjoyment to know that while you are listening to an opera from Milan or a Sunday evening concert from Hilversum, while you are revelling in the music of the Viennese orchestras,

or the martial strains of a German band, the people of those countries whose guest you are in spirit are finding their pleasure in the programmes from Daventry, and solemnly earthing their aerials to the "Goodnight, everyone, *good*-night" of a familiar voice in a studio in London.

ON THE TEST BENCH



Our comments regarding some interesting new components.

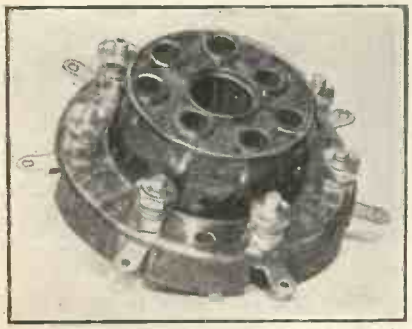
More Telsen Components

AMONG the new Telsen components, probably the most important, or, at least, one of the most important, is the Telsen iron-cored screened coil, which is said to be "the smallest and most efficient tuning coil ever designed."

This is a sweeping claim, but it is based on a solid foundation, and constructors acquainted with the efficiency of the ordinary Telsen screened coil will not hesitate to accept it.

The Telsen iron-cored coil is made in three types; the single coil at 8s. 6d., the twin matched assembly at 17s., and the triple matched assembly at 25s. 6d.

FOR THE NEW VALVES



A well-made Telsen holder for seven-pin valves.

We have already tested the single type in our standard coil tester, and as a result of these preliminary observations alone we can say that Telsen have certainly produced something out of the ordinary.

Another new Telsen component is the seven-pin valve holder suitable for "Class B" and other such valves. It is an extremely well-made valve holder and its sockets are positioned with precision, for it takes its valve easily but with good contact at each pin.

The metal sockets are extended in one piece to form soldering tags, and substantial terminals are fitted.

The Telsen screened H.F. chokes are being made in three types: the All-Wave Binocular, which covers from 10 to 2,000 metres; the Standard (100 to 2,000 metres); and the Short Wave (10 to 100 metres), the prices being 4s. 6d., 2s. 6d., and 3s.

We have tested both the "All-Wave" and the "Standard," and find them perfectly satisfactory in every way. Readers will see all these new Telsen components in "M.W." sets, for their standards and their prices are such that they simply must be used!

TELSEN H.F. CHOKES

Both binocular and ordinary types of screened H.F. chokes are included in the Telsen range of components.

TRIMMED FROM THE TOP

A feature of this Polar "Star" Minor three-gang condenser is the positioning of the trimmers at the top for accessibility.

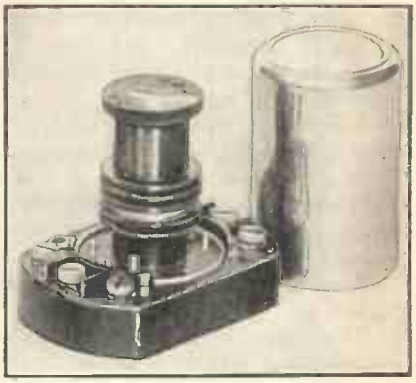
The Polar "Star" Minor

Among the new lines due to Messrs. Wingrove and Rogers is the Polar "Star" Minor three-gang condenser.

This is a well-designed and soundly constructed component which retails at the low price of 18s. 9d.

It is provided with a totally-enclosing dust cover, and the substantial frame is of cadmium-plated steel.

AN IRON-CORED COIL



Telsen coils with iron cores are available as single, dual or triple units.

A very attractive feature is that the trimmers are operated from the top, and this accessibility enables trimming to be carried out easily and without the necessity of diving about among the wiring.

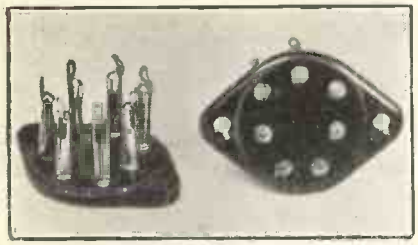
Also, of course, it makes for more accurate trimming because the hands can be kept well away from the condenser.

The Polar "Star" Minor is accurately balanced, and its movement is perfect.

It more than maintains the high standard that previous manufactures of Messrs. Wingrove and Rogers have attained.

Some Components for the New Circuits

FOR CHASSIS MOUNTING



Made in moulded bakelite, these Preh valve holders cost only 1s. each.

Preh Valve Holders

The Preh Manufacturing Co., Ltd., have sent us samples of their British-made seven-pin valve holders.

These are of moulded bakelite, and the contact sockets are made of phosphor bronze and designed in such a way that the valve pins are accommodated easily but firmly.

The soldering tags are extensions of the sockets themselves.

The price of the Preh seven-pin valve holder is 1s. It is, of course, suitable only for chassis-mounting, and soldered connections have to be made to it.

A Magnum Slow-Motion Dial

The Magnum slow-motion dial is a most practical and distinctive design. It can be fixed direct to a baseboard or to the frame of a gang condenser, or mounted on a panel.

And it is supplied with an attractive escutcheon of brass having an oxidised copper finish. The dial is calibrated in either 0-100 degrees or in wavelengths based on Magnum canned coils.

There is an effectively-placed scale light.

The whole assembly is carried on a robust steel frame, and the driving spindle is supported both at the back and the front, there being a taper bearing to eliminate undesired movement.

The drive is wonderfully smooth, and there is not the slightest slip.

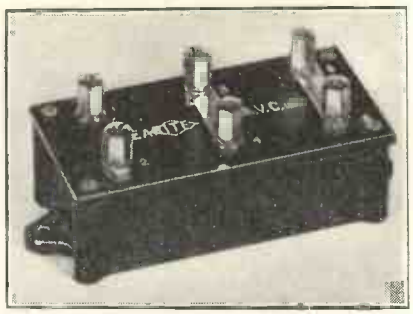
It is a dial we can recommend to constructors.

New Wearite Components

A number of new components has been produced by Messrs. Wright and Weaire, including special items for most of the new circuits.

For example, there is an A.V.C.

AN A.V.C. UNIT



All the components necessary for automatic volume control are contained in this Wearite production.

unit embodying all the components essential to automatic volume control, using a Westector.

The modern principle which this exemplifies of compacting individual components into units is one which is to be highly commended. The constructor is thereby saved both time and money. Money is saved because the cost of such a unit is invariably lower than the cost of its individual parts if bought separately and of the same quality.

And time is saved because many of the circuit connections are integral with the unit. It is an economical, tidy and efficient method.

There are also some new Wearite H.T. smoothing chokes. The H.T. 12 is a particularly useful type. It has an inductance of 20 henries at 75 ma., and is of the constant inductance type. Even if subjected to an overload of 30 per cent, which it will carry safely, the inductance falls in only about the same proportion.

A good feature, too, is its low D.C. resistance. This is 400 ohms, and that is very good, particularly in view of the reasonable price.

The Wearite Class B driver transformer appears to us to be a particularly sound piece of radio engineering. It provides for two ratios, 1 to 1 and 1·5 to 1. The resistance of its primary winding is 400 ohms, and that of its secondary halves 150 ohms each (100 ohms in the case of the tap for the higher ratio).

These figures reveal that the component adequately fulfils the strict requirements of a high-grade Class B transformer. And our tests prove that it functions as such.

SUBSTANTIALLY MADE

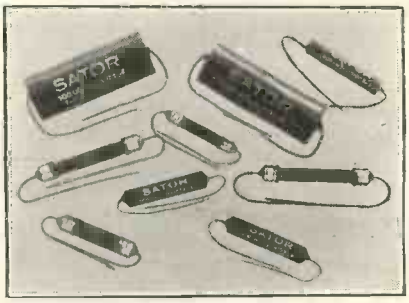
These two attractive Wearite components are the new H.T.12 smoothing choke (on the left) and Class B driver transformer.

Sator Resistances

We have had the opportunity of testing a number of Sator resistances of various values. These resistances are composed of a special ceramic material, and they are claimed to be immune to temperature changes.

And our tests confirm that an unusually high order of stability has been achieved.

STABLE RESISTANCES



Sator resistances are available in a wide range, and are claimed to be unaffected by temperature changes.

They are also close to their specifications in regard to their resistance values.

A very wide range of types and values of these Sator resistances is available suitable for all purposes.

Patent Aerials

There seems to be quite a revival of the patent aerial idea. Many and various are the makes of these that are to be seen in the radio shops these days.

They largely owe their present measure of success to the fact that sets are nowadays much more sensitive than they used to be. We have yet to test one which can live up to the claim of "as good as" or "better than" an outdoor aerial.

The PERMEABILITY 2

EFFICIENCY

This highly sensitive two-valver, designed in the "Modern Wireless" Research Laboratories, has a powerful output, adjustable selectivity and a permeability tuning unit, and will bring in a large number of stations.

ECONOMY

Not only is this receiver low in first cost, but its running expenses are kept down by the special H.T. current economiser. The milliamps. required being in direct relationship to the volume provided.

IRON-CORED tuning inductances have now been with us for about a year, for it was some twelve months ago that the first Ferrocart tuning coils made their appearance, and we received our first introduction to the new type of coils.

Since then other types have been introduced, and to-day we have a range of dust and laminated iron-cored coils that should satisfy the requirements of practically every set design.

Varying Inductance

But the matter has not ended there, for with the coming of iron cores for H.F. coils the possibility of using a variable core, i.e. variable inductance, has arisen and the permeability tuner has arrived.

This is the fulfilment of a dream that radio enthusiasts have had for a long time, and though it is still in its infancy as a practicable proposition, it should grow during the next few years until it is of paramount importance in set designs.

For those who are not familiar with the idea of permeability tuning, we should explain that it is a scheme that provides for a variation of inductance by varying the amount of linkage of the coil winding with the iron core. This can simply be done by sliding the core through the coil in varying degrees, or by sliding the coil up and down the core.

Aids to Compactness

In either case the effect is the same, for the inductance of the coil varies, and therefore the ratio between inductance and capacity varies, or in other words the tuning of the coil. The capacity of the arrangement is only that of the windings of the coil, which can be kept very low and does not vary. As the inductance can be made high, the result is higher efficiency than is obtainable with the normal condenser tuned coil.

Therefore, by all theoretical considerations the H.F. voltage developed across such a tuner should be greater than that normally developed across a condenser-tuned coil, and the receptive powers of a set using the permeability arrangement should be unusually good.

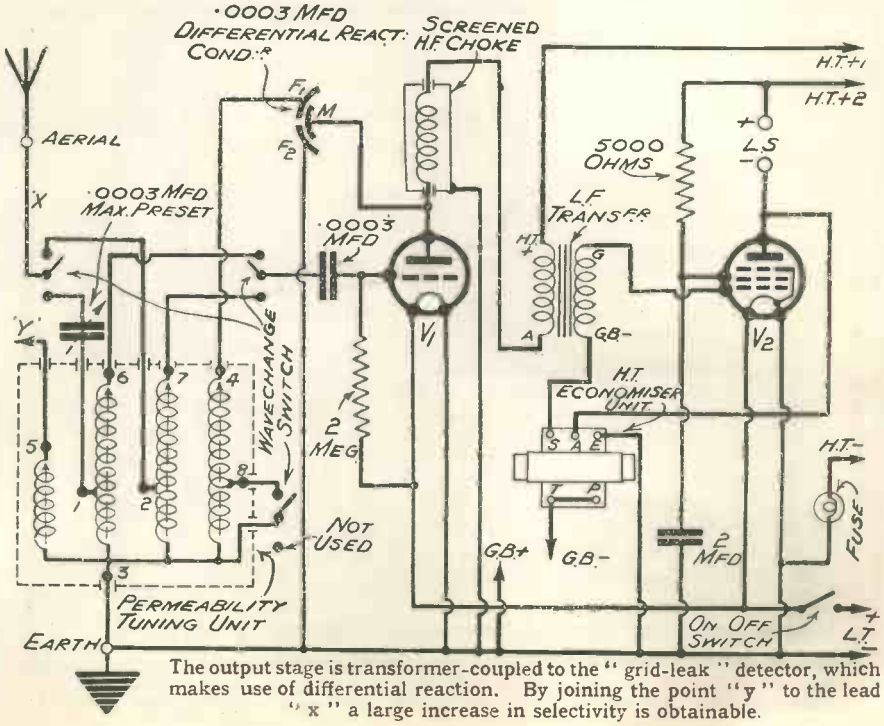
The use of the iron core also makes for compactness, and iron-cored coils of quite small design can be made as efficient as air-cored inductances of very much larger diameter. This is all to the good, for when the iron-core compactness is coupled with permeability control, thus obviating the need for a variable condenser, we can expect smallness and efficiency to go hand in hand, a state of affairs hitherto unknown in radio.

There are many difficulties to be overcome before large sets discard variable condensers in favour of permeability tuners, for the ganging of this type of tuner is no easy matter. Accuracy of winding, complete homogeneity of core, and perfect mechanical action are needed before ganged tuners can be turned out in a manner that will spell commercial success. And the ganging of these tuners, especially for long and medium wavebands, is no easy task.

For Small Sets

Small sets, however, can take advantage of the permeability tuner right away, for a very compact, easily used example of this type of inductance has already been placed on the market, and we introduce to you here a

SENSITIVE DETECTION AND PENTODE OUTPUT



The output stage is transformer-coupled to the "grid-leak" detector, which makes use of differential reaction. By joining the point "y" to the lead "x" a large increase in selectivity is obtainable.

small two-valve receiver employing it. The tuner is just a black cylinder with terminals round the periphery and disc-drive tuning control at one end. It is not large, and takes up about as much room as an ordinary two-gang condenser, being perhaps a little longer but not so broad as that well-known component.

The action of the permeability tuner is to move the tuning inductances to and fro over an iron core, the distance the latter projects into the centre of the winding the higher the inductance and the greater the wavelength.

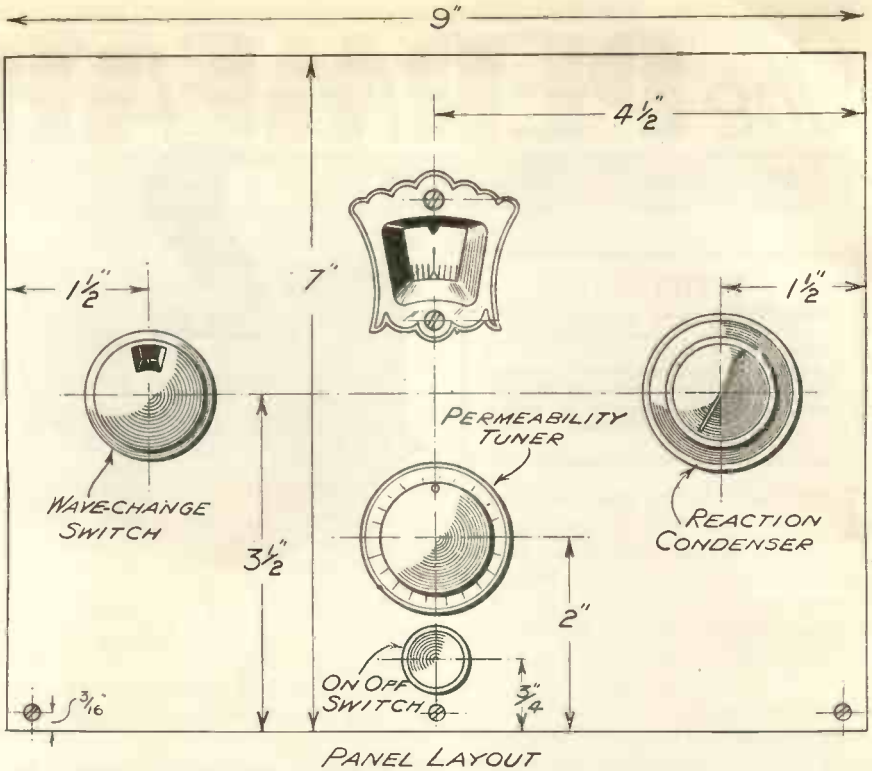
Important Innovation

There are four windings in the tuner, separate secondaries being used for medium and long waves, instead of the more familiar tapped coil, a small primary consisting of very few turns, and a tapped reaction, which is reduced or increased in turn numbers according as the tuner is switched to medium or long waveband.

The permeability tuner has been included in a simple two-valve receiver that is extraordinarily cheap to run, due to another innovation which is of the utmost importance to battery-set owners.

We refer to the H.T. Economiser, which is a device that undoubtedly makes for a saving of something like 50 per cent in the H.T. current consumption of the output valve.

It is well known that both Class B and the earlier Q.P.P. methods of output represented a saving of H.T. due to the fact that only the positive half-cycles in each push-pull section operated the valves, which were biased right down, or so constructed that the zero bias point coincided with the anode-bend point of the anode current curve.



PANEL LAYOUT

The control for the permeability tuner takes the place on the panel of the variable condenser knob. A dial and escutcheon very similar to those used with ordinary tuning condensers are also utilised.

The economiser offers something similar to the user of a *single* output valve—a state of affairs that has hitherto never been dreamed possible.

It is realised by all constructors that the output valve (like all other valves of the set) is a device which, on receiving voltage impulses on the grid, modulates its anode current with an exact replica of the voltage variations on the grid.

How Current Is Wasted

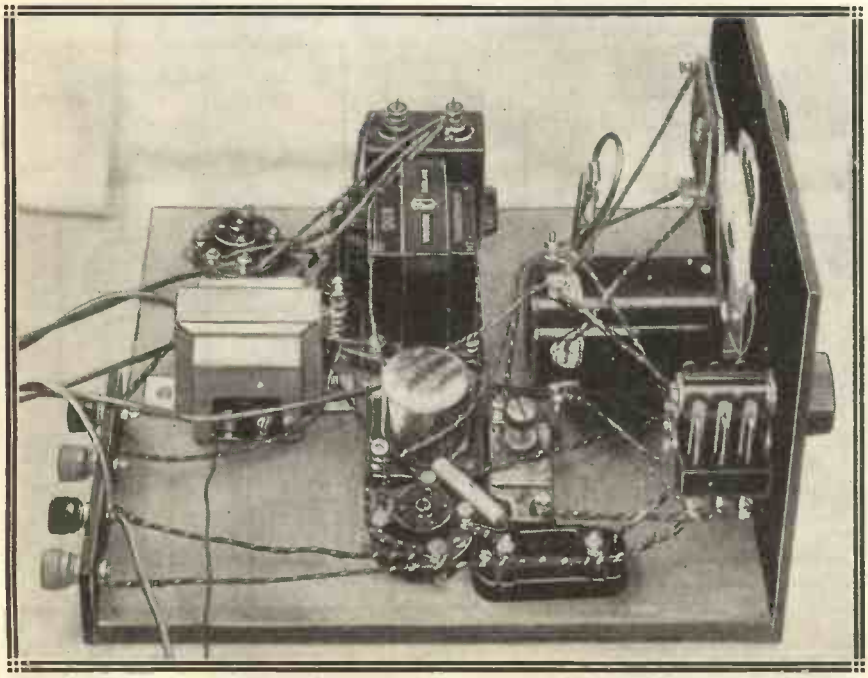
Thus when the grid is made more positive the anode current goes up, and when a negative half-cycle arrives the anode current falls. Thus we have anode current fluctuations around a certain steady mean value, the fluctuations being replicas in *current* of the grid fluctuations in *voltage*.

Normally the output valve (as other valves) is biased so that the anode current fluctuations can occur to an equal maximum above or below the mean. That is, the valve is biased to the mid-point of the straight portion of its anode current-grid voltage characteristic.

At this setting an average triode will consume about 10-12 milliamps., *whether or not any "signal" is coming through*. A pentode will take more as a rule.

This in itself is waste, obviously. But further waste is apparent when we remember that only on peak

EMPLOYS THE LATEST RADIO INVENTIONS



Among the most recent developments incorporated in this set are the H.T. Economiser unit, seen near the terminal strip, and the permeability tuner mounted on the panel.

No Tuning Condensers are Needed

passages of music (assuming the set is being run properly, below overloading point) does the anode current modulation cause variation to the maximum extent above and below the static mean.

Accommodating the Peaks

Thus, supposing the mean is at 10 milliamps., the two ends of the straight portion of the curve are 3 and 17 milliamps. The only times the current will swing (at L.F. of course) between 3 and 17 is when very loud reception is being carried out. Normally the average swing will be between, say, 7 and 13, while during a silent period, or the searching for distant stations, the swing is nil.

Obviously, to get an average swing of 6 milliamps. we need not bias the valve to give 14. Thus we need not set the steady anode current at 10. We could set it at 6, and still get 3 up and 3 down without distortion.

During quiet reception, therefore, a bias setting that gave 6 milliamps. of steady current could be used, but as soon as a loud passage came we should find we were over-biased, and that although we could get our 7 milliamps. upward swing, we could not get our 7 downwards. We should get partial rectification, and consequently bad distortion.

Self-Adjusting Bias

Obviously we want to be able to alter the setting of the bias in accordance with the strength of reception, so that an adequate anode current swing (up to the limits of the valve) is obtained all the time. Just as obviously, this cannot be achieved by any manual control.

This is where the economiser comes in. It is a device which controls the bias setting of the valve in exact accordance with the strength of the reception, and so it can be used to keep the valve biased in such a way that the requisite anode current swing is always available.

This is what happens. A small, not noticeable, portion of the A.C. output of the valve is shunted off to a dry rectifier, which immediately turns it into D.C. of a value consistent with the strength of A.C.

INCREASING SELECTIVITY

When the spring clip is fixed on to a bared part of the lead from the aerial terminal, an extra winding on the permeability tuner is brought into circuit and the selectivity on both bands is increased.

This D.C. is applied across a resistance so that a voltage is developed across it. This voltage is therefore also proportioned to the strength of A.C., or in other words to the strength of reception.

Now, suppose the valve to be over-biased, almost to its anode-bend point. It receives a small " signal " and the anode current variations take place. A large signal follows, and the anode variations try to follow the form of the voltage variations on the grid. They cannot, for though the positive grid impulses result in large anode current increases, the negative impulses cannot decrease the anode current by a similar amount, for the valve is biased " down."

This is where the economiser rectifier gets to work. The valve's output is being applied to the rectifier, and as the output increases so the rectified voltage increases, and on powerful " signals " we get a matter of some 5 or 6 volts developed across the resistance.

Rectifier Connections

Incidentally, by design, the rectifier is so connected that this voltage is positive in regard to the grid of the valve, and it is applied to that grid. Thus it tends to increase the positive bias of the grid—or, in other words, to decrease the negative bias.

Assume the correct bias point for the valve is 9 volts negative, at which value the greatest fluctuations of anode current (7 milliamps. in our example) can occur. At this point 10 milliamps. of current flow when no " signal " is present. Assume also that when biased down to a matter of 4 or 5 milliamps. the bias value is some 15 volts. Obviously we have to decrease the bias by 6 volts to enable the valve to operate to its fullest extent.

Done by the Economiser

At 15 volts bias we get 5 milliamps. (say) static current. We have taken an arbitrary anode-bend point of 3 milliamps., so we can carry a signal that results in a current change of

BUILD YOUR " PERMEABILITY TWO " WITH THESE COMPONENTS

Component	Make used by Designer	Alternative makes of suitable specification recommended by Designer.
1 Permeability tuner	Sovereign	—
1 ·0003-mfd. differential reaction condenser	Graham Farish	British Radiogram, Bulgin, Telsen
1 L.F. transformer	R.I. " Dux "	Lissen, Ferranti, Telsen
1 Screened H.F. choke	Graham Farish HMS	Wearite, Telsen
1 ·0003-mfd. preset condenser	Telsen W.151	Polar, Goltone, Sovereign
1 2-mfd. fixed condenser	T.C.C. type 50	Dubilier, Telsen, Igranic
1 ·0003-mfd. fixed condenser	Dubilier type 610	T.C.C., Lissen, Telsen
1 2-megohm grid leak with terminals or wire ends	Lissen	Graham Farish, Dubilier, Telsen
1 5,000-ohm resistance with horizontal holder	Graham Farish " Ohmite "	Dubilier
1 H.T. Economiser unit	Benjamin	—
1 Four-pin valve holder	W.B.	Telsen, Benjamin, Lissen, Ferranti

Component	Make used by Designer	Alternative makes of suitable specification recommended by Designer
1 Five-pin valve holder	W.B.	Ferranti, Benjamin. Lissen
1 Three-pole two-way switch	Wearite I.23	—
1 Push-pull on-off switch	Lissen LN.5070	Tunewell, Telsen, Igranic
1 Baseboard, 9×10 in.	Peto-Scott	—
1 Ebonite panel, 9×7 in.	Peto-Scott	Goltone, Becol
1 Cabinet to fit above	Peto-Scott	—
1 Terminal strip, 4×1½ in.	Peto-Scott	—
4 Terminals	Belling-Lee type R	Bulgin, Igranic
4 Wander-plugs	Clix	Igranic, Eelex, Goltone
2 Accumulator spades	Eelex	Clix, Belling-Lee
1 Wander-fuse	Belling-Lee	—
1 Crocodile clip	Bulgin CR4	—
1 Coil " Pull-back " wire	Radiophone	—
Screws, flex, etc.	Peto-Scott	—

± 2 milliamps. only. For maximum output we want ± 7 milliamps., and for this to be available we have to decrease our negative bias from —15 to —9 volts.

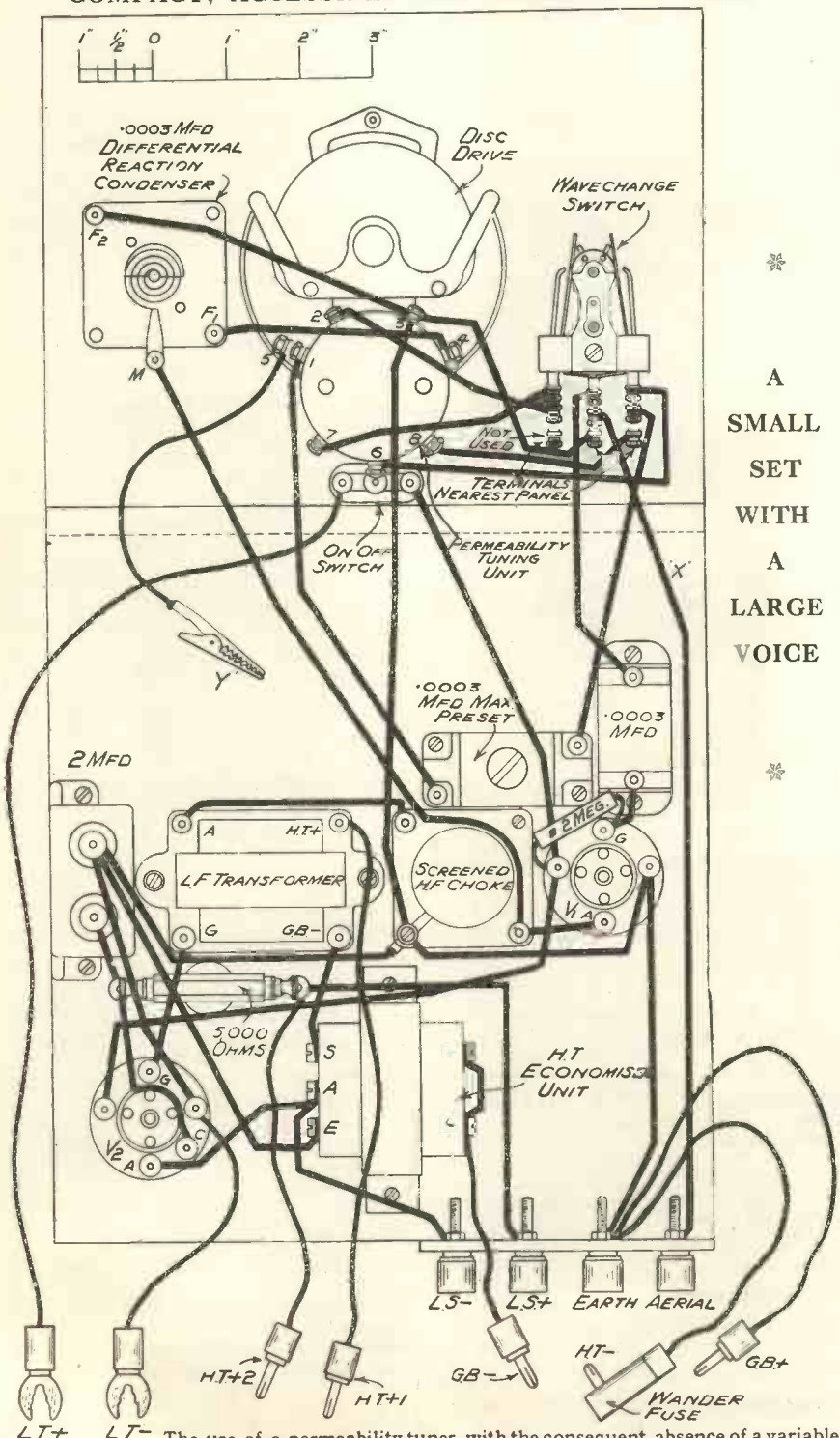
This is done for us by the economiser, which is so set by the makers as to provide the requisite 6 volts positive bias to overcome the unwanted negative bias. Furthermore, the action of the economiser is proportional.

If we have a "signal" of such strength as to demand, say, an anode current change of ±5, the bias reduction required being, say, 3·5 volts, the economiser will develop that voltage (in a positive sense) and apply it to the negative bias of the valve, thus carrying out the required change. Thus, on moderate strength reception the valve is still being run as economically as possible, no more anode current passing than is necessary.

MAKES AND TYPES OF VALVES WE RECOMMEND

Make	Detector	Output
Mullard	P.M.1H.L.	P.M.22
Cossor	210H.F.	230H.P.T.
Marconi	H.L.2	P.T.240
Osram	H.L.2	P.T.240
Mazda	H.L.2	Pen.220A.
Tungsram	H.210	—
Hivac	D.210	Z.220

COMPACT, ACCESSIBLE AND HIGHLY EFFICIENT A SMALL SET WITH A LARGE VOICE



The use of a permeability tuner, with the consequent absence of a variable condenser, is largely responsible for the straightforwardness of the layout. Note that no screening whatever is necessary and that the battery leads are run direct from components to batteries.

Proportional Consumption

This may sound rather complicated and electrically elaborate, but in practice it is simplicity itself, for with the economiser connected in circuit the valve is biased as highly as is consistent with good results on very quiet passages, and the economiser looks after everything else.

Thus we reach a state of operation in which the consumption of anode current is proportional to the strength of the "signal" output. In other words we pay for what we use of the H.T., and do not have a large amount of power running to waste when no reception or weak programmes are coming through.

This constitutes a very marked saving, and on normal strength of reception, such as is usual in the average household, the total reduction of H.T. consumption over an evening is in the nature of 50 per cent.

Selectivity Adjustments

As regards the actual construction of the set, that is clearly shown in the wiring diagram, and there is not the slightest difficulty in it. The aerial circuit is a little unusual, perhaps, for besides the normal series adjustable condenser, which is used for control of selectivity, we have an additional adjustment by means of a crocodile clip connected to the small primary winding of the coil unit.

This winding is of very small dimensions, and its effect when connected by means of the clip to the aerial circuit is to reduce the aerial input considerably, thereby increasing the selectivity beyond that point

The Most Modern Two-Valve Receiver

obtainable with the series condenser adjustment.

Thus, in cases of very bad interference, such as might arise when the set is used very near a twin station, the clip is connected to the aerial lead, either on the aerial terminal or on the terminal of the preset condenser which goes to the switch, and the selectivity immediately increases. Naturally volume decreases, so that reaction has to be used more, but this is quite a normal method of achieving selectivity on small sets. As will be seen in one of the photographs, a small length of the aerial lead to the switch may be bared to receive the clip.

Pentode Output

The wavechange switch is a three-pole rotary change-over type, and it changes the secondary coils and the reaction inductance. The former coils need two-point change-over, for aerial and grid, and the reaction one-point shorting to another point on the same coil

Ordinary leaky grid detection is employed, and the detector is transformer-coupled to the pentode valve. Differential reaction is used, and the normal decoupling of the auxiliary grid of the pentode is carried out with a 5,000-ohm resistance and a 2-mfd. condenser.

The anode of the pentode is fed direct to one of the loudspeaker terminals, it being intended that a speaker with a pentode type of transformer, or a tapped transformer input, shall be used with the set.

Economiser Connections

The economiser is connected, as can be seen, between the anode of the pentode and the negative filament. It also has connections to the grid-bias terminal of the L.F. transformer and to the G.B. negative plug. In the diagrams the terminals T and P on the economiser are shown shorted together. This is the setting for a "large" pentode of the Pen.220A type, and the shorting alters the value of a resistance in the component.

For a small pentode or a triode valve the terminals should not be shorted, but the G.B.— lead should be taken from terminal T, P being left unused.

The operation of the set is exactly similar to that of an ordinary two-valver. The tuning is carried out in the normal way. Wavechange is controlled by turning the rotary switch to one side or the other, in the centre the coils are disconnected and nothing will be received. The on-off switch is the usual push-pull type under the tuning control.

As regards bias setting, the value should be about half as much again as the voltage specified for the valve by the makers. Thus, a 9-volt bias valve would require about 13·5 to 15 volts, and a 12-volter would probably need 18 volts.

Quality Tests

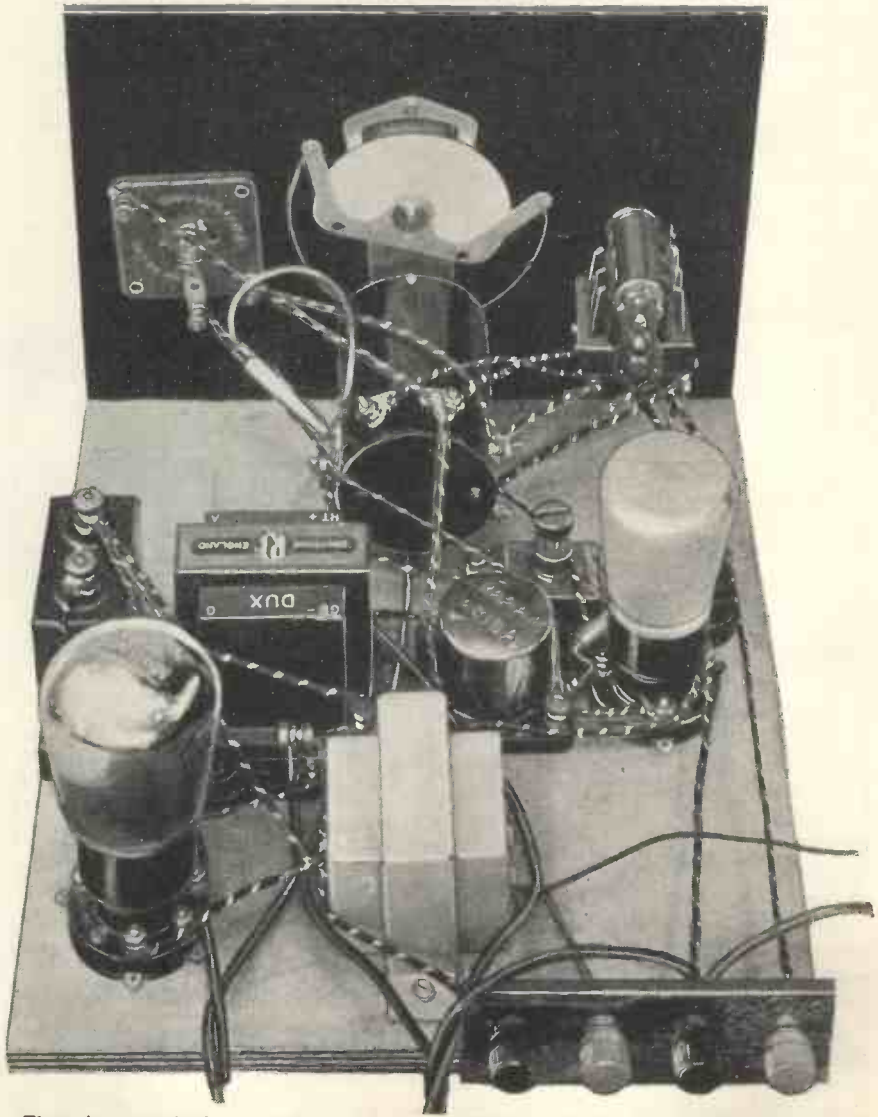
This value should be tested with the set operating on a weak station, or on a weak passage of the local station's programme.

Then, if the quality is O.K. the bias should be increased as far as is consistent with that quality.

THESE ACCESSORIES WILL GIVE GOOD RESULTS

BATTERIES.—H.T. 120 volts.—Lissen, Ediswan, Ever Ready, Pertrix, Marconiphone, Hellesens, Drydex, Siemens, G.E.C., or Block H.T. Accumulators.
G.B. 16½ volts.—Siemens, Lissen, Ediswan, Hellesens, Pertrix, Marconiphone, Drydex, Ever Ready.
L.T. 2 volts.—Block, Exide, Ediswan, Lissen, G.E.C., Oldham,
LOUDSPEAKER.—W.B., Rola, G.E.C., R. & A., Blue Spot, Celestion, Epoch, Magnavox, Marconiphone, Amplion, H.M.V., Ferranti, Atlas, Ormond.
AERIAL AND EARTHING EQUIPMENT.—Electron "Superial," Goltone "Akrite," Radiophone "Receptru" down-lead, Bulgin lightning switch, Graham Farish "Filt" earthing device.

EVERY COMPONENT PLAYS AN IMPORTANT PART



There is not a single unnecessary item, and each part adds its quota to the high overall efficiency, and thus ensures a harmonious whole capable of really superb results.

"M.W.'S" RECORD REVIEW

The latest recordings provide for all tastes and moods. Classical and light orchestral works—some fine vocal discs—and an interesting medley of "unusuals" are offered for your delectation.

THERE are so many good things to talk about this month that it will be well to omit any preamble. Amongst the records which follow are some which *must* and many which *may* go into your collections for future enjoyment. First, then :

Quite the big event is a new recording of *Beethoven's Fifth Symphony in C Minor* by the London Philharmonic Orchestra, conducted by Weingartner (Columbia DX516–9). This, the most popular, the most tuneful of the nine, has become endeared to all who know it for its uplifting loveliness. Every phrase is within the appreciation of anyone ; every passage leaves its message in the memory. This, definitely its finest recording, is worth any sacrifice which leads to its acquisition.

Classical Music

Before we leave Beethoven, I must mention the *Egmont Overture* on H.M.V. DB1925. Spirited music, this, suggestive of vigorous action. A different aspect of Beethoven admirably shown by the B.B.C. Symphony Orchestra.

Recording technique in England becomes better and better. It will be readily agreed that its standard is already high, but the striving towards perfection continues. A notable step has been made by Columbia in their recording of Balakirew's *Russia* on two records (DB1236–7). The advance is made in the acoustic effect, and has resulted in the reproduction of the exact tonal properties heard in a filled concert hall, each group of the instruments being clearly identified.

Sir Hamilton Harty, who conducted the London Philharmonic through the piece, says that it must be listened to " as a performance, not as mechanical reproduction. The surging and excitement of a first-class orchestra have been captured for the first time." It is indeed wonderful, and it is good that so interesting a piece was chosen for its introduction.

Light Orchestral Music

Most of the lighter pieces come from Parlophone this month, and some excellent Continental recordings are offered. Dajos Bela Dance Orchestra play two attractive flowery pieces called *Wood Violets* and *Cornflowers* (R1608), and two excellent Waldteufel

DISTANCE NO OBJECT!

A Columbia record was made of the marvellous ovation accorded Henry Hall on the occasion of his last Radiolympia, performance. It was thought that Henry Hall should hear this record while he was on holiday in New York. The transatlantic telephone was used, and here you see Christopher Stone listening to the playing of the record, which was simultaneously heard by Henry Hall in New York.

tunes are played by the Orchestra Mascotte in *I Love You* and *To You* (R1610).

As the commentator says : " They have just enough modern flavour to appeal to the modern musical palate." The Drury Lane production, " Ball at the Savoy," is represented by the Edith Lorand Viennese Orchestra in a *Selection* (R1598) and the Barnabas Von Geczy Orchestra in *Free and Young* and *I Always Keep My Girl Out Late* (R1602). Paul Abraham will score a success, for the music is bright and tuneful, although without the high-lights of his " Viktoria and Her Hussar."

On no account miss Marek Weber's Orchestra in *Indra Waltz* and *Love's Dream After The Ball* (H.M.V. B4428). Two delightful tunes, played with their customary brilliance.

Vocal—Solos and Choral

At last, a really good rendering of Teresa del Riego's *Homing* by Derek Oldham (H.M.V. B4481). Splendidly sung, with the equally beautiful *Still As The Night* on the other side. Both gems. Joseph Schmidt has two, both magnificently done. First, *O Paradiso* (from Meyerbeer's " L'Africana"), with *Penso* (Tosti) (Parlophone R1593). The others are relatively unknown, but have an atmosphere of their own. They are *Blessed Are They Who Are Persecuted* (from " The Evangelists ") and *Joy That True Didst Prove* (from " The Dead City"). These are on Parlophone R1604. Schmidt is becoming increasingly popular ; his voice is of rare quality, and in such airs as these he takes a high place amongst European tenors. I specially recommend *O Paradiso* for general approval.

Peter Dawson is always a favourite, but I have never heard a better record of his than H.M.V. B4482. On it he sings Stanford's *Outward Bound* and *Drake's Drum*. The first only matters, so outstandingly good is it. Music and lyric are both real art, and the fine choral singing in it deserves equal praise.

A Popular Quartet

Wireless listeners have heard the McGowran Male Quartet, very popular entertainers from (I believe) Birmingham. They have made their first record—a splendid one. (Columbia DB1178.) They sing *A Farewell* (Kingsley) and *Little Tommy* and *A Catastrophe*. The first, to a setting by Colman, is delightfully done, as are the two humorous ditties on the other side.

Boy sopranos often betray the qualities of the curate's egg, but Jack Davie, who makes his appearance on H.M.V. C2582, is good all through. He sings *Waft Her, Angels* and *Art Thou Troubled* in finished yet unaffected style, which is unusual. His voice is pleasantly sweet, too.

To close this section, a delightful and unusual record—*The Flower Waltz*

(*Continued on page* 478)

VALVES for 1934

A comprehensive survey by K. D. Rogers of the latest valve developments, which will inevitably control set design during the coming year. The advance of the thermionic valve has been extremely rapid during the last few months, and the effects are bound to be felt throughout the world.

NEVER in the history of radio has development been so rapid as during the last nine or ten months. Things have always been moving quickly in set design and component construction, but never before has there been such an influx of new schemes and devices for making radio reception either cheaper or more effective, or providing a combination of both economy and efficiency.

Forging Ahead

And with the exception of one development, such as the iron-cored coil, practically the whole of the advance that has been made has been situated in the valve world.

Not one or two minor changes have been made, but an astonishingly large number of important major innovations has been introduced, altering the whole trend of receiver design, and providing results that were undreamed of a year or so ago.

And the changes that have taken place are not confined to one section of radio reception. It might have been thought that the battery receiver had pretty well reached its zenith in economy, efficiency and power, and that all future advances would be bound to come on the mains-driven set side of the industry.

Not a bit of it! Although the mains user has by no means been neglected, three of the most far-reaching developments have been produced for the benefit of the battery-receiver owner, *and for him alone.*

I refer to the Quiescent Push-Pull, Class B and the H.T. Economiser. This latter can rightly be ranked among the valve developments in that it depends on rectification for its operation, carried out either by a thermionic valve, or a dry rectifier—which is a non-amplifying "valve" pure and simple.

Quiescent Push-Pull

All these three are newcomers of 1933, and two of them will make themselves very strongly felt during 1934. The other, which was the first to arrive, has been somewhat overshadowed by No. 2 and No. 3, though a mixture of 1 and 2 is being used in the design of two of the most famous valves of to-day and to-morrow. I refer, of course, to the disposition of quiescent push-pull by Class B and the Economiser.

Quiescent push-pull was a system of using existing triodes and pentodes in a push-pull circuit that was composed of specially designed parts enabling the valves to be so biased that they were normally in a "quiescent" state. In other words, they were biased down to just about the anode-bend points, in which state the anode current drawn with no modulation on the grids was obviously very low.

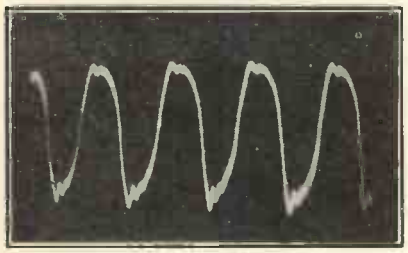
On the arrival of modulation the current went up—both valves obviously operating in "push-

SOME OF THE LATEST CLASS B VALVES

A group of positive drive output valves. They are Mazda P.D.220, Cossor 240B and 220B, Mullard P.M.2B., and Ferranti H.P.2. Note the special non-microphonic bulb of the 220B.

push," using only the positive half-cycles and working 180° out of phase with each other. Thus a low *average* operating anode current was obtained, due to the fact that the amount of current taken was proportional to the strength of the grid impulses, and thus to the output power.

WITH GRID BIAS



The A.C. output form of the Marconi B.21 is illustrated by this oscillograph.

No special valves, other than matched pairs of triodes and pentodes, were brought out for Q.P.P.; and, in fact, this method of amplification very soon gave way to Class B, which is a "push-push" method of operation, working on an anode-bend point that falls on, or slightly to the left of the zero bias axis.

A Special Valve

Thus most Class B valves—for here a special valve has been designed—operate without any grid bias at all, there being only two makes (Marconi and Osram) which require slight negative bias.

Obviously, operation from a zero or small negative bias will entail the acquisition of a positive potential by the grids of the valve (the valve is really two valves in one), and this is exactly what does occur.

FROM FERRANTI

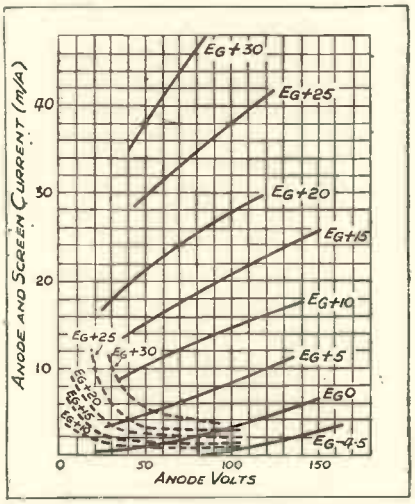
The H.P.2, a Class B valve of the zero bias type made by the famous transformer manufacturers.

In this case, however, the grid current caused by the positive signal bias on the grid does not cause distortion, due to the fact that not only is a special low-resistance secondary input (or driver) transformer used with the valve, but this transformer is preceded by a valve capable of providing power output — not merely a voltage amplification.

The net result is that power (voltage and current) is supplied to the grid of the Class B valve, and the strongly positivised grid releases in the valve a very high anode current, which fluctuates through very wide limits, rising at times of full modulation to 40 or 50 milliamps. and dropping on silence to a quiescent current of some 2·5 or 3 milliamps.

As the maximum current represents an output power of about 2,000 milliwatts, which is reached only on peak passages in the broadcasting, it will be realised that taken over a matter of hours the *average* current falls far

CLASS B CHARACTERISTICS



The anode-current-anode volts characteristic of the Osram B.21.

short of this value, being, in fact, a matter of some 8–12 milliamps. for the Class B valve, dependent on the strength level desired by the owner of the set.

Special Class B valves of the zero bias types have been brought out by Cossor (240B. and 220B.), Mullard (P.M.2B.), Mazda (P.D.220), Ferranti (H.P.2), Lissen (B.2), and Hivac (arriving shortly), while the Marconi and Osram B.21 requires about 3–4·5 volts negative bias on its grid.

Improved Quality

The reason for this is that by using a combination of Q.P.P. and Class B the output of the valve has been rendered very pure and remarkably free from any tendency to certain valve oscillations which would cause "rattle." The full claims and reasons for this, as set out by the makers, cannot be gone into here, but the fact remains that the B.21 is certainly an outstanding valve.

Class B has also been the cause of the origination of the Cossor stabiliser valve, a neon lamp specially designed to act as a voltage stabiliser in mains H.T. units intended for use with Class B valves. Owing to the very great fluctuations of anode current in the Class B circuit the voltage stability of the unit must be exceedingly good. There must be no great fluctuations of voltage as more or less current is drawn from the mains unit. Hence the S.130 has been produced to act as an automatic control of voltage.

NON-MICROPHONIC

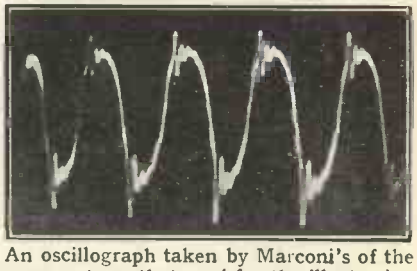
The Osram B.21, which needs negative bias, is enclosed in a special anti-microphonic envelope.

As a rival to Class B another economy idea was launched, a scheme that is particularly ingenious, in my opinion, and designed to give the battery set user full Q.P.P. or Class B economy with his ordinary output valve, only one valve being required.

The H.T. Economiser

This is the economiser circuit, which in its two main forms (thermionic valve and "dry" rectification) enables the average anode current of the output valve of the set to be reduced by some 50 per cent.

WITHOUT GRID BIAS



An oscillograph taken by Marconi's of the same note as that used for the illustration in Column 1, but passed through a Class B valve that is prone to oscillation. Note the rough form.

Naturally, the cheaper method of arranging such an economiser is by means of the dry rectifier, which needs no power energisation. Such a rectifier is the W.6 Westector, which is made by the Westinghouse and Saxby Signal Co., and has for some months been used as an H.F. rectifier. It has been incorporated during the past few weeks in a neat unit produced by Benjamin Electric, Ltd., and forms an excellent way for

Large Output with Minimum Battery Consumption

VERY POWERFUL

This was the first Class B valve to be released in Britain, and is capable of giving a 2,000 milliwatt output.

cutting down H.T. consumption without impairing the quality or maximum power of the receiver's output.

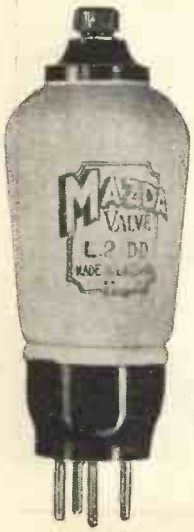
With Class B—I am still on the question of battery sets—also came a number of smaller valve improvements which are in some manner closely linked with Class B. For instance, special driver type valves, which can be used for other L.F. and output purposes, were designed, such as the Marconi and Osram L.21; while in the multi-mu S.G. domain, in order to enable the maximum voltage of a set's grid-bias battery to be kept to very low limits, special valves were produced.

Bias for the Driver

Class B requires but 4·5 to 6 volts for the driver (or in case of the B.21 the driver and the "B" valve), yet with "normal" types of multi-mu S.G. valves a bias battery of from 9 to 16·5 volts is required for adequate control of mutual conductance.

To obviate this, and to keep the maximum voltage down to some 6 or 9 volts the short grid base multi-mu valve was designed by Mullard, in the form of the P.M.12M., which can be completely controlled with a variation of 6 volts grid bias.

BATTERY D.D.T.



The 2-volt double-diode triode valve was first released by Mazda.

High Efficiency

The efficiency of the valve and of the Cossor 220V.S., the Mazda S.215V.M., and the Marconi and Osram V.S.24 is high, and the short base valve is a welcome arrival which should be widely used.

CONSTANT VOLTAGE

The special neon voltage stabiliser for Class B power packs.

The mains section of radio reception has enjoyed a number of interesting changes, which have in certain cases had a reflection on the battery side. One of these is the new Mazda double-diode triode, the L.2/D.D., which is designed to provide both pure rectification of H.F., L.F. amplification, and also automatic volume control, or in its abbreviated form A.V.C.

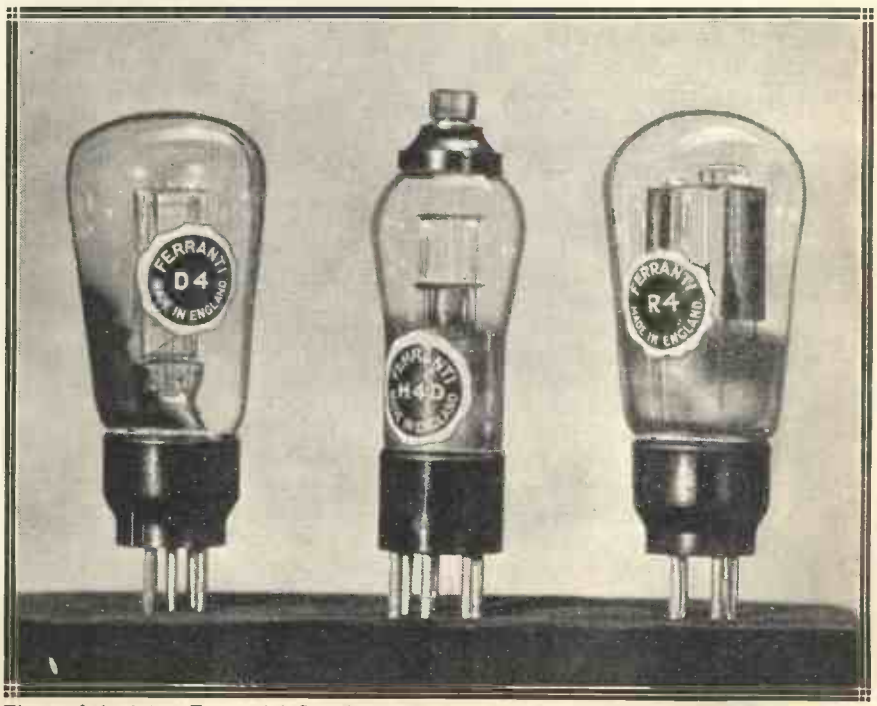
The L2/D.D. at the time of writing is the only battery-operated double-diode triode, and as such deserves special notice. Its filament voltage and current are normal (2 volts at ·1 amp.), and its internal A.C. resistance is 10,000 ohms. The amplification factor of its L.F. section is 16, thus giving a mutual conductance of 1·6. The foregoing are the chief types of battery valves, though practically every week sees the inclusion of some improved pentode or non-microphonic detector in the range. And while on the subject of non-microphonic valves, I should draw attention to the recent arrival of two special S.G.'s from the Marconi and Osram factories, the S.23 and the S.24.

They are both of the "fixed" type, not multi-mu valves, and for both of them one of the main claims is non-microphonicity. In addition, the mutual conductances are high, while the anode and screen currents are low. Of the two the S.24 has the higher slope, the figures being 1·1 and 1·4 ma./volts, while the S.24 takes ·15 amp. filament current, and the S.23 requires

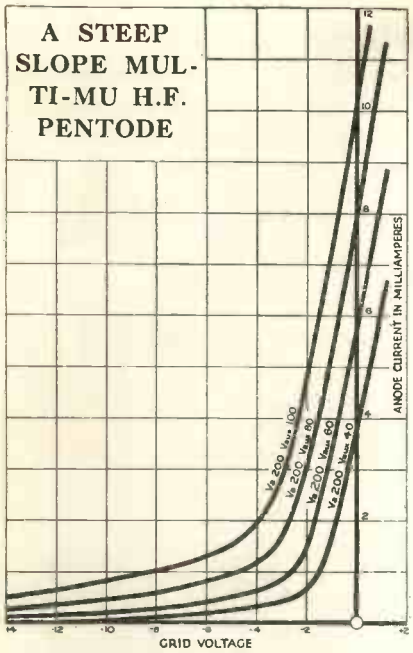
VALUABLE MIXER

The H.F pentode, of which this Ferranti S.P.T.4 is an example, is ideal as a superhet mixer valve

THREE ALL-MAINS VALVES FROM MANCHESTER



Three of the latest Ferranti A.C. valves—the D.4 (detector and 1st L.F.); H.4D., a double-diode triode; and the R.4 rectifier.



The curves of the V.P.4, a Mullard multi-mu screen H.F. pentode—one of the "Golden" series.

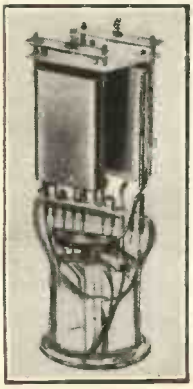
·1 amp. Both are 2-volt valves, of course.

I have forgotten the latest battery arrival of all among the H.F. valves—the H.F. screen pentode. For some time we have been used to screen pentodes of the mains-driven variety, and with plenty of promises re the battery version of this class of valve. At last the 2-volt H.F. pentode has arrived (probably by the time this is read others will have followed) in the Osram V.P.21.

First in the Field

It is of the multi-mu type and enables a conductance variation of from 1·1 to ·008 ma./volts to be obtained with a grid-bias control of 0–9 volts. It is supplied only with a 7-pin base and metallised bulb, and is designed to take ·1 amp. filament current at 2 volts, and to work on a maximum anode voltage of 150, and a screen potential of 60 volts.

IN EMBRYO



The electrode structure of the Mullard P.M.2B.

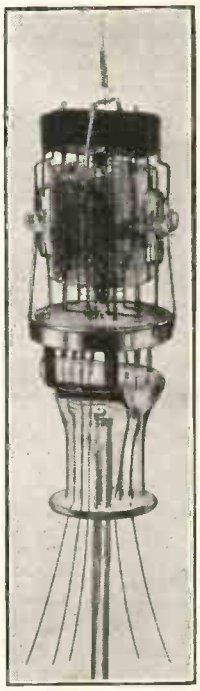
An interesting alteration in valve *bulb* design that has come during the last few months, and especially in Class B valves, is the "mounded" shape, evolved to remove the resonant characteristics of the symmetrical bulb. This new shape prevents valve ring due to bulb vibration, and therefore goes a long way towards the prevention of microphonicity.

Mains Types

And now to consider the mains-driven valves that are to play a large part in the provision of your radio reception during the coming year.

There are probably more individual new types among the mains valves than in the ranks of the battery-driven variety, but their aims are necessarily very different. Where the battery valves have for the most part aimed at providing more

WELL MADE!



The V.P.4 is one of the most intricate valves to construct, as may be judged by this photograph.

A THREE-"WATTER"

The internal details of an up-to-date power pentode—the Pen.4V.A. Note the 7 pins.

economical running, with bigger volume of output than it is usual to obtain with ordinary valves, the mains types that have been introduced are for the purpose of making operation of a set simpler, and for making the set more selective and sensitive.

A Large Variety

Thus we have a large variety of double-diode valves for diode rectification and for automatic volume control, and we have a series of H.F. pentodes to provide minimum coil damping and high stage gain.

Naturally, Class B and Q.P.P. are not devices that are needed where all-mains operation is available, for the simple reason that there is ample power at extremely low cost, and there is, therefore, no need to try to conserve it by using Class B or Q.P.P. But, as will be seen, the output side of the mains set has not been neglected, though the greatest advances have taken place at the H.F. end of the receiver.

Let us consider the A.C. mains valves first, for more has been happening on the A.C. side than the D.C., though most of the A.C. advantages are likely to be added to the D.C. in the near future.

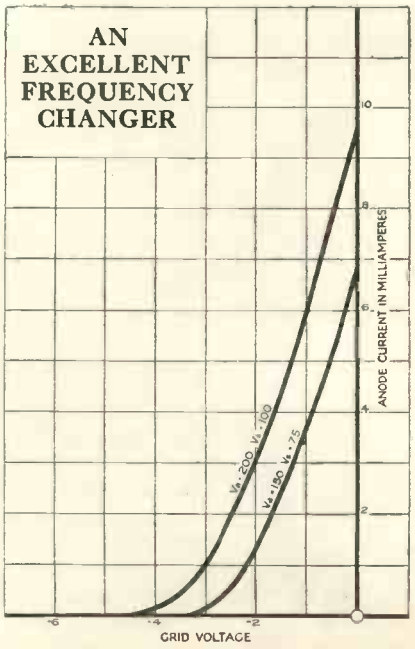
THE V.P.T.4

The V.P.T.4 is a multi-mu version of the S.P.T.4. It comes from the Ferranti factory.

First the double-diode valves. These are at the moment available in two types, triodes and pentodes, though I believe that by the time this appears there will be one or two makes of tetrodes on the market.

Internal Structure

The double-diode section of these valves is quite easy to understand. It is simply a cathode and two anodes. No H.T. is used and the two anodes (or diodes) can be used either for



The Mullard H.F. pentode S.P.4 curves. It makes an excellent superhet frequency changer or mixer.

THREE IN ONE

Valves Rapidly Increasing in Efficiency

The Osram double-diode triode, M.H.D4, carries out rectification, L.F. amplification and automatic volume control at one and the same time.

half-wave rectification (one of them, or the two linked together), for full-wave rectification, or one of them for half-wave rectification and the other for A.V.C.

In this latter case in its simplest form the "signal" is applied to both the diodes; the L.F. component of the rectified output from one is passed to the amplifying section of the valve (triode, tetrode or pentode) and the H.F. component of the rectified output of the other is applied in cumulative form to the grid-bias control of multi-mu S.G. or H.F. pentode valves. By this means the bias of these valves can be varied by the potential developed on the diode by the incoming "signal." In other words, we have automatic bias control, the bias being increased as the strength of "signal" applied to the diode increases and vice versa.

The effect of increasing the bias is to *decrease* the mutual conductance, thereby reducing the stage gain, so that a form of self-controlled gain is obtained, or in other words automatic volume control.

The L.F. section of the double-diode valve takes the form of a complete triode, tetrode or pentode valve, being absolutely separate from the diode portion, except that a common cathode tube is used (the diodes operating on the emission of the lower end, and the L.F. section working on the main length of tube above the diodes), and it is in the same glass envelope.

A MULTI-MU CATKIN

This is the screened M.S.4V.B. which has similar characteristics to the glass-enclosed M.S.4V.B

Quite Independent

Thus the triode or tetrode or pentode section of a double-diode valve can be used as an L.F. valve, or even as a grid-controlled detector, without in any way being upset in its characteristics and with complete electrical independence of the unused diode portion which, incidentally, is statically screened from the remainder of the valve.

The characteristics of the average triode part of a double-diode triode are similar to those of an ordinary moderately steep-slope detector or first L.F. valve. Thus the Mazda A.C./H.L.D.D. has an impedance of just under 12,000 ohms, with an amplification factor of 35.

Varying Impedances

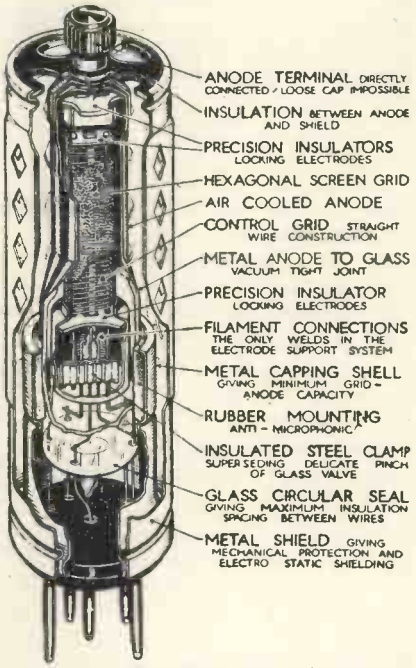
Other D.D.T. valves have impedances of between 11,000 and 17,000 ohms, and all the valve manufacturers (Mullard, Marconi, Mazda, Osram, Tungsram, etc., etc.) make them with the exception of Cossor.

This company has pinned its faith in the double-diode pentode, which is similar in action to the double-diode triode, except that it has a greater amplification factor and, moreover, is of the multi-mu variety, its amplification being controllable automatically by the double-diode section of the valve. Thus the valve can be used not only to control the H.F. gain, but also the amplifying powers of the L.F. section of the set.

The main valves of the double-diode type that have so far been released are as follows: Mullard T.D.D.4, Mazda A.C./H.L.D.D., Marconi and Osram M.H.D.4, Cossor D.D. Pen., Ferranti H.4D., and Micromesh H.A.2.

All the A.C. double-diodes take 4 volts (they are indirectly heated,

REMARKABLE VALVE CONSTRUCTION



This sketch shows the various features of the famous "Catkin" non-breakable valve. The model shown is one of the screened variety of S.G. amplifiers.

THE UNBREAKABLE PENTODE

The Catkin M.P.T.4, showing the enamelled anode, and also this electrode cut away to reveal the inner structure.

OVER SEVEN WATTS!

The latest Mullard super-power 4-volt A.C. valve, the D.O.26, which gives about 7·5 watts undistorted output.

INDIRECTLY HEATED

The 7-pin indirectly-heated cathode power pentode, Pen.4.V.A.

of course) and 1 amp. of current. They are fitted with 7-pin bases similar in pin disposition to those of the Class B valves.

The amplifying powers of the S.G. valve have been steadily improving during the last year or so, and now another electrode has been added to increase its power still further—the H.F. pentode has arrived, with its mutual conductance of something up to 6 or more milliamps. per volt. The impedances are of necessity high, so that for any large percentages of the amplification factors to be obtained in practice the valves must be used with really efficient coils. Not that the S.G. pentode does not give better results than the normal S.G. with ordinary coils; it does, but the full benefits do not accrue unless proper provision in the tuning circuits is made.

Fixed or Multi-Mu

The H.F. pentodes are available in either fixed or multi-mu types. The former are particularly useful as mixers for superheterodyne circuits with cathode injection, while the multi-mu type are excellent for the intermediate stages of the set with A.V.C.

Many say that the H.F. pentode will oust the screened grid from its place, but this remains to be seen, though undoubtedly the pentode will tend to supersede the S.G. in superhets. The main virtue of the pentode is that it can handle larger outputs than those available from the tetrode, as well as being able to provide greater stage gains.

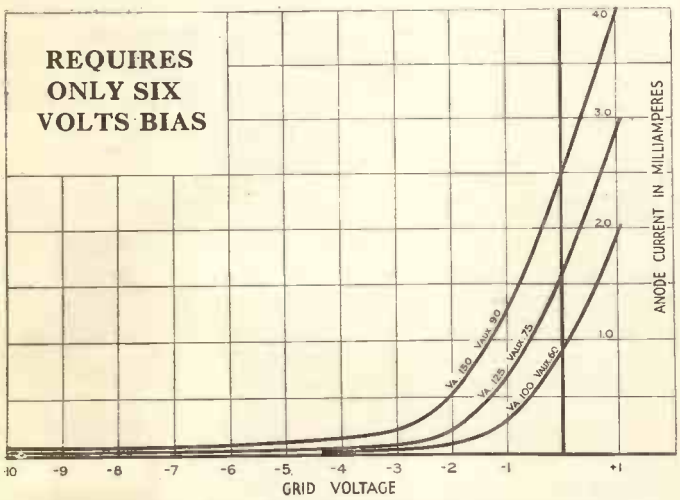
No Standard Bases

So far no standardisation of base has been made with the H.F. pentode, which can be obtained in 5- and 7-pin mountings, according to the make and type. Naturally, owing to the high stage gain the H.F. circuits of sets using these pentodes must be carefully screened or feed-back between anode and grid circuits may occur, with disastrous results as to the stability of the set.

SHORT-GRID BASE

A multi-mu valve that is ideal for Class B sets.

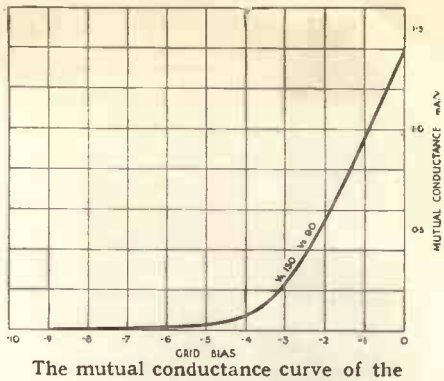
The applied anode voltages of the H.F. pentodes varies with make from 200 to 250, with screen voltages of 100 or 20. In most cases the suppressor grid is internally connected to the cathode, but models such as the Mazda A.C./S.2/Pen. can be obtained where the third grid is connected to a separate pin. Incidentally, in this valve, which has a 7-pin base, the metal coating of the bulb is also connected to a separate pin, for individual earthing—an advantage where superhet mixing circuits are concerned.



The first of the steep slope, short-grid base multi-mu battery S.G. valves was the Mullard P.M.12M., whose characteristic curves are shown above.

Here are some of the chief H.F. pentodes with their maximum mutual conductances and types of bases; those that are of the multi-mu variety are denoted by us with (M.) after the valve. Cossor M.S./Pen., 3·5 ma./v., 5 pin; M.V.S./Pen., 3·0 ma./v., 5 pin (M.). Mazda A.C./S.2/Pen., 6·0 ma./v., 7 pin. Mullard S.P.4, 3·5 ma./v., 5 pin; V.P.4, 2·5 ma./v., 5 pin (M.). Ferranti S.P.T.4, 2·0 ma./v., 5 pin; V.P.T.4, 2·0 ma./v., 5 pin (M.). Marconi and Osram V.M.P.4. 3·5 ma./v., 7 pin (M.); M.S.P.4, 4·0 ma./v., 7 pin; and the Micromesh 9A.1, 4·25 ma./v, 5 pin (M), and 8A.1, 4 ma./v, 5 pin.

RAPID VARIATION WITH G.B.



The mutual conductance curve of the P.M.12M.

A Big Power Valve

Other valves of note among the A.C. type are the new Mullard pentode Pen.4.V.A. and the D.O.26, the latter being a special large output valve like the D.O.25, but with a 4-volt filament. It will deliver about 7 watts undistorted output power. The Pen.4.V.A. is an indirectly heated pentode capable of handling about 3·5 watts output.

I must not forget the Catkin valves, those unbreakable "all-metal" constructed examples of the Marconi and Osram range, which were introduced some months ago and created such excitement. They are available with

(*Continued on page* 476)

TWO MIGHTY MAZDAS

Two more new arrivals to the list of A.C. valves—an H.F. pentode and a double-diode triode.

ON THE SHORT WAVES

ALL THE LATEST NEWS AND INFORMATION

ALTHOUGH the Show is ancient history by now, there are one or two remarks that I must make about it before we all settle down to our new season. First and foremost, it is evident that interest in short waves is most definitely on the increase.

Great Interest Shown

I was told by the people who exhibited short-wave gear on their stands that they were quite besieged by listeners who, as yet, had never tackled short-wave work at all. The stock line of attack appeared to be on these lines: "Tell me, is all this story about reception of America on short waves a fable, or is there something in it?"

And this in the year of grace 1933. Incredible though it may seem, there are still plenty of folk who have never even *met* the owner of a short-wave set. The more hardened sceptics among them are firmly convinced that the whole business is a lot of rot, and that the long lists of DX stations heard are the result of pure imagination.

I think the factor which would have the greatest effect upon people in this category would be the plain fact that more and more short-wave sets and components are finding their way into Radiolympia each year. Certainly there was no lack of short-wave interest on the MODERN WIRELESS stand; my colleagues tell me that there was no lack of short-wave queries, either.

On 5 Metres!

Being endowed with a specially malicious sense of humour, I could not refrain from doing a little "baiting" at Olympia. The trouble was to find a stand showing short-wave gear under the care of someone that didn't know me.

But I was amply rewarded in one or two cases by marvellous tales about the things that a pure ignoramus, just starting radio, could hear on 5 metres. "Oh, yes, sir; musical programmes all day long from amateur transmitters working on 5 metres——" In one case I was told that there was a continuous musical broadcast from the Crystal Palace Tower on that wavelength.

Short waves are becoming more and more popular, and to whatever extent you are interested and in whatever way, you will find much to hold your attention in these pages by our popular contributor.

With his wide practical experience of work on these fascinating high frequencies, W. L. S. is able to give you first-hand information on all aspects of the subject; and he presents it in a most readable and attractive manner.

Seriously, though, these short waves of ours are coming on very nicely. They are not everyone's meat yet by a long way. But the type of man who has tried out every conceivable circuit for ordinary broadcast reception and has become thoroughly used to the business almost invariably turns to short-wave work for a relief. If he want excitement, he gets it; if he wants trouble, he usually finds some of that, too. But it all makes life interesting.

A Westinghouse Demonstration

I have been reading some interesting details about the Westinghouse exhibit at the "Century of Progress" Exposition at Chicago. They are demonstrating the transmission and reception of 9-cm. waves. If we call 5 metres "ultra-short," what on earth are we going to call 9-cm. waves?

Incidentally, as one would expect,

A NEAT AND COMPACT SHORT-WAVE INSTALLATION

A feature of this American station is the entire absence of unnecessary apparatus and elaboration. It was specially employed for the purpose of communicating with the Italian air armada as soon as this approached the American coast.

Renewed Activity on the 10-Metre Band

waves of this length are really and truly optical in their behaviour, but where the "quasi-opticals" stop and the "truly-opticals" begin, we have not yet found out.

These waves, however, can be totally reflected from a flat conducting surface (e.g. a sheet of copper or brass), and can actually be focused on a point by means of a parabolic mirror.

"Beamcasting"

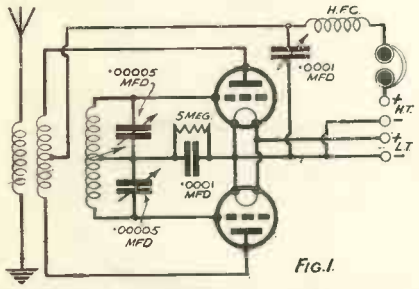
The name "beamcasting" has been adopted to describe this demonstration, which is given along a balcony several hundred feet in length. This is claimed to be the first practical demonstration of the reception and transmission of such short waves.

Incidentally, not everyone knows that there is a perfectly reliable beam service working across the English Channel on a wavelength of 18 cms.

For the first time, one can say that we are getting very near the limit of radio waves. One can't go down for ever—we shall be encountering the "heat-ray" part of the spectrum before long.

While on the subject of the "ultra-shorts," there are one or two remarks that I want to make about them: 5 metres is apparently one of those unchanging waves. We don't use the

VALVES IN PUSH-PULL



Beautiful stability is the chief characteristic of push-pull detection when used on short waves. This circuit shows how the two valves should be connected.

reflected ray at all (even if there *is* one) and "conditions" do not seem to vary at all from one day to another.

Ten metres, on the other hand, is near the border-line. As well as being an excellent wave for short-distance communication, there *is* a reflected ray, as we proved in the season 1928–9. During that time it was quite a commonplace matter to work with amateurs in the U.S.A. on the 10-metre band, and two-way work with South Africa and India was also carried out on more or less rare occasions.

Just at present "ten" shows distinct signs of waking up once more. At the moment communication with Central Europe seems to be all the rage. Stations in Czecho-Slovakia and Hungary are very active on the band, and have been worked with reliability from this country on innumerable occasions. I venture to prophesy that it will not be long before we hear the "Yanks" back on that band.

When the eleven-year sunspot-cum-conditions cycle was most favourable for 10-metre work—in 1925–6—the band had not been touched. Amateurs did not begin to "tame" 10 metres until 1928.

The "Mush" Problem

This winter, 1933, should somewhat resemble in its properties the winter of 1930 or even 1929. When we get to the next "peak" year—supposedly 1936 or 1937—we shall find some very remarkable happenings on 10 metres, and may even discover a reflected wave on 5 metres.

The great hunt for "quiet backgrounds" continues unabated. We are hearing that the "mush" that we all complain of on short waves can come from the Milky Way, from meteors entering the earth's atmosphere, from spots on Saturn, and from Mrs. Brown's vacuum cleaner next door.

Unfortunately, several of these sources are beyond our control. Even the vacuum cleaner can't always be silenced, because, for one thing, it isn't always easy to find out which particular vacuum cleaner it is that causes the trouble.

While this state of affairs prevails it is up to us to keep our sets as quiet as possible. Readers all know that I have a soft spot for the single-valve receiver; but I have gone one stage further than that in the past week. I have added a second valve, which is not an H.F. stage, neither is it an L.F. stage.

A Stable Circuit

This cryptic remark translated into plain English is interpreted "push-pull detection." Fig. 1 shows the circuit, from which it will be seen that anyone can work out lots of push-pull detector circuits by the use of ordinary common sense.

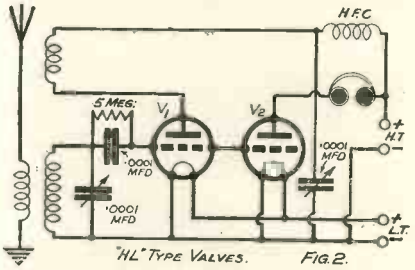
Push-pull detection is not everybody's circuit. It is rather in the class of an experiment for the man who wants to see how things work, but in my case it seems to be definitely worth the upkeep of the extra valve.

Worth Trying

Beautiful stability is the chief characteristic of the circuit; reaction control has to be handled to be believed; and it does *not* work equally well with one of the valves removed!

If anyone wants to try this out for himself, I recommend that he should

FOR QUIET BACKGROUND



Those who seek to quieten the background noise of the short-waver should try this scheme in which one valve is used entirely for reaction purposes.

wind the three coils on one former, keeping to the conventional sizes. Naturally, we have to couple the aerial inductively to this circuit; capacity coupling to one of the grids would unbalance the whole thing.

A test worth trying, though, is to use two short aerials, identical in shape and length, and running in opposite directions, and to couple one on to each end of the grid coil, making sure that the coupling capacities are the same in each case.

An Alternative Scheme

You will be hearing a lot more about push-pull detection before long! Now for one or two other methods of quietening the background. Does anyone remember the "separate reactor" circuit? Fig. 2 shows the form it takes nowadays.

This circuit is simplicity itself, and also comes in the category of "one-valve circuits that use two valves." V_1 is the "reactor," V_2 the detector.

The merit of this arrangement is simply its quietness and the fact that atmospherics and strong local signals do not cause a "spill-over." Perhaps some enterprising firm will produce a valve one of these days that can be used in this way.

Another scheme that I am still pursuing is that of obtaining *really*

Obtaining Easy Tuning on Short Waves

easy tuning on short waves. I have done this on my own "amateur-band" receiver simply by forsaking the non-amateur waves altogether. I have designed my coils so that the minute tuning condenser that I use (less than .00001!) just covers the amateur bands.

The result of this is two-fold; first, tuning is as simple as it is on the medium broadcast band; and, secondly, one arrives at a wonderfully high L/C ratio, with correspondingly high sensitivity.

Increasing the Inductance

At one time during my experiments I was using *twenty* turns of 2½-inch diameter to reach the 40-metre band, and *ten* for the 20-metre band. Compare these with the usual turn numbers of eight and three, and you will see what a high L/C ratio *can* be.

I want to repeat this performance on a short-waver to tune in the short-wave broadcast bands only; but the trouble is that so many stations work outside the allotted bands that I haven't yet found out what ranges I really want to cover.

(Query: Why is it that an amateur transmitter loses his licence for working outside the allotted bands to the tune of 50 kc., while broadcast stations are 2,000 kc. out in some cases, and advertise the fact in published lists?)

I can honestly say that with a single-valve receiver I have never yet come up against a signal that has been too *weak* to tune in, but every day I meet signals that are below the background level. I am still waiting for someone to tell me how this state of affairs can possibly be improved by the addition of note-mags. I invariably find that the "signal-mush" ratio becomes considerably worse.

Using H.F. Amplification

The one and only hope of salvation, in my opinion, lies in the use of H.F. amplification of special design. I think a really good S.G. stage does improve matters, but one doesn't often meet one.

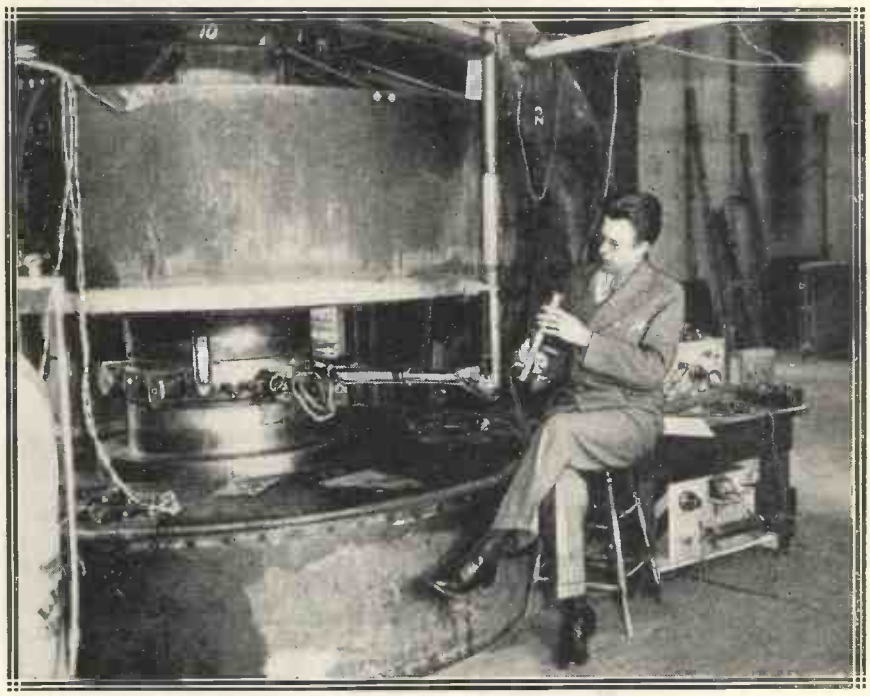
I had better explain that "really good" implies complete screening, loose aerial coupling, low damping in every possible way, and complete stability. This is not so easy!

The fashion with short-wave S.G. stages has been to damp down the grid circuit by tight aerial coupling so as to make the stage fairly stable. Even then it hasn't always been really "tame."

This opens up a new line of research, now that we are plentifully supplied with mains-driven screened H.F. pentodes of almost incredible efficiency. One of these at signal frequency followed by another as detector should make quite a lively sort of set.

Short-wave conditions, at the moment of writing, are distinctly good. Practically every broadcasting station with a regular schedule can be heard at some time of the day or night. The 49-metre Americans are particularly good after midnight, and Nairobi and Jo'burg can always be heard earlier in the evening.

APPARATUS FOR SPLITTING UP THE ATOM



Undoubtedly a new scientific era will open up when we know more about the structure of the atom. Professor Lawrence of the University of California is here seen with apparatus used for experiments in the splitting of the atoms of lithium and boron.

On the amateur bands the most exciting happenings have been the sudden arrival of Australia and New Zealand on 40 metres in the early mornings (7 a.m. or thereabouts), and the equally sudden influx of South Americans on 20 metres in the evenings.

Reception on 20 Metres

On a recent evening, on 20 metres, between 8 and 8.30 p.m., I logged Brazil, South Africa, Bahamas, Sierra Leone, India and the West Coast of America (W6, California).

There is every indication that this is going to be a very good winter for short waves.

We may assume that the year that came lowest in the "trough" of the eleven-year cycle was 1932. Conditions this year have undoubtedly maintained a higher level than they did last year, and 1934 should be the equivalent of 1930, which was quite a good all-round year.

Constant Improvements

We must not forget that receivers and transmitters are constantly being improved; so that when (and if) we ever have another brilliant year like 1927 or 1928, we shall all be somewhat surprised at the results that are possible.

The possibilities that intrigue me most are concerned with 10 and 5 metres. We did catch a glimpse, in 1928 and 1929, of what 10 metres could do in reasonably good conditions, and there is not the slightest doubt that it is improving again. We ought to be hearing Americans on that band again during the coming winter.

But what of "5"? I wonder whether it is just possible that we shall at last discover the presence of a reflected wave on five metres? It may only just come down at the Antipodes, or in some obscure spot, but it *would* be an exciting discovery.

ROUND THE TURNTABLE

By TONE ARM

Improving Bass Response—An Excellent New Valve—A Peak That Vanished.

I DO not profess to be highly technical in my outlook on radio; I know a certain amount of the more superficial facts concerning the science, but the mathematics of the whole business leave me cold. I just cannot grapple with them.

Possibly some of my readers are in the same boat, though no offence is intended by the remark. But radio maths. *are* a bit sticky, aren't they?

Hit or Miss Methods

As a matter of fact, one can get on very well, up to a point, without going *very* deeply into radio, though I must admit that sometimes it means buying experience rather more expensively than would otherwise be the case. Anyhow, beggars cannot be choosers, and if the higher side of radio is above one, there is nothing to be done but to seek advice or else plod along on the more or less hit or miss principle.

I have just had a case in point, where something that has been mildly annoying me for months has been unexpectedly cured by a slight alteration in my radio-gramophone. Incidentally, another annoyance has been greatly reduced, though this was to some extent expected as a possible corollary of the change.

A Splendid Set

On the gramophone side of my outfit—the A.C. "Diodion," published some months ago—I have been using a Mullard 164V., shunt-fed transformer coupled to a D.O.24.

The result has been excellent from the point of view of quality, especially as any slight tendency to over-brilliance in record reproduction could be rectified on the tone adjustment of the transformer.

All this is in a big radiogram cabinet with inch-thick sides, and working through a choke filter output and 8-mfd. condenser to a mains-energised "Magnavox" moving-coil speaker. This is in itself brilliant in characteristic, and gives excellent bass response.

Five-Watt Output

Now, with the D.O.24 I got a 5,000 milliwatt output, but with a certain amount of mains "sing," not hum (I am running from an A.C. converter on mercury arc rectified D.C.), and with a peak point in the bass at about 120 cycles, as near as I could judge.

The peak was not troublesome, but it was there all right, though, apart from it, there seemed to be no boxiness or boom. As a matter of fact, the peak always seemed to be inherent in the set and speaker, and nothing to do with the cabinet.

MR. JETSAM AND MR. FLOTSAM

The deep notes of Jetsam (left) probably cause resonance troubles in a great many sets which are afflicted with non-linear low-note response.

Larger Grid Swing

It used to annoy me sometimes when Jetsam was doing his deep stuff, and when Henry Hall's double-bass 'cello was hard at work

A few days ago I was given a Mullard D.O.26 to try. This is a new valve with a larger grid base than the two I had been using, and with not so steep a slope. Also, the impedance was low, being a matter of 600 ohms instead of 1,390.

A Great Improvement

I duly altered the bias resistance to accommodate the new valve, which, by the way, takes the same filament wattage (4 volts, 2 amps) and the same H.T. (400 volts), and plugged the valve in the holder. Having adjusted the variable bias resistance till I got 60 milliamps. on the output milliammeter (the maximum of the valve is 63), I switched on the gramophone and tried it.

The results were amazingly different from those I had considered quite excellent before. The tendency for over-brilliance had gone, though there was certainly no lack of top, and the bass reproduction was enhanced, and went lower than before.

This was expected, seeing that the new valve had a lower impedance than the former, but what was not expected was the complete removal of the 120-cycle peak. Obviously this peak had been due to electrical unevenness in the reproduction and not to any mechanical fault in the speaker or to box resonance, and I can only assume that somehow the output circuit (filter-cum-speaker transformer load) tuned to that frequency with the previous output valve. The peculiar thing is that the optimum load for both D.O.24 and 26 is the same.

Anyhow, whatever the reason, the hump has gone, and the reproduction is wonderfully even in response. Also, though somewhat expected, due to the lower amplification of the D.O.26, the mains "sing" has been almost totally removed. Needless to say, I am sticking to the new valve, especially as I find I can fully load it, and it will give a maximum undistorted output of some 7,500 milliwatts, providing an excellent margin of safety over the normal strength level for peak passages.

My next experiment will centre round the speaker, for I have just received a novel design of moving-coil instrument which theoretically holds out great promise. But more of that later.

Why Not RATIONALISE RADIO?

By
MARCUS G. SCROGGIE,
B.Sc., A.M.I.E.E.

To rationalise means to make rational or reasonable. Within the limits of these small islands there are domestic electric systems of at least fourteen different voltages. So lamp manufacturers, instead of making only one sort of lamp for each wattage or candle power, have to make a whole host of different lamps to suit these voltages. It is still more difficult for manufacturers of motors and other appliances, because they have to provide not only for voltage, but for D.C. and A.C.,

We blame on to our ancestors the muddles into which our inconvenient system of weights and measures sometimes leads us. But radio is the creation of our own time and we have only ourselves to blame if we fail to remedy some of the "medieval" absurdities which already exist in some aspects of radio. Typical examples of the non-standardisation of components, and also instances where uniformity has been obtained, are given in this contribution.

A STEP FORWARD

An excellent example of rational standardisation is the universally accepted colour code for fixed resistances.

and if for A.C. they are confronted with about a dozen different frequencies, including not only the familiar 50 cycles, but curiosities like $33\frac{1}{3}$, 80, and $83\frac{1}{3}$.

The Grid System

Years ago it was realised that all this was definitely *not* reasonable, and so the Grid System, with a single standard supply throughout the country, was put in hand. When fully working this will be of incalculable benefit to all concerned, and not least to the people who have to make wireless receivers that will work anywhere.

The system of weights and measures that is known, to our shame, as the "British" system, with its $5\frac{1}{2}$ yards to one rod, pole, or perch, is another example of something that is unreasonable. Perhaps the most valuable result of the French Revolution was to deliver us at least partly from this curse. One shudders to think what it would have been like if electrical units had been based on the British system.

Of course, we say, it was the stupidity of our ancestors that handed down to us muddles of this sort, from which we extricate ourselves with difficulty. We are far too clever and sensible to adopt a lot of separate and badly related standards where one will do. But are we?

Radio is modern enough, surely. A splendid opportunity for working on rational lines from the start, with no superfluous frills and complications. Everything dovetailing in a perfect system. No unnecessary strain on the memory trying to keep in mind all the different things needlessly produced for one job.

Yet there are absurdities in radio that might have been perpetrated in the Middle Ages. When you go to buy a 3-electrode A.C. mains valve, with a 4-volt 1-amp. heater, a resistance of about 12,000 ohms, and a magnification factor of about 36, you may actually ask for a 41M.H.F., an A.C./H.L., an M.H.4, a 354V., an S.S.4G.P.A.C., or an A.R.4101, according to the maker (surely a minor detail compared with what the valve *does*). There are scores of different types of valves, each with a similar weird array of titles.

In Solemn Conclave

I once sat for hours in solemn conclave at committee meetings of valve makers who tried to draw up a uniform and rational system of names.

WHAT'S IN A NAME?

If you want a particular type of valve, you will find it in the range of almost any manufacturer. Yet its name in one maker's list will be quite different from its title in a competitor's catalogue. Not a rational arrangement!

Sometimes Even the Maker Doesn't Know

but reasonableness lost the day. How much better in America, where each type of valve has its simple number, irrespective of who happens to be responsible for giving it birth.

If reason were able to prevail over unreason, not only the titles but the majority of the valves themselves would be scrapped. There are far too many types.

The purchaser of components may be rather irritated by the plethora of wares offered to him at the present time and may find it difficult to choose. Or he may revel in this foolish abundance. But if he realised that by scrapping three-quarters of the

WHY NOT STANDARDISE?

An output transformer like this costs money, and while it will match certain loudspeakers to a particular power valve, the absence of a standardised loudspeaker impedance may render the transformer useless if other speakers are bought.

types and styles and specifications, the remainder could be bought more cheaply and with less delay and uncertainty in delivery, he would ask why it is not being done. The answer is lack of rationalisation.

An Example

The trouble is that things hang together so. On a world scale that is why every nation under the sun has to meet to discuss what each must do with its money and tariff systems. *If* all the interests concerned in radio would meet together, and *if* they would be sensible about it, things could be made so much simpler.

Take loudspeakers, for example. It is right that there should be a selection of types, so that if you are prepared to pay more for rather better quality you can do so, or contrariwise. And there is room for individual taste in tone. But having made your choice in this respect, you are surely entitled not to be humbugged by finding that the impedance is wrong, or the field winding incorrect. Owing to the scores of output valves that exist the odds are heavily against any particular loudspeaker matching yours.

Power Transformers

Now, if a few standard output valves were selected, to cover all reasonable requirements, and the rest ruthlessly eliminated, there would be a minimum of different impedances to provide for—two might be enough. Then there is the power transformer. The primary, alas! is bound to have tappings until the electricity supplies are standardised, but the secondaries afford an example of a degree of standardisation already effected. There are three types of rectifier valve, corresponding to 250, 350, and 500 volts; so transformers need be arranged for no other voltages—for the valve rectifiers anyway.

Another example of standardisation—why do so many good ideas come from America?—is the colour code for resistors. It would have been like our people to have had a different colour code for each manufacturer. Luckily we have been preserved from that.

Pick-Up Impedances

It should be no difficult task to standardise pick-up impedances. At present, given a pick-up, one doesn't know what is the most suitable volume control resistance. For one it may be 250,000 ohms; for another, 10,000 ohms. Impedances vary so much. It is impossible to design a tone-correction circuit without knowing the impedance, and sometimes even the maker himself doesn't know that! Having got the right tone corrector for one pick-up, it is quite useless for others of different impedance.

Wavebands. There seems to be no uniformity among receivers in the matter of the bands of wavelengths covered. That may be excusable in short-wave sets, but why should some medium wavebands start at 200 metres, others at 220, 240, or even 260 metres? The top limit is also ill-defined. Many stations are thus excluded from reception even although there is quite enough amplification available. There is more in it than merely the wavelength coverage—a rational uniformity in this respect is bound up with coil inductances and the minimum and maximum capacities of condensers. It would be very beautiful if these could all be made uniform and interchangeable.

And there are many other things that should be agreed upon by all manufacturers, with a view to cutting out all superfluous variations and making everything as simple and certain as Ford spares. But there exists a horrid example as to the wrong way to do it. Years ago the British Engineering Standards Association took in hand to standardise ebonite panels for radio. They did it so thoroughly that by the time they were finished with the job ebonite panels had become obsolete. We don't want the methods of Royal Commissions and Select Committees.

How difficult it is for anything to be done rationally in this world!

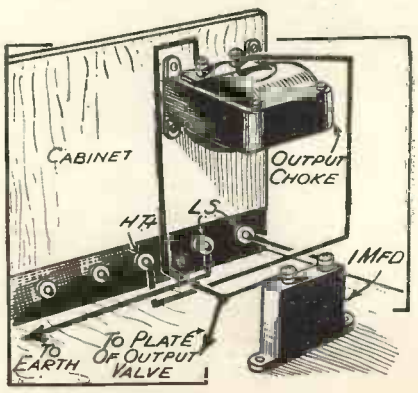
SPACE FOR ADDITIONS

Finding room for those extra components so often needed when modifications are made to a set.

CONSTRUCTORS frequently find that there is insufficient room on their set baseboards for additional components. This difficulty need not prevent the addition of choke output filters, conversion to Class B output, etc.

If space is lacking on the baseboard for the additional filter or Class B choke, condensers and so on, these components may be mounted on the inside of the cabinet itself. If they are mounted towards the cabinet top they will not foul valves and other components in the set, and flex leads of ample length will suffice as connections.

FIXED TO THE SIDE



Illustrating how room may be found in a compact set for the choke of an output filter.

The type of detector employed in a receiver has a marked effect on performance, and the correct selection of the form of the detector stage is a very necessary essential in good receiver design.

By JOHN RUSTON, B.Sc. (Eng.).

WHEN deciding which type of detector to include in a receiver it is necessary to know the advantages and limitations of the various kinds available. Also, in order to appreciate these limitations and get the best results from the type used it is necessary fully to understand the principles on which the detectors work. So it is proposed firstly to indicate the requirements of an "ideal" detector, and then to explain the action of the types commonly used in practice and show in what respects they fall short of the ideal.

The Ideal Rectifier

For, when the rectifier acted as a pure resistance, the current flowing through R would be proportional to the input voltage, and hence the voltage across R would have the same waveform as the input voltage, but average value of the H.F. component gives the L.F. waveform shown dotted. The circuit shown would produce the desired result if the rectifier acted as a pure resistance to currents in one direction, and as a perfect insulator to currents in the other direction.

HOW THE "PERFECT" DETECTOR WOULD BEHAVE

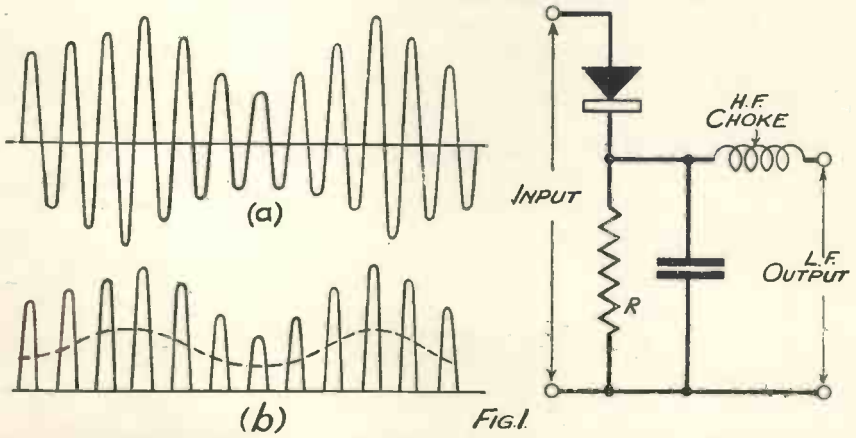


FIG. 1.

If a "perfect" detector were set up in the circuit shown to the right in the diagrams above, it would convert the complete H.F. wave of (a) into the uni-directional waveform of (b). Such conversion would imply that the detector possessed infinitely great resistance to currents flowing in one direction and negligible resistance to those in the opposite direction.

The function of the detector stage is to obtain an L.F. output which corresponds exactly to the modulations of the H.F. carrier wave, and the simplest way of doing this is to merely rectify the latter and then smooth out the H.F. component.

Thus, Fig. 1(a) represents a modulated carrier giving the rectified waveform 1(b), which in taking an in the reverse direction no current would flow and the voltage across R would be zero.

A device which approaches closely to this ideal rectifier is the diode valve. Thus, it is almost a perfect insulator to currents trying to flow from cathode to anode, but it is not quite a pure resistance to currents in the reverse direction.

As shown in Fig. 2, a pure resistance would give a linear relationship between current and applied voltage, whereas the diode's characteristic is slightly curved. This causes the rectified waveform to be slightly distorted, the distortion being exaggerated in the figure to show it clearly.

Actually in a good diode this deviation from a straight line is hardly noticeable. Since the diode characteristic remains straight up to voltages of 50 or so, input voltages of this order can be used without distortion, and this constitutes one of the diode's greatest advantages.

High Impedance Desirable

Another requirement of the detector is that it shall not impose an appreciable load on the preceding H.F. or I.F. stage, since this would reduce the stage gain and selectivity. Some diodes do offend in this respect, but by using a high value of load resistance the damping on preceding circuits can be made negligible.

DIODE CHARACTERISTIC

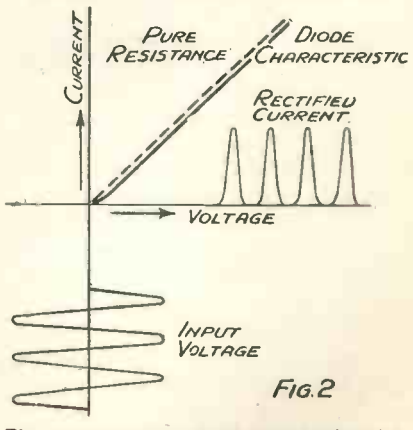


FIG. 2.

The nearest approach to "perfection" in detectors is the diode which has the very slightly curved characteristic shown by the full line above.

Diode, Anode Bend or Leaky Grid?

The H.F. metal rectifier as exemplified by the Westector has similar characteristics to the diode valve and gives similar results, although it has a lower impedance and so is liable to produce more damping.

The anode-bend detector obtains the required rectifying action by working on the curved part of the valve characteristics. Thus the grid is biased back as in Fig. 3, and by plotting out the anode current for values of input voltage, the anode current waveform is obtained.

THE PRINCIPLES OF ANODE RECTIFICATION

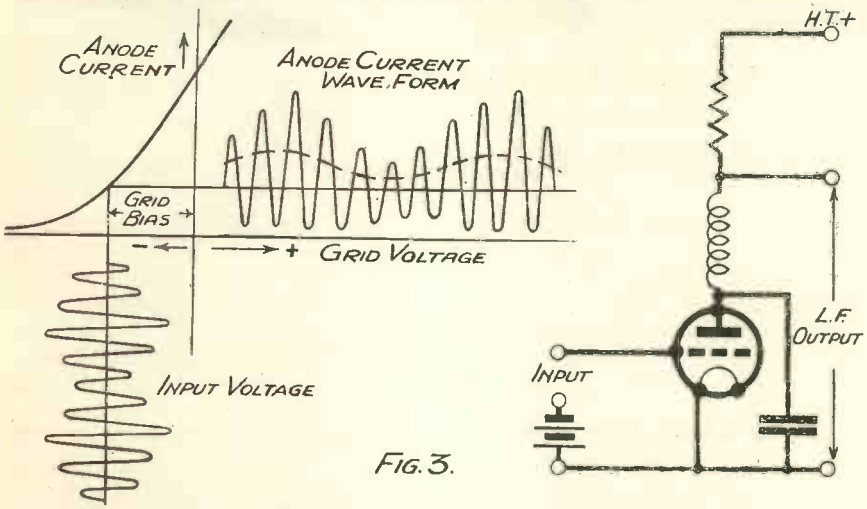


FIG. 3.

Anode-bend rectification takes advantage of the curvature of the anode current characteristic by employing relatively high negative bias.

Owing to the curvature of valve characterstics, an input voltage in one direction produces a greater change in anode current than an equal voltage in the other direction. So when a mean value of the H.F. anode current is obtained we are left with the L.F. waveform shown dotted.

Slight Distortion

This is not, however, an exact reproduction of the modulations of the carrier, for it can be shown theoretically that the curvature of the characteristics must lead to the production of harmonics of the modulation frequencies, and also to inter-modulation between different frequencies. Hence, distortion is inherent in the anode bend detector, and its only advantages are that it amplifies the signal as well as detecting it, and that it can cope with a greater input voltage than the grid-leak type, which we will now consider.

Grid-leak detection, with its big brother, power-grid detection, is the most sensitive type available, and so it is very popular in sets in which as much gain as possible is required from each valve. The action of this detector is more complex than that of other types, and must be studied carefully to understand it fully.

Consider first the conditions when no signal is being received; Fig. 4 shows the grid current characteristic of a typical detector valve, and also the straight line relationship between the current and voltage across the grid leak R. Any direct current flowing from grid to filament must flow back through the grid leak; hence the voltage of the grid will adjust itself to a value OQ for which these currents are equal.

Also, since no direct current can flow through the condenser C, the average value of current from grid to filament must equal the average value of current in the grid leak. Now suppose an unmodulated H.F. voltage is applied to the input, then this voltage will reach the grid unchanged, since the condenser C is about 0·0001 mfd., and offers only a small impedance to H.F. fluctuations.

How It Works

This fluctuating grid voltage will cause corresponding fluctuating grid and grid-leak currents, and the mean values of these latter must be equal. Hence, owing to the curvature of the grid current characteristic, the mean grid voltage must adjust itself to a more negative value OQ^1. The effect, then, of the H.F. input is to increase the mean grid potential by the amount QQ^1, and the greater the input the greater this change.

By plotting out the grid current waveforms for various magnitudes of input voltage it will be found that the change is nearly proportional to the H.F. input over a limited range.

When the H.F. input is modulated its magnitude changes according to the L.F. waveform, and so the mean grid potential will vary in the same way as long as we are working on the straight part of the curve.

(Continued on page 472)

ALMOST UNIVERSALLY EMPLOYED

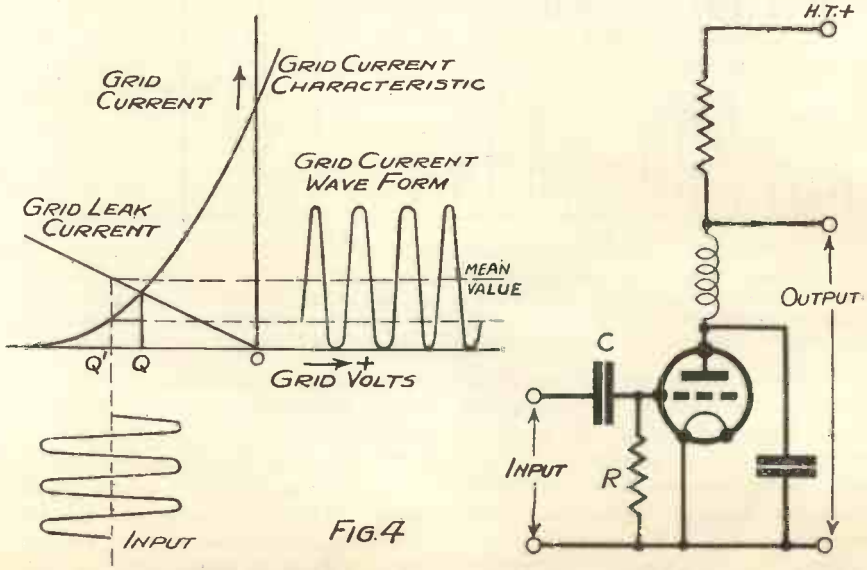


FIG. 4

By far the most popular form of detector is the leaky grid, and you will find the detailed description of how it works, which is given in the text, easy to follow with the aid of the curves depicted here

KENDALL'S CORNER

The following article from the pen of our distinguished contributor, Mr. G. P. Kendall, will undoubtedly create widespread discussion. The views he expresses are not necessarily ones with which we are in complete agreement, but, believing that virile controversy is always desirable, we invite our readers to send us their views on the interesting points raised by Mr. Kendall.—[The Editor.

WITH all due ceremony, permit me to take my hat off to you, readers of "M.W." I always knew that you were a knowledgeable body of people, but I must confess that you surprised me by the instantaneous way you realised the importance of the Step System and set to work to try the K4.

At the time of writing there has been no chance for me to hear from anyone who has actually completed the set, but already I have evidence that it has awakened a simply amazing amount of interest among constructors everywhere.

Realised Expectations

And yet perhaps I should not say amazing, because all along I knew that the K4 was one of those sets which come along at intervals of years and "date" everything which has gone before, so that every keen constructor simply must investigate it.

The interest itself is therefore only what I confidently expected, but it has certainly been extraordinary to see how swiftly that interest developed after the publication of the last issue of "M.W." Tremendously gratifying, too, for I think it must mean that you must all remember me well enough to know that when I tell you that a new thing is important, that thing should be looked into at once!

Keeping in Touch

By the time I come to write the next instalment of these notes I hope many of you will have found time to drop me a line to tell me what you think of the Step System and what results you are getting from your K4's. Not that I really need to be told what a fine scheme the Step System is, or what superlative results the set will give (I'm not really so modest as they make out!), but it is mighty pleasing to an inventor to hear what people think of his new ideas. Seriously, though, it is a great help to a designer of sets for the home constructor to be able to keep in touch with his readers in this way, as I always did when I wrote for "M.W." in days gone by. I hope, therefore, that no one will find it too much trouble to report progress, no matter how briefly.

It Always Happens

Remember that a number of people are sure to write to me and point out that the Step System is nowhere near as good as some scheme they used 'way back in the year dot: it always happens on these occasions, for nothing seems to stir up a certain type of inventor so much as the sight of someone else producing an idea which is not merely bright but also practical.

It is apt to be rather confusing to the unfortunate designer, however, and that is why I am always grateful to the ordinary sane constructor when he takes the trouble to write and say that he likes one of my new schemes. He performs thereby a real service to all his fellow-constructors, for he enables me to get a better perspective on their needs and keep my knowledge thereof up to date.

It is my aim in life to meet those needs as well as I possibly can, and a little appreciation now and again is a great help: it spurs me on to greater efforts, and enables me to direct those efforts into the channels which will be most pleasing to my readers.

Agitation About Prices

So where's that fountain pen? Somebody's borrowed it? Well, it's only a few words I want, so what about the old dip-and-scratch lying on the writing-table? Or even a pencil?

And now, please, I want to let myself go on a subject which has been rankling for a long time.

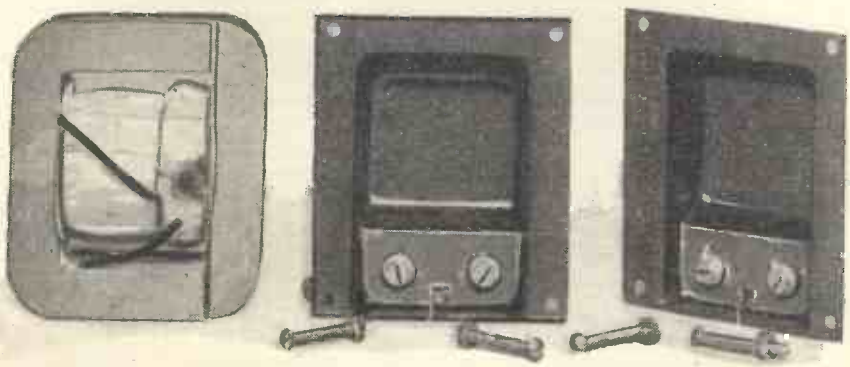
I refer to the agitation which has been going on in certain quarters to get the manufacturers to produce cheaper components which shall yet be as good electrically as those now being offered at higher prices.

The underlying reason for the agitation is simple enough, even if it is not always openly confessed. It is just that the agitators have realised, rather late in the day, that in many cases it is no longer very much cheaper to build a set for oneself, and they hope that the component makers will perform some sort of miracle which will restore the old happy state of things wherein the ranks of the home constructors were swelled by hosts of people who merely built sets because they saved money in so doing.

Shifting Responsibility

This agitation seems to me a most unfair one, for two reasons: first, it is

DOES A NEAT OUTER CASING INCREASE COST?



As is pointed out in the text, making components look attractive does not necessarily increase production costs. In the transformer illustrated above, the casing is made to serve also as clamps for the core's laminations.

The Little-Understood Question of Costing

to some extent at least an attempt to shift the responsibility for the high cost of many set designs from the shoulders of the designer to those of the component makers.

Secondly, it must tend to give the general public the impression that component manufacturers' profits are excessive and would allow of substantial price reductions being made. This I believe to be most unjust. There are still greedy people in the industry, I know, but in general you can take it that the keen competition of modern conditions is enough in itself to bring the prices of all ordinary components down to very fine limits.

A Case in Point

This aspect of the "lower prices" cry is just another example of the truth of the old adage about the dangers of a little knowledge. The people who are responsible for spreading this impression know enough in many cases to make quite a good guess at what is called the "prime cost" of a given component, but they do not understand the relation of this to the actual costing to which the manufacturer must work if he is to stay in business.

Let me give you an example. A medium-price low-frequency transformer may be priced at, say, ten shillings. Now, an elementary knowledge of radio design will tell us that the probable cost of the materials in one of these transformers will be perhaps half-a-crown, while the labour charge is not likely to exceed a shilling.

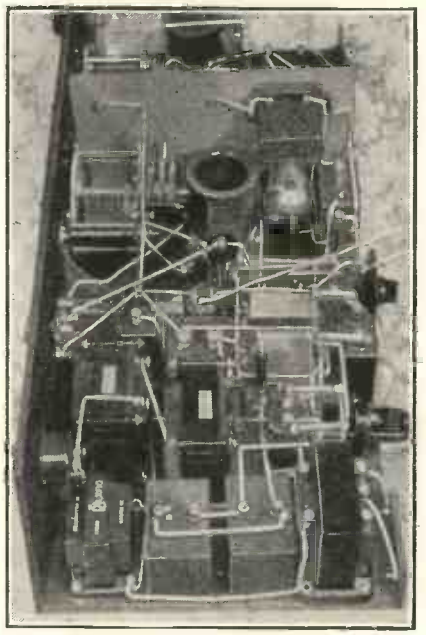
Thoughtless people are apt to conclude that the total of three-and-six at which we have just arrived is the true cost of the component, and here, they say, is a man making a most exorbitant profit. He is selling for ten shillings an article which only cost him three-and-six, a ratio which is surely unreasonable.

Reckoned in Pence

But how many of those transformers do you think he actually sells for ten shillings? Probably only a small fraction of his output. The bulk will go through the wholesalers, in which case the manufacturer will get something of the order of six shillings each for them.

Here is a big drop in the imaginary profit already, but there is more to come: what about an allowance for "overheads," advertising, and the expense of the research which produced the component? By the time these factors have been taken into account and the true cost arrived at, it is probable that the remaining margin of real profit will have to be reckoned in pence!

WHAT ABOUT WIRING?



In an elaborate mains set of this type, how many constructors would be prepared to forgo the joys of good sized terminals for the sake of the small saving provided by the use of wires and soldering tags and the elimination of attractive casings?

I hold no brief for the radio manufacturer (he does lots of things with which I disagree violently), but I do hate to see him attacked unjustly, hence this attempt to give you a real insight into the little-understood question of costings.

Reducing Prices

You will realise, of course, that I have taken an extreme example for discussion, for it is actually very doubtful whether even a highly-efficient firm could live on the very small margin I have assumed. Probably the prime cost would have to be pared down considerably to permit of a retail price of ten shillings.

Some of the more enlightened critics have attempted to justify the moan about prices by making the suggestion that components should be made with little or no regard for appearances, dispensing with the ornamental moulded cases now commonly used, adopting instead the skeleton construction seen in the parts of commercial receivers, dropping terminals in favour of soldering tags, and so on.

I am not going to deny that *some* reduction of cost can be obtained in this way, but I do want to warn the reader not to expect too much from it. It is only too easy to exaggerate both the extent of the saving which can be effected and the number of cases in which the method can be applied.

A Good Example

The low-frequency transformer is again a good example, for we have here a component which has evolved from just such a skeleton form as the critics are now suggesting. Those of my readers who can recall the early days of the game will remember that most of the first L.F. transformers had their iron cores clamped between strips of bent iron which formed the fixing feet of the component as well as a support for the piece of ebonite on which the terminals were mounted.

The bobbin containing the windings was exposed, and so had to be made fairly presentable to look at and be given some sort of protective covering to preserve the fine wire from accidental damage. The assembly, too, was quite a troublesome process, for everything depended upon the exact positioning and proper tightening up of the clamps.

In the modern method the core is simply pushed into slightly tapering grooves in the moulded case, possibly supplemented by small wedges, then the lead-out wires are connected to the terminals and all that remains is to fix the bottom of the case in position.

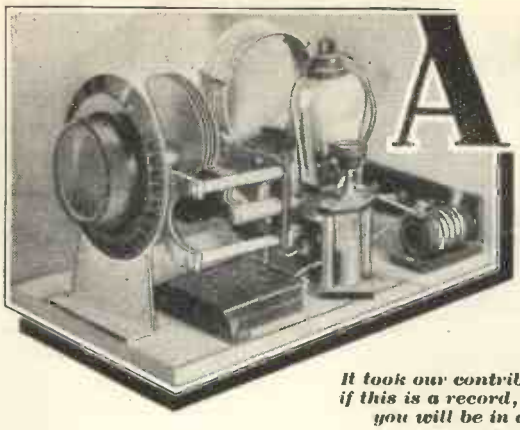
There is an obvious saving in assembly time here, and hence in cost, and the metal clamps, clamping screws and terminal strips are all eliminated, likewise the covering of the bobbin.

A Little Knowledge

Against this saving we have merely to set the cost of the moulded case, and here again a little knowledge has led some folks astray. Because the moulding tool may cost perhaps £100, they have argued that to use a moulded case is necessarily a very expensive business, quite forgetting that the tool cost can often be spread over something like 20,000 cases!

In such circumstances the allowance on each case to cover the cost of the

(*Continued on page* 481)



A Short-Wave S.G. Unit

BY W.L.S.

It took our contributor an hour to build the H.F. amplifier which he describes. We do not know if this is a record, and anyway, there's no need to beat it because when you've made the unit you will be in a position to create reception records which your friends won't easily beat.

I RECENTLY had occasion to make some very hurried alterations to a short-wave set of mine, in order to obtain rather more selectivity than usual. Time was short; it was Friday afternoon, and on the Saturday morning some special tests commenced. I had found that interference from commercial stations just outside the band on which I was to listen had achieved rather alarming proportions.

Made in an Hour

After a little preliminary "think," I made up the screened-grid unit that you will see in the photograph, coupled it up to the detector of the other set, and all was well. The actual construction took about forty minutes, and a further twenty saw the whole thing working well.

I have come to the conclusion that many good short-wave receivers would be better still for the addition of a stage of S.G. Their owners, however, usually do one of two things. Either they think that the S.G. means reconstructing the set altogether, and shirk the job, or they build up a temporary unit that is so completely "hay-wire" that it doesn't work, and probably never will.

A little unit on the lines of the one described is sufficiently permanent to "stay put" and to work well; yet its construction does not entail any particular trouble or time.

Few Components

One of the diagrams shows a plan view of the baseboard. The preset condenser to the left is intended for variable aerial coupling, while the neutralising condenser on the right does the job of coupling this new stage to the existing detector. The only other components are the valve holder, coil holder and coils, variable condenser, short-wave H.F. choke, a 1-mfd. condenser, and the terminal strip.

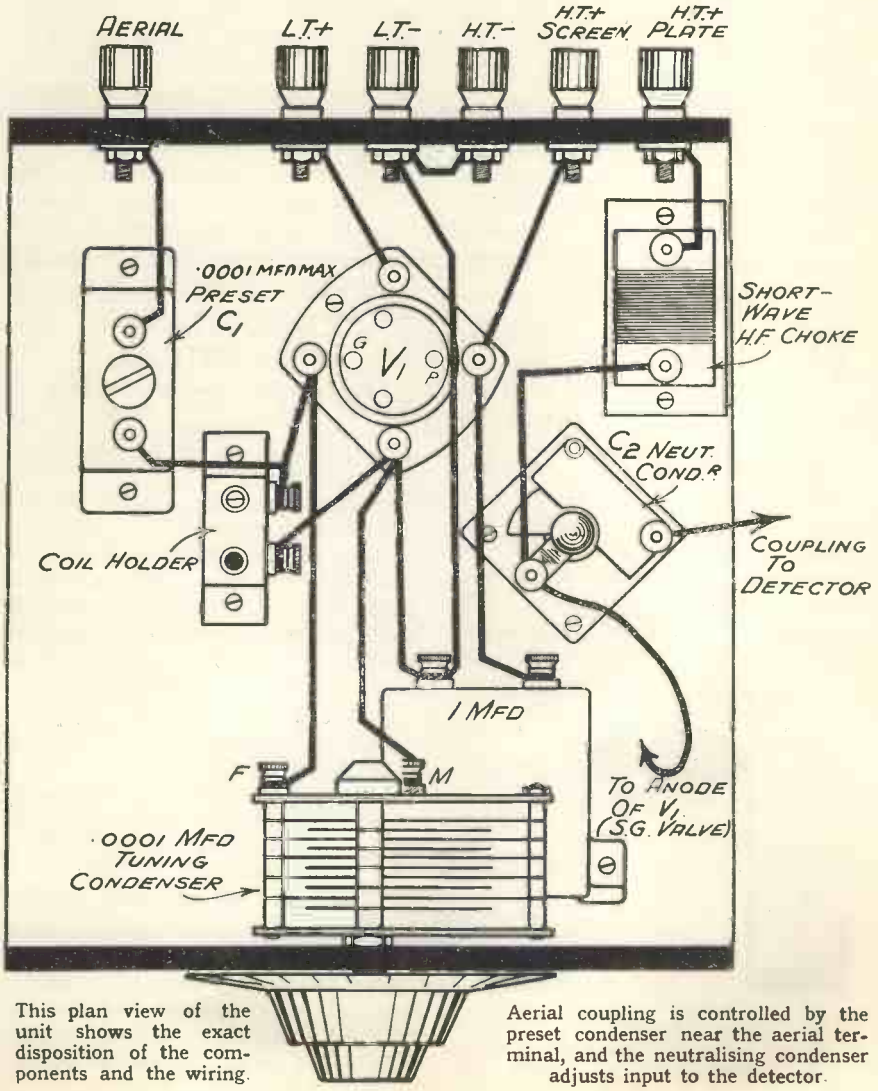
A convenient size for the variable condenser is ·0001, but it does not matter much if a larger one is used, for when the unit is properly adjusted this control is quite coarse in its tuning effect. No slow-motion dial is needed with a ·0001, and probably even a ·00025 could be handled by the average short-wave listener without one.

The whole unit may, in fact, very well be built as the result of a raid on the junk-box (although *real* junk is best left out of it).

Connecting Up

When connecting it up to the existing short-waver, the flex lead from the coupling condenser is taken to the top of the detector grid coil. If the set has a capacity-coupled

SIMPLE TO BUILD—EASY TO USE



This plan view of the unit shows the exact disposition of the components and the wiring.

Aerial coupling is controlled by the preset condenser near the aerial terminal, and the neutralising condenser adjusts input to the detector.

A Unit That Will Improve Most Short-Wavers

aerial, simply screw down the coupling condenser on the set as far as it will go, and connect the lead from the unit to the aerial terminal.

The aerial lead is naturally removed from the latter and connected to the new aerial terminal on the left of the unit. Full H.T. is put on the "H.T. Plate" terminal, and 60–80 v. on the "H.T. Screen." The L.T. leads should be taken from one of the valve holders in the existing set, so that the L.T. switch acts on the new unit as well as the set.

Making the Coils

The coils for the S.G. unit may very well be home-made, hand-wound to about 3 in. diameter and mounted on the standard 2-pin plugs. A 4-turn coil of this kind will cover roughly 19–30 metres, a 6-turn 29–60 metres, and a 9-turn 36 to 75 metres, with a ·0001 or ·00015 condenser. The actual tuning ranges, however, depend upon the amount of damping introduced from the aerial by the condenser C_1.

In operation, the set itself should first be handled as usual, without touching the S.G. unit, except for adjusting the coupling condenser C_2, so that dial readings on the set remain

SIMPLICITY PAYS

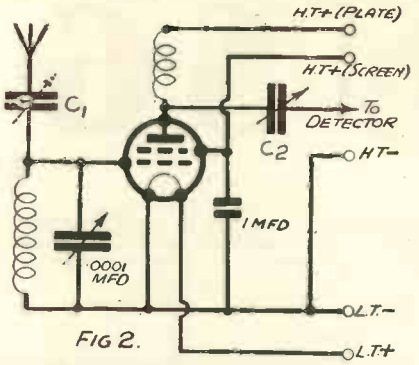


FIG 2.

Amplifying at H.F. on short waves calls for extreme simplicity of design, and an absence of unnecessary complication is a feature of the unit.

unaltered. If the aerial was formerly inductively coupled this may not be quite possible, but if the coupling was capacitative it certainly will be.

Having got thus far, swing the tuning condenser on the unit round, and note whether signals appear to come into tune in any position. If they change very much in pitch, increase the aerial coupling to the unit until they hardly move.

By discreet "wangling" of the preset and neutralising condensers it is possible to arrive at a state of affairs which appears ideal—that in which the rotation of the new tuning condenser acts simply as a volume control on signals, and hardly alters their pitch at all, even when the receiver is oscillating.

Quite a fair amount of amplification is obtainable from a unit of this kind, right down to 20 metres, although naturally one gets more above 30 than below. But the chief advantage is the great increase in selectivity, a characteristic in which the ordinary autodyne detector circuit cannot be said to excel.

Improved Selectivity

You will notice no more "spreading" from high-powered commercial stations a long way away from the wavelength on which you are listening, and, in addition to this, you will find the general operation of the set much improved.

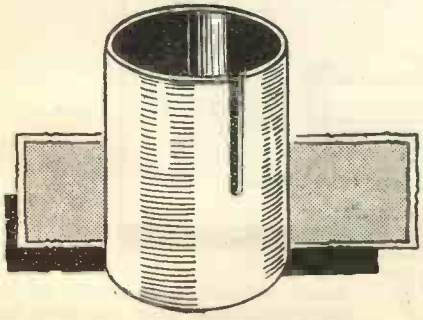
Threshold howl is tamed, hand-capacity effects cured, "wobbly" signals from a swinging aerial completely prevented, and all sorts of minor details cleared up. A unit of this sort is quite a panacea for short-wave troubles, and, as such, worth its weight in gold.

Coil Winding

WHEN winding home-made solenoid coils, probably the most fiddling and irritating portion is securing the ends of the various ends of the wire.

The plan to adopt is to slit the former lengthwise for about two-thirds of its length. Whether the former be of vulcanite, paxolin or cardboard, this operation is best performed with a fine hacksaw. The startings and ends of the various section windings are slipped into the

SECURES THE ENDS



A slit cut in a coil former provides a convenient means of holding the wire ends

ESSENTIALLY PRACTICAL

Two valuable hints for the man who likes to make things for himself.

slot and pulled down tight to the end of the former.

It is best to secure the start of the winding with a small splinter of wood, and when the coil is finished the various endings can be finished off more permanently with a blob of wax or Chatterton's compound.

If the winding is put on rather tight it may be found that the slot is closing up. Should this be the case it is better to insert a match stem to keep the slot open. This is particularly desirable at the top end.

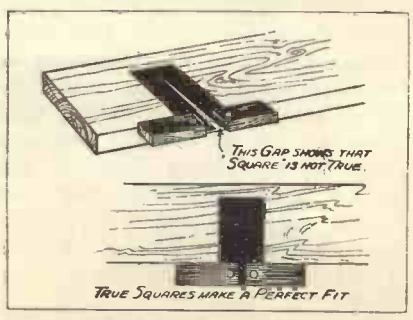
Square Squares

"Square up your square" is a trade tag every amateur cabinet-maker should take notice of. Squares, especially the cheaper ones, are invariably unsquare, although, perhaps, only to the extent of $\frac{1}{16}$ in. in a 6-in. blade length. But if one comes to fit together two pieces of wood which are $\frac{1}{16}$ in. out of square, the result is a $\frac{1}{8}$-in. gap.

The following scheme is the only successful method of proving one's square. Using a length of clean wood with a perfectly straight edge, mark off a square cross line, and then reversing the square mark off another line in close proximity. You will then see in what condition is the square.

If it needs re-squaring, a file should be used, applying more pressure on the part of the edge to be ground.

TRY THIS METHOD



A ready check on the trustworthiness of your square can be made by this method.

SPOTLIGHTS *on the* PROGRAMMES

Comment and Criticism about Radio Entertainment

DAME RUMOUR has been busy again. We learn that Val Gielgud has been spending valuable time in Scandinavia collecting some twenty or thirty Swedish plays which he proposes to let loose upon unsuspecting listeners.

The real facts are that Val Gielgud brought back from a holiday in Sweden the manuscript of a Swedish farce which, suitably translated, will probably be heard in the New Year. It happens to be very funny. It was also written by an Italian in French and then translated into Swedish (or something like that), so it *must* be good!

Radio's Irreparable Loss

If anyone has become an institution in broadcasting it is A. J. Alan, prince of storytellers and "the man whom nobody knows." His rare appearances at the microphone are always awaited with impatience. From now on we shall listen in vain, for it seems quite unlikely that A. J. Alan will do any more broadcasting.

Give Someone Else a Look In!

There seems to be a growing tendency for the B.B.C. to depend more and more for its entertainment upon the members of its own staff. I understand, for example, that the 1933 Christmas pantomime, which has for some years been written and produced by Ernest Longstaffe, is this year to be a Broadcasting House affair from start to finish.

This is all wrong. The greater the number of experienced showmen who can be induced to broadcast the better for the listener. The shows put on by Charlot, Longstaffe, Cochran and Ridgeway prove my point.

While the Dramatic Department is encouraging outside enterprise by its co-operation in the Radio Play Competition organised by our sister journal, "Popular Wireless," it seems a pity that the parochial spirit should invade other branches of the service.

Radio Play to be Filmed

I have for a long time wondered why some of the more enterprising of the British film producers did not see the opportunities for first-class films which lie in many recent radio plays.

Now comes the news that a new company—Triumph Films, which has its studios at Hammersmith—has bought the cinema rights of Philip Wade's most recent radio play, "The Game." The "shooting script" has just been completed and production will start early this month as soon as the details of the cast have been settled.

Although musical productions have been transferred from the studio to the screen, this is the first "straight" play to be made into a film. And very good it should be, too.

Incidentally, it should not be very long before the screen rights of our Val Gielgud–Holt Marvell serial are snapped up. A film of Broadcasting House, the "palace of mystery," should have a tremendous box-office appeal.

Complaints from the South

I continue to get numerous complaints from listeners in the Bournemouth area about the apparent lack of consideration offered to them by the B.B.C.

Ever since the Bournemouth transmitter was synchronised with the powerful Scottish National station, listeners in the South Coast town have had to forgo their Children's Hour in the National programme because the two stations cannot radiate different programmes at the same time.

There are several thousand listeners in Bournemouth whose sets are designed to receive only the local station. So far, the only answer to their complaints has been, in effect, "buy a larger set and listen to Daventry."

Bournemouth has the largest percentage of licences

IN THE CAUSE OF CHARITY

Mr. Owen Nares, Miss Peggy Wood and Sir Henry Lytton photographed in the studio on a recent occasion when they gave a concert in aid of the League of Mercy.

A Burlesque on Broadcasting in the States

per head of population in this country. Surely a minority is entitled to some consideration when it reaches such dimensions ?

Possibly the B.B.C. does not realise that many people are content to pay 10s. a year for their news bulletins and sports commentaries alone. An increase in licence figures does not necessarily mean an increased satisfaction with the programme material.

Department for Public Relations

Miss Hilda Matheson, for some years Talks Director of the B.B.C., makes a strong appeal in a contemporary for a public relations department at Broadcasting House. There is a sad lack of knowledge on the part of the listening public of the various policies of the B.B.C. Public confidence is something which the B.B.C. should set out to win—not disregard altogether. Unfortunately the individual listener has no organised body through which to express his opinions ; consequently the wishes of listeners are generally disregarded altogether or assessed on a mere handful of letters which reach Broadcasting House.

Incidentally, any public relations department might well be used to promote better relations between Broadcasting and the Press. The officials responsible for this work at the moment are the essence of tact and politeness, but they are tied by such masses of red tape that where they might really be of use, their hands are tied.

The fact that very much radio criticism is not well informed is due in great part to lack of facilities for information.

More About American Programmes

The second of Eddie Pola's attempts to put over an American type programme from a B.B.C. studio will be heard on November 16th, under the title " America Calling Again." This again is a burlesque on broadcasting in the States and should not be taken *too* seriously.

Among the artistes to be impersonated this time are Al Jolson, Sophie Tucker, the Mills Brothers and Bing Crosby. It doesn't need an advance programme to point out that The Moderniques will undertake to present the Mills Brothers. Eddie Pola will be the announcer, of course.

We have heard so much about the retaliation programme which was being staged in America that it would be interesting to hear now whether this programme has taken place, and, if not, whether the B.B.C. propose to let us hear ourselves as others hear us. It would make a first-class relay.

In the Programmes

LESLIE FRENCH

As befits a Shakespearian actor, Leslie French was born on Shakespeare's birthday in 1904. The boom in film babies having not then started, began his professional career at the late age of 9.

Five years of Shakespeare with Sir Philip Ben Greet were followed by six

years of drama and musical comedy. First came on the air in 1927, and has since found a firm footing, thanks to Mr. Eric Gill, over the entrance to Broadcasting House.

In 1929, back to Shakespeare, to be followed by " Derby Day " (also broadcast), " Strange Orchestra, " and in the open-air in Regent's Park.

Has broadcast in every kind of radio play and musical show. Principal hobby—dropping bricks.

Played the part of " Jim " in the musical play " Mr. Cinders " ; and if you don't believe it, take a look at his photograph ! P.C.

A Winter "Spring-Clean"

For many years the " Radio Times " has provided a weekly jig-saw puzzle to those who search diligently for the forthcoming programmes according to the instructions of Filson Young and others. It is, therefore, more than interesting to note that, by the first issue of the New Year, all advertisements will have been excluded from the programme pages. It may, then, be possible to arrange for a general uniformity in the weekly positions of different stations' entertainment.

Round the Studios

The " First Time Here " programmes on Saturday afternoons have been steadily improving. The time is right for this kind of show, and if a little more rehearsal made the shows a little slicker they would soon rival some of the evening variety.

* * *

Midland Regional listeners on November 8th will hear a real Shropshire village play written by the wife of a doctor and acted by village players. This is the genuine thing of which we cannot have too much in the programmes. What about another Cornish episode in the near future ?

* * *

The " advance publicity " scheme, started by Eric Maschwitz in his Music Hall shows, has now been extended to the Radio Play Festival. Val Gielgud's trailers of forthcoming plays are an excellent inducement to listen. I hope they will not stop at the end of the festival.

* * *

I wonder, by the way, if Sir John Reith knows who was the first solo artiste to broadcast from Broadcasting House—and where, and why ?

The Week's Good Cause

The publication of the figures for the April-June wireless appeals accentuates the fact that while a poor speaker may not, perhaps, do much harm to a nationally popular charity, a really good speaker may do an infinite amount of good for a comparatively unknown cause.

For instance, the two highest amounts for the three months were both obtained by Canon Woodward—£3,153 in a National appeal for St. Columba's Hospital and £1,539 for the Women's Holiday Fund on the Regional wavelength.

These figures show how successful wireless appeals can be—and how invidious is the task of Mr. Iremonger, who is now revising the list of charities ! PATRICK CAMPBELL.

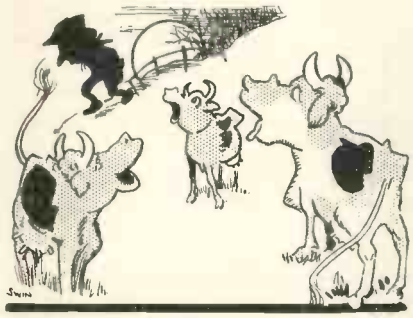
REFLECTIONS of a RADIOTIC

The Prototype of the Typical Listener—Some Television Possibilities—Humble Beginnings—The Women Listen to the Radio.

By "PROSPERO"

LEAVES from a Listener's Diary. After a three-hundred miles' drive at an average of forty-five miles an hour, to see by television the face of a man in Schenectady who at the same time was sending to me by radiotelephony a reproduction of a piece of music which had been played in Tokio the same day, I fell back heavily on Uncle Gundolph's Diary for an antidote.

LIKE TRUMPET CALLS



"They would be those scrawny beasts of Thomas Fenn at Orchards, that tipsy atheist."

"Uncle Gundolph"—Mr. Gundolph Twobun (pronounced *Twone*), Rector of Oakgall Magna in the county of Shropshire—is my uncle removed back to the eighteen-twenties, and his diaries, eight volumes bound in "American cloth," have for many years been used to weight down the pastry-board which covers the bread-bin in the larder.

Seeking Peace

Occasionally I have opened a volume at random when I have visited that depository in search of an unofficial snack, and in almost every instance have lighted upon a recipe for tar-water, a much-prized remedy of the period.

But after the television trip it seemed to me that peace, proportion and even sanity might be found in those records of a less complex era, and in pursuance of the idea I found instead that Uncle Gundolph was a prototype of the typical listener. For example:

Becoming Bird-Conscious

Lay awake early this a.m. and heard the larks racketting in the air above Long Bottom Mead. Began to harbour longings after lark pasties but was put out by the still-room door, which rattles on its hangers.

Here you have the British listener in the process of becoming bird-conscious! Would *nightingales* make good pasties? And please note the "interference," man-made, from the still-room door.

Again, *Coming home weary from the hay getting in Top Glebe, I observed how the cries of the cows against the over-shooting of the milking hour were curiously transmuted by distance into the semblance of trumpet calls for the death of some good king. They would be those scrawny beasts of Thomas Fenn at Orchards, that tipsy atheist.*

You see? The listener likes the music but criticises the conductor. Now for a very characteristic sample.

Papa and Vaudeville

Wednesday, comes a troop of mummers who infected the Great Barn with their worldly songs and posturings. Was constrained to shut little Ebenezer and his sister Jane in the cellar for the fear that they might hear aught unseemly. Yet one, a vagrom, gipsyish, creature danced like the daughter of Herodias before Herod. Mem for sermon: That Herod be not hastily judged.

That is Papa Listener looking down his nose at Vaudeville, warning the kids off and then sneaking back to listen privately and think about Marie Lloyd!

And here we have, to the life, the listener who complains that he doesn't pay ten shillings a year to listen to Chamber Music.

Wakened at one of the clock this Christmas a.m. by the waits, who must needs visit me first, being their rector. After communing with Mistress Twobun I caused cakes and cider to be taken to the waits by Betty, who stayed over long because young Slattery was present with his fiddle. Thereafter, a grievous nocturne and no sleep for an eternity. When I consider that the bass viol alone stands me in two shillings by the year for strings, I marvel at the decay of church music. Mem: To see young Slattery upon the matter of Betty, that he rob us not of the best cheese-maker hereabouts.

Dangers of Television

So good-bye to Uncle Gundolph for the present, for we now switch over to the future, which means television. Now all this fever of prophecy and anticipation of television causes me

"WORLDLY SONGS"

"Was constrained to shut little Ebenezer and his sister Jane in the cellar for the fear that they might hear aught unseemly."

several shades of anxiety, because I am a man with a wife and a family which includes a sizable daughter. It is all very fine to promise that we shall be able to see plays while we sit

Good Radio Work Done in Lowly Surroundings

comfortably at home, but my experience is that the lady part of my family prefers to sit comfortably in a theatre and is not likely to accept a two-by-four glass screen at home.

I can well imagine myself entering the family circle with the news that they shall see and hear A—— B—— in, say, "The Tango Parade." The females would at once fly to don flounces, paint, powder, cloaks, ridiculous shoes, ear-rings, etc., I should then reveal that the show would take place, as usual, in my study, at 8.15 p.m. on the National. After which my beer would be stopped for a week and I should be classed as a C3 pa and hubby. It simply would not work.

The Eternal Female

You see, these lady persons regard a visit to the theatre as a romantic adventure. The joy of eating a dinner which they have not had to think out and cook; the lights, colours, and smells of the theatre; the fierce agony of observing other women's clothes and complexions; the romantic and completely indigestible supper in a Jewish restaurant with an Italian name—all these spell ecstasy to the fair creatures who grace our homes.

So that when we males, preoccupied with overdrafts, income tax, and gas bills, suggest that all the plays a reasonable being needs may be seen at home—Brock's Benefit! No, television is not the comfort I thought it might be. You can invent what you like—but you can *not* change the eternal female.

Hint to Beginners.—I read somewhere that a man who received an enormous order for dry batteries at one of the Radio exhibitions had begun his business by making a few dozen in a shed or cellar. He deserves to succeed if only for his infernal cheek in "horning" into the battery business when so many old and large firms had their teeth well into the gravy.

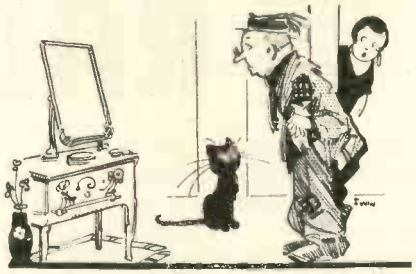
To Make Your Fortune

I remember learning that the originator of a well-known brand of cigarettes rolled his first specimens by hand in an attic. Faraday did some of his best work in a cellar, and Ford's first Lizzie was built in a very dreary-looking structure—the sort of place where gangsters make their last stand.

There seems to be some virtue in the shed, shack, cellar or hovel, after all. So I advise you not to seek out a financial magnate and ask him to float your invention on the grand scale, but to put on some old clothes, ruffle up your hair, and make a few samples to hawk round the streets. Otherwise, the magnate will probably offer you a hundred pounds and draw down a hundred thousand for himself.

Jumper Dialogue No. 1.—Scene: Prospero, his wife Prosperine and his daughter Prosperette, sitting round the fire. Prospero smokes, dallies with a newspaper and adjusts the radio receiver. The other two knit "jumpers." The conversation goes like this:

ADVICE TO INVENTORS



"I advise you to put on some old clothes, ruffle up your hair, and make a few samples to hawk round the streets."

Prospero: Rather good programme to-night.

Prosperine: Is it? Prosperette, are you sitting on my pink? Is it a band?

Prospero: Yes, military. Going to play Bolero.

Prosperette: Mother, I shall have to widen the neck.

Prospero: But I'm going to switch over after that to hear Queen's Hall.

A FAMILY AFFAIR

"What a funny band. The tune is all the same. Like bagpipes!"

The cat's got your wool again! They're playing that thing I said I wanted you to hear.

Prosperine: Oh, yes? Where are the scissors?

Prosperette: Dash! I shan't have enough of the cerise after all. Have you got enough for a dozen rows?

Prosperine: Look in my basket. Prospero, we shall have to speak to Mary. The girl eats the loaf sugar like sweets.

Prospero: All right. You speak to her. Here's Bolero.

Prosperette: Mother, I don't quite see how to wangle this fullness on the shoulder.

(Bolero works up.)

Prospero: Isn't that fine? Tah tah tah *tum.* Tah tah tah *tum.*

Prosperine (rapidly): *One, two, three, four,* etc.

Prospero: What, lost a stitch? Oh—sorry!

Prosperette: What a funny band. The tune is all the same. Like bagpipes!

Prospero: Ah, well! That's Bolero. Now for Queen's Hall.

Prosperine: Is that where they do roller-skating?

Prospero: No, m'dear. It's where they hold concerts.

Prosperette: Will Jack Hulbert be there? Dash, that's the second needle to-night!

Prospero: No, Sir Henry Wood and Lamond!

Prosperine: Lamond? Isn't that a Scotch lake? One, two, three, four, etc.

Prospero: Ah, I believe this is the beginning of that bit I want you to hear.

Prosperine (rising): *Oh, yes?*

Prospero: Where are you going?

Prosperine: Only just to get a pattern. Prosperette, where did you put that Wool Weekly? The one with the pattern of the Jumpiskirt in Angora.

(Ten minutes elapse and Prosperine reappears.)

Prospero: Hang it, Prosperine, you've just missed that bit I wanted you to hear.

Prosperine: Never mind, dear! Perhaps I've heard it before. Can you hold this skein for me? Isn't it dark? Dear me, how the days do draw in! (Curtain.)

Beauty Retires

So the Lady Announcer has come, said her piece, and melted away.

A plucky but too ambitious boa constrictor found a dead elephant. After four days of crawling round it in an attempt to find a suitable place at which to begin the big swallow, the snake gave up in despair, saying that Nature had conspired against him.

Thus it is, I fear, with Mrs. Borrett. She did her best, her charming best—but Nature had conspired against her. Honeyed accents alone could not fully qualify her to recount Fat Stock Prices with conviction, or Football Results with gusto.

Some trade news and views that will prove of interest to readers, whether or not they are connected with the radio industry.
Members of the trade are invited to send items of interest or photographs to be included under this heading.

Improved H.T. Batteries

MORE for your money! That is the cry heard all over the world nowadays, and progress is, rightly or wrongly, measured by the how-much-do-I-get-for-the-price rule. In many branches of radio, however, the question of quantity per unit price is undoubtedly the right way of measuring advancement, the H.T. battery being a good case in point.

A COMPACT UNIT

One of the smallest three-gang variable condensers yet manufactured has been produced by Utility.

For a long time the H.T. battery has been regarded as the weak link in the battery-set chain. It has been steadily strengthening, admittedly, but it is still regarded by many as the weakest link in the chain.

This is not altogether fair, for the modern H.T. battery is a thing to be relied upon, and it is remarkably long suffering. Rarely is it used properly, being nearly always overrun, sometimes seriously, by set owners who want more current out of it than it was designed to give.

But good and long suffering as it is, both the G.E.C. and Hellesens have considered the H.T. battery can be further improved, and the last few weeks have seen the release of new types of batteries for which great things are claimed.

The new G.E.C. battery has what is called "stabilised" electrolyte, which gives the battery better and steadier life. The 120-volt type, at 11s., gives 144,000 milliwatt hours guaranteed. This means that at a discharge rate of 10 milliamps. the battery will last 120 hours, which at the rate of about three hours' listening per day means something like six weeks of good hard use.

Larger capacity batteries can be obtained, giving a greater length of service, but 10 milliamps. discharge from an ordinary sized battery is a good heavy drain, and the guaranteed life of some 120 hours is certainly a good one.

Hellesens we have also mentioned as being hard at work on improved H.T. batteries.

Here we have a new type of battery, which has been shown to give no less than 50·2 per cent longer life than ordinary types. The new type is known as "Hi-Life," and is available in the usual sizes and at popular prices.

So what with better H.T., Class B and economiser circuits, the battery-set owners' radio is rapidly becoming a really economical proposition to run.

"The Book of Igranic"

Better printing, bigger pages, brighter presentation are the main outstanding features of the modern radio catalogue, and the latest arrival to my collection I really must salute warmly. It is titled as above, and is a remarkably fine literary and typographical achievement.

There are 48 pages, giving you all the details you require about the new Igranic components and presented in a way that makes it very interesting reading The layout and the typescript are excellently arranged, making a most noteworthy achievement. Hats off to "The Book of Igranic." And, of course, it is free to all who send for it to Igranic Electric, Ltd., Queen Victoria Street, London, E.C.4.

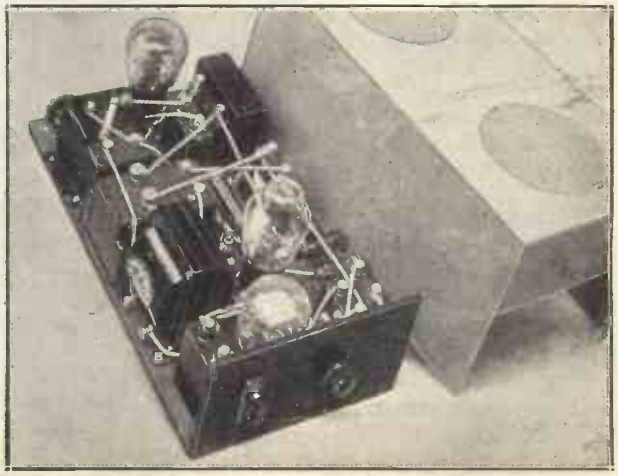
Make Them Smaller

I have a definite grouse! The new iron-cored coils are most disappointing. Not in performance, but in size. Why are the admitted advantages of iron cores being, in most cases, so ruthlessly cast aside, resulting in coils that are just as bulky and cumbersome as the old air-cored types?

The variable condenser people, and notably Utility with their new three-gang assembly, have got down to the matter of size—they have had to for the set manufacturer—and remarkably fine but very small condensers are being brought out.

Not so the majority of the coil

THEY SIMPLIFY DESIGN



With this two-valve amplifier using full voltage valves an undistorted output of 5 watts is available.

The Question of Universal Receivers

makers, who if they turn out small inductances for the set manufacturer either do not let the home constructor have the same model, or else cover it with a gigantic gasometer to form a monument of metal that, in some cases, is quite as large, or even larger, than the air-cored coil it is meant to supplant.

In the case of ganged coil units things are becoming very awkward, for while the condenser gang continues to shrink, the difficulty of providing short grid leads between the condenser and coil sections is increasing. Let the condensers become more compact by all means—it is all to the good. But for goodness' sake, coil manufacturers, get down to the problem, too, and let us have the main advantage of iron-cored coils—small size. A few have done it; what about the rest?

Wasted Watts

And now, being in a querulous mood, here's one for the valve manufacturers. Where is the full voltage valve? For some time past we have heard a great deal about midget sets and universal (A.C. or D.C.) receivers. Valves have been brought out by the chief valve concerns for D.C. operation that are also suitable for A.C. working, *but* they are all of the series heater connection type.

In other words, instead of taking the full voltage of the mains across the heaters, they require not only series connection but a break-down resistance between the heater and the mains.

This may not be so wasteful in the case of D.C., but it is certainly a waste where A.C. is concerned, for a break-down heater resistance will dissipate more energy than a good transformer, and is incidentally more inconvenient to place owing to the heat given off. As in A.C. sets using the series "universal" valves one has to have a rectifier *and* a heater resistance, one might as well use a transformer and A.C. valves, and have done with it.

Full Voltage Valves

The best way of making a universal set is to have full voltage valves, with a full voltage rectifier, such as are made by Ostar Ganz, an Austrian firm who are marketing their valves over here.

They have tackled the problem really seriously, and have produced an excellent range of valves, with an output valve giving as much as 5,000 milliwatts A.C. output.

The A.C. and D.C. versions of a full voltage valve set are exactly the same, though on D.C. the rectifier valve can be shorted out if desired. No transformer is required, and no heater resistance is necessary.

The total wattage consumption of sets up to four valves is also less than that of a four-valve set using some of the British valves, while in addition is the fact that no "oven" is required to dissipate surplus voltage, with the attendant problem of where to place it so that it shall not scorch the cabinet or set fire to the house.

I shall probably be taken to task for the last remark on the grounds that there is no danger with such devices. True enough, but the heat given off, in all seriousness, is really great, especially with the comparatively high current values, and it has to be carefully placed to avoid overheating, for it cannot conveniently be placed inside the set, unless this is made specially large to accommodate it.

An Ediswan Display

In order to link up with the return to Greenwich Mean Time, on October 8th last, the Edison Swan Electric Co., Ltd., arranged that all their depots and sub-depots throughout the country had a large window and showroom display, consisting of torch and cycle lamp cases, torch refill and flashlamp batteries, hike-lites, and all types of commercial batteries.

A cordial invitation was extended to all dealers to inspect these displays at the depot in their particular area, at any time convenient to themselves during the fortnight commencing October 9th. These displays were of a very attractive nature, and Ediswan's should certainly be congratulated on the idea.

Electric Clocks

Negotiations have also been completed whereby The Edison Swan Electric Co., Ltd., will in future, be marketing Battery and All Mains Bulle Clocks.

A small range of models will be stocked by the main branches of The Edison Swan Electric Co., Ltd., in England and Scotland.

Illustrated lists are now available, and can be supplied upon request.

New Marconiphone Sets

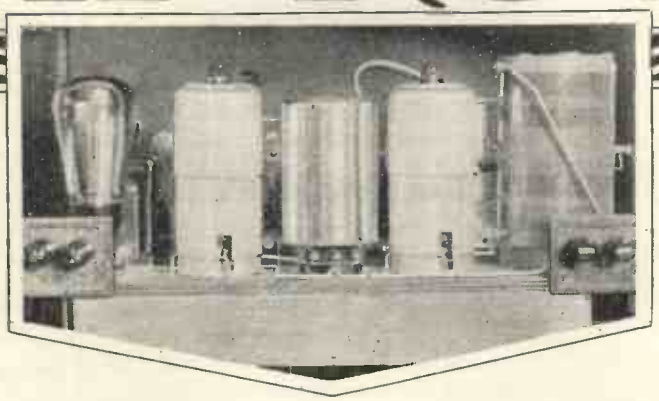
Readers with D.C. mains will be glad to hear that the Marconiphone D.C. Models 276 and 278 have now been released. Supplies will be somewhat limited at first, but will increase as production gets into its stride.

The 276 D.C. receiver is an exact counterpart of its A.C. brother, and the 278 is the D.C. form of the 272 A.C. receiver.

DEMONSTRATING THE "DIODION PLUS"

An "M.W." technician explains the operation of the famous "Diodion Plus," described in September "Modern Wireless," to an interested visitor at the National Radio Exhibition.

BEAT NOTES



It is due to frequencies beating together that one hears whistles from oscillating sets, and also that two stations heterodyne one another.

AN EXPLANATION By K. E. B. JAY.

EVERYBODY knows nowadays that broadcast music is propagated by electro-magnetic waves in the ether. These electro-magnetic waves are set up by a transmitter which applies an oscillating electromotive force to an aerial system so arranged that it shocks the ether into sympathetic vibration at the same frequency as the oscillating voltage.

Oscillating Electrons

This E.M.F. is the effect of causing the electrons in a circuit to oscillate. The oscillatory circuit, as it is called, consists of a coil and condenser (L and C in Fig. 1), and is so connected to a valve that its electrons are kept swinging from one end, A, of the coil to the other end, B, or one plate of the condenser to the opposite.

To begin with, the end A is neutral as represented by P in the graph in Fig. 2; when the oscillation starts the electrons will flow away from A, leaving a deficiency, and pile up at B until their inertia causes them to swing back again past the neutral position of A till they are in excess at that point and deficient at B, when once more they will flow back.

Since the electrons are particles of negative electricity it follows that a deficiency of them represents a positive charge, and so the charge at A has become first positive and then negative, as illustrated by Fig. 2 at Q and R; in this graph the quantities plotted along PY may be regarded as E.M.F.'s and those along PX as times in seconds.

Cycles Per Second

We notice that this curve repeats a sequence of events between every other zero (i.e. between P and S in Fig. 2), which is called a cycle, and the frequency of the oscillation is defined as the number of cycles per second; the maximum value of the E.M.F. is called the amplitude, a; the linear distance between maximum and maximum (or between P and S, which is the same thing) is the wavelength, and this is related to the frequency by the equation:

Velocity of electro-magnetic waves = wavelength × frequency, or in figures, and re-writing the equation:

$$\text{Frequency (cycles per second)} = \frac{300{,}000{,}000 \text{ (metres per sec.)}}{\text{wavelength (metres)}}$$

The oscillation represented by Fig. 2, which is of the simplest kind known

CIRCUIT AND CURRENT

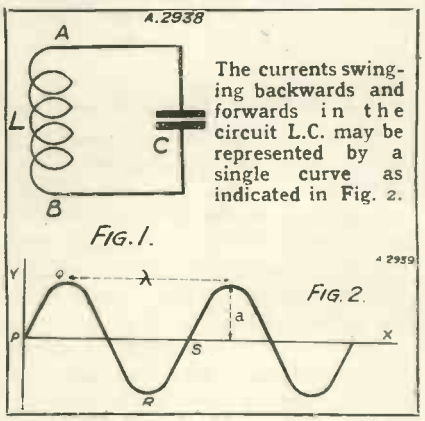


FIG. 1.

FIG. 2.

as simple harmonic motion, corresponds to the E.M.F. in the transmitting circuit and therefore the transmitted wave.

Now, when the transmitted wave is applied via the aerial and earth to the tuned circuit of a receiver it will cause the electrons in that circuit to oscillate in an exactly similar manner to those in the transmitting circuit and hence set up a corresponding E.M.F. across the ends of the coil of the receiver.

Suppose next that another oscillating E.M.F. is set up across this coil by a local oscillator of some kind; this also will swing the electrons in the coil, and if it is of the same frequency as the transmitted wave it will act in such a manner as to increase the amount of swing and therefore the voltage developed across the coil.

Changes in Swing

If, however, the frequency is not quite the same it will tend first to increase and then to decrease the swing. This is more clearly illustrated in Figs. 3, etc. In Fig. 3 is an oscillation whose frequency is nine cycles per second (this is, of course, much below any radio frequency, but it will be convenient to illustrate my point).

In Fig. 4 we have a second oscillation of eight cycles a second. We know that, taken separately, any such point as P′ on Fig. 3, and P″ on 4, represents the E.M.F. across the coil at a certain time, t, seconds; clearly, then, if both oscillating voltages exist in the circuit together at this time, t, the total voltage across the coil will be the sum of the two voltages P′ and P″.

We may, therefore, represent the total voltage across the coil at any moment by a curve obtained by adding together the two curves 3 and 4. The complex motion so obtained is shown in Fig. 5

They Work in Step

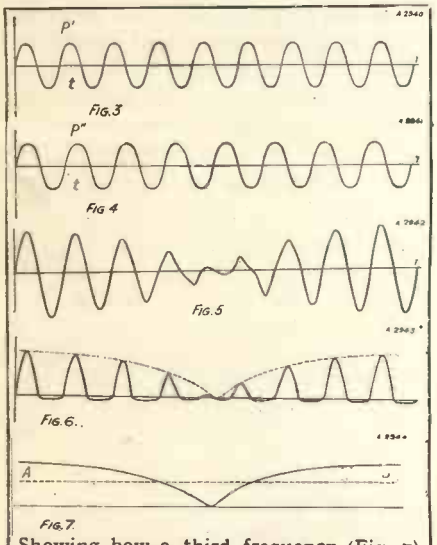
The two oscillations are in step at first and the electron swing is greater than that due to either separately, but as they work out of step the swing becomes smaller until it is even less than the individual wave, after which they again work into step.

BEAT NOTES
—continued

This complex oscillation is then rectified by the detector, so that only the positive half is present in the anode circuit, as in Fig. 6, in the form of a pulsating direct current. It is clear that there are two components of this current, the rapid pulsations at radio frequency of Fig. 6, and the much slower pulsations due to the variation of amplitude of the first, shown in full in Fig. 7 and dotted on 6.

This slow pulsation may be regarded as an oscillation, not about the zero line, but about some mean value such as AB; putting in AB in Fig. 7, we see that the pulsation is

BUILDING UP A BEAT



Showing how a third frequency (Fig. 7) is built up from two others (Figs. 3 and 4).

definitely periodic, although not of the same symmetrical form as 3 and 4, but the important fact is that, in the space occupied by 9 and 8 oscillations respectively of the original waves, there is only one oscillation of Fig. 7. The frequency of this wave, in short, is equal to the difference between the frequencies of the original waves.

Related Frequencies

In the above graphical construction I have discussed frequencies of nine and eight cycles per second and a resultant frequency of one cycle per second. These are, of course, very low indeed, but the same rule would hold good for any similarly related frequencies. If these frequencies, for example, become 45,000 and 40,000 cycles per sec., the oscillation of Fig. 7 would be 5,000 cycles per sec. This would then be a possible case, and we should hear in the telephones a single note of 5,000 cycles. This 5,000-cycle note is called a beat note, and the process by which it is produced is the heterodyning of the two waves. The two waves concerned are, of course, the transmitting station and a locally produced oscillation.

Unmodulated Waves

This latter is almost always set up by allowing the detector valve to oscillate, but it is clear that such a condition would not give rise to an audible note unless the receiver was oscillating at a frequency close to that of the transmitting station.

The reason why a neighbouring receiver may be heard heterodyning a transmission is this—the neighbour's oscillating receiver acts as a small C.W. transmitter sending out an unmodulated wave.

When, however, the oscillating receiver heterodynes a broadcast transmission, the C.W. transmission of this offending receiver becomes modulated, and this modulated wave will be quite easily received near by, since it will amount to a very low power broadcast of a note of a single frequency (the beat-note frequency).

Another case of heterodyning frequently occurs when two transmitting stations are working on frequencies separated by such an amount that would give rise to a beat note of audible frequency.

Practical Illustration

This phenomenon of beats has many important applications. The simplest is in the reception of C.W. telegraphy, where the unmodulated transmitted wave is inaudible until the local oscillation of the receiver sets up a beat note that can be heard in the headphones.

Beat notes occur in any phenomenon involving wave motion; in sound they may sometimes be heard when one is tuning up, say, a 'cello against a piano; as the 'cello comes nearly into tune a low-frequency beat note can be heard as a rapid rise and fall in the intensity of the sound, of the order of five or six beats per second.

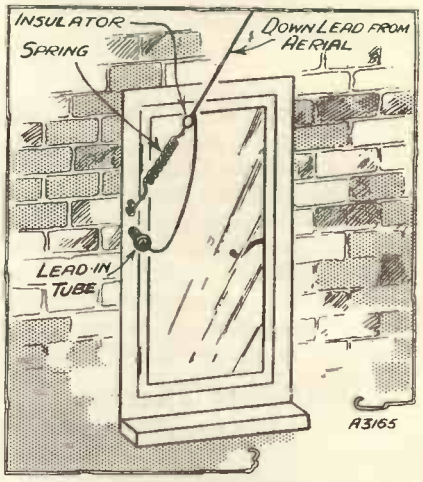
Another common case occurs when an aeroplane has two engines whose characteristic notes are slightly different; the noise of the engines will be heard as a single roar, but it will rise and fall in intensity in a similar manner to the 'cello and piano.

KEEPING AN AERIAL TAUT
A simple way of fitting in a spring.

A SINGLE wire aerial looks neater when it is stretched taut, as well as being electrically more satisfactory.

With tight halyards, however, there is a likelihood of considerable strain being thrown on the aerial wire, since the ropes will shrink somewhat in wet

ON THE DOWN LEAD



One way by which an aerial can be prevented from swaying about.

weather. Moreover, if the aerial is supported by a tall pole, this is likely to sway in a strong wind, with the possibility of snapping the aerial or the ropes.

A simple method to keep the aerial taut, while precluding any chance of it breaking, is to run the rope through a pulley and weight the end of it.

If your aerial is already up, and somewhat slack, as it probably will be, a simpler scheme to achieve the same end is to attach a spring to the down lead, as shown.

TWO TIGHTENING TIPS

Before mounting valve holders on the baseboard, tighten with a screwdriver from underneath all the terminal bolts, so that they will not work loose afterwards when making connections.

* * *

Don't forget to prise open your H.T. wander plugs occasionally so that they fit snugly and securely into the sockets of the battery.

FAULTS I HAVE FOUND

By a SERVICE ENGINEER

Wide first-hand experience in trouble-tracing in all kinds of receivers well qualifies the writer of this feature to advise readers how to locate faults in their own sets. Loss of sensitivity and selectivity due to damping, and faults caused by dust and dirt, are among the subjects dealt with this month.

THERE is one very common fault that is likely to develop in almost any kind of receiver, and for which there is no obvious or certain cure—lack of selectivity.

The maximum degree of selectivity obtainable from any set is, of course, governed by the design of the tuning and associated circuits and the quality of the components used; local reception conditions also have a considerable effect and must be taken into account where a new receiver is being tested out for the first time.

Flat Tuning

But in these notes I am more concerned with the *falling off* of selectivity rather than the existence of poor tuning at the start of affairs, for this latter complaint is comparatively easily dealt with by making tests with different apparatus under the same conditions or, alternatively, the same apparatus under *known* conditions.

I frequently get complaints about receivers which have given long and excellent service, and which show distinct and steadily increasing flatness in the matter of tuning.

Valves are usually suspected at first, although they are usually quite blameless as regards this particular type of trouble; indeed, the most likely characteristic that a valve can offer as a cause of dud tuning is *excessive* emission and we have yet to discover the screened-grid valve which will give abnormal milliamps. as a sign of old age!

"Damping Load"

If we assume good design in a set which develops such a fault, then the cause of the trouble may be safely set down to the formation of a comparatively low resistance or "damping load" across one or more of the tuning circuits, which flattens out the resonance peak of the inductance and capacity forming that circuit.

Such a resistance may exist almost anywhere in the H.F. side of the receiver, and it would be impossible to enumerate all the "hide-outs" which require thorough inspection if the source of the trouble is to be discovered.

DUST CAUSES CRACKLES

A pipe cleaner will remove dust from between the vanes of a variable condenser. Many of the crackling noises which are heard when a short-wave set is tuned are due to the presence of dust.

As a guide to readers who will sooner or later have to undertake this somewhat tedious operation, I intend to mention a few of the faults of this nature that I have, from time to time, actually discovered. In the accompanying diagram, also, I have indicated by means of dotted resistances the positions in the circuit where this unwanted damping may be discovered.

In one case that I remember very well, I had spent several hours in carrying out the most careful tests and examination on various parts in the set, and at last came to the conclusion that the coils themselves were the cause of the trouble.

The Coils to Blame

I removed them from the receiver (there were only two, thank goodness!) and inspected them with the greatest care.

They were wound with good silk-covered wire on what appeared to be excellent "Paxoline" formers, and there was certainly nothing to be seen that aroused suspicions.

However, I was fairly confident that the other tests I had made limited the trouble down to these coils in some way or another, and I therefore went to the trouble of putting them in a warm (not hot!) oven for about an hour.

Long before the hour was up I saw what I had hoped for, and knew that the trouble was solved.

Very soon after placing them in the oven, tiny bubbles appeared on the edges of the formers and, on holding them in the cool room temperature an appreciable amount of steam was given off.

Accumulated Moisture

The explanation is, of course, that during the many months in which the set had been working satisfactorily, the coil formers and the insulation of the wire had been slowly absorbing moisture from the atmosphere, and as the moisture content of these parts increased so the H.F. resistance of those coils decreased and therefore the selectivity slowly became worse.

But I think that "Paxoline" must have been varnished cardboard!

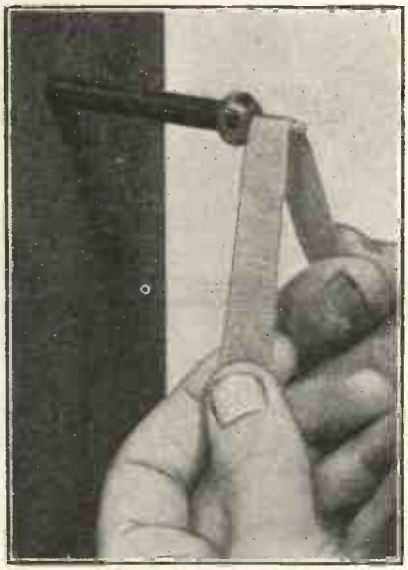
An accumulation of dust is, of course, a more or less obvious producer

Now is the Time to Overhaul Your Set

of unwanted resistance paths, and I need hardly warn MODERN WIRELESS readers against it. In the course of my work, however, nearly every fault is no "less—or more—than the dust!" for I have to deal almost entirely with commercially made sets which never enjoy that periodic internal cleansing which is universally desirable.

Any circumstance which produces an increase of emission in the valve which immediately succeeds a tuning circuit will throw a heavy load on that

KEEP IT CLEAN



When the volume falls off don't forget to examine the aerial system. If the lead-in insulator connection is dirty, clean it up with a strip of emery cloth.

circuit, since the impedance of the valve will be sensibly reduced.

A milliammeter in the plate lead of the valve will indicate such symptoms, and the most likely cause of the trouble is grid-bias failure or (less likely) an increase in H.T. voltage.

Earthing Switches

Perhaps I should have prefaced all these remarks with a denunciation of that horror of horrors—the unenclosed aerial-earthing switch.

By this time it will be obvious to all readers that an accumulation of dirt around the contacts of such a device will be equivalent to a resistance connected directly across aerial and earth or, more to the point, across the aerial tuning coil.

Unfortunately, an accumulation of dirt is not the only point to watch here, for, at a rough estimate, there are three millions of these switches in use to-day which cost their economic owners anything between—but not exceeding—threepence and sixpence each!

Why it is that such a vital link in the radio chain should always be "axed" I don't profess to know, but I do know full well that the insulation of a three-penny switch is not as good as that of one that cost half-a-crown, and it can be relied on to drop ohms at a fairly regular and devastating rate.

So look to your aerial switches, you "penny-wisers!"

Reducing Resonance

A short while ago—last September, to be precise—I told you in these columns of one or two ways in which the last traces of mains hum can be removed from receivers.

It has since been pointed out to me that these same hints can be equally well applied to the removal of excessive bass response, and to this I heartily agree, but with reservations.

For one thing, when we are dealing with over-emphasis of low notes the trouble is often mechanical or acoustic rather than electrical, and consequently requires rather different treatment.

By all means, if you are certain that "peakiness" in the bass register is due to loudspeaker or circuit characteristics, go ahead on the lines I suggested, but it is quite possible that the trouble can be cured more simply.

I attended to a set a short while ago that "out-jetsamed Mr. Jetsam" in the production of low notes, and found that the trouble was nothing more than resonance at natural frequency of the receiver cabinet.

This often occurs with the popular "consolette" type of set, in which the loudspeaker is built in to the receiver cabinet.

The remedy is to shift the resonance frequency of the cabinet by means of judiciously-placed struts between the sides or top and bottom of the case.

'WARE BAD JOINTS!

Every connection should be mechanically sound. When a receiver suddenly develops a background crackle, go over all the joints and make quite sure that they are tight.

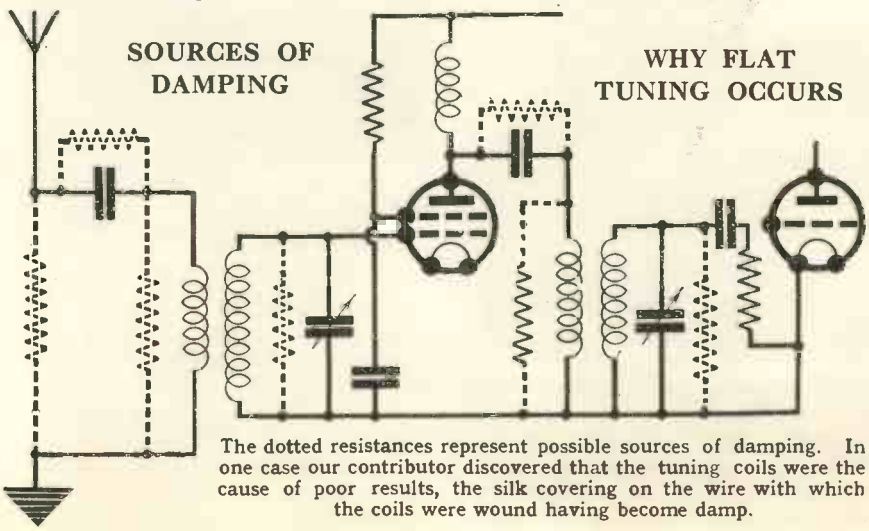
If the trouble is electrical, you can try the effect of wiring a small fixed condenser in series with the speech coil of the speaker, which will cut down the proportion of low frequencies that will get through to the coil.

Try It Yourself

The condenser should be in the neighbourhood of ·1 mfd., but you should find the best value to suit your own requirements by experiment.

Most of the faults that are experienced on modern receivers are capable of being grouped under various headings

(*Continued on page* 480)



The dotted resistances represent possible sources of damping. In one case our contributor discovered that the tuning coils were the cause of poor results, the silk covering on the wire with which the coils were wound having become damp.

RADIO LIGHT BROADCASTING

The ever-increasing congestion of the ether has accelerated investigation into novel methods of programme distribution, and our contributor here looks forward to the time when "wireless" as we now know it will be superseded by broadcasting over beams of light, from a series of "Radio-lighthouses."

By SEXTON O'CONNOR

THE possibility of "talking" over a beam of light is already well known. One can, for instance, apply speech frequencies to the circuit feeding an arc-lamp, and use a selenium cell to receive the message at the distant end.

Improved Method

The "photophone," as it is called, is, of course, an improvement on the old-fashioned signalling lamp in which Morse signals are sent by opening and closing a shutter placed in front of the lamp. It might be said that when signalling in this way, by "blacking-out," the modulation on the light-beam is "all or nothing," whereas in using the beam to carry speech the modulation is only partial.

The photophone utilises, first, a microphone for impressing the speech-frequencies upon the source of light; secondly, a light-sensitive cell which is sufficiently sensitive to detect small changes in the overall strength of the beam; and, thirdly, a source of light able to respond faithfully to all the different frequencies imposed on it by the microphone.

Reflected Rays

The underlying principle is illustrated in Fig. 1, which shows the rays from a powerful lamp concentrated into a parallel beam by a reflector and lens, and focussed at the receiving end upon a light-sensitive cell. The circuit used at the transmitting end is indicated in Fig. 2, whilst the receiver is similarly shown in Fig. 3.

Two-Way Telephony

Many years ago this method was developed to the point where a two-way conversation could be carried out over a distance of 20 miles, by using a powerful arc-lamp modulated by a 200-kw. transmitter.

Since then all three essential components of the "talking beam" have been improved almost beyond recognition, thanks chiefly to the work done both in television and in the art of producing "talking" films.

The type of glow-lamp used for making variable-density sound-on-film records for the cinema is one example of a light-source sufficiently flexible to cover the full frequency range of orchestral music; whilst in the modern grid-controlled neon lamp, as developed for television, the frequency response is even more sensitive.

A Special Lamp

Quite recently a special form of mercury-vapour lamp has been produced capable of responding to modulation frequencies of the order of 50,000 per second. As shown in Fig. 4 this consists of three separate chambers. The small bulb on the right contains a pool of mercury which is vaporised by the H.F. currents flowing in the coil A. The gas molecules so produced pass into the main part of the lamp, where they are ionised by the coil B and produce an intense beam of a bluish white colour.

The light waves so generated are also modulated by the H.F. signal currents flowing in the coil B. In this way a range of signal frequencies can be imposed on the outgoing beam which would be sufficient, if used on a television system, to transmit a picture showing at least double the detail of the present 30-line scanning system.

So much for the transmission end of the "talking beam."

On the receiving side the efficiency of the modern photo-electric cell or "electric eye" has been enormously increased within the last few years, thanks again to television and the talking films.

To Relieve Congestion

In fact, the whole technique is now so far advanced that the possibility of utilising light-beams as a medium for the distribution of broadcast programmes is being seriously considered as a commercial proposition.

In the first place congestion in the ordinary broadcast waveband is increasing so rapidly that listeners are

ILLUSTRATING THE PRINCIPLE OF BEAM TRANSMISSION

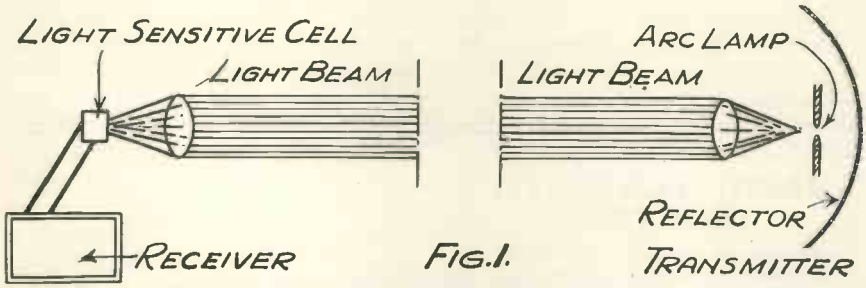
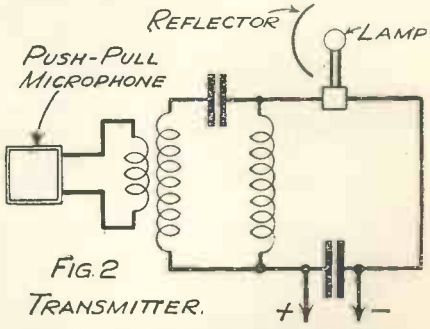


FIG. 1.

The basic principles of "light" broadcasting are clearly shown here. Concentration of the modulated beam is achieved by means of reflectors and lenses at both the receiving and transmitting ends.

CONTROLLED BY A MICRO-PHONE



This "outline" circuit shows the arrangement of the transmitter. A microphone varies the intensity of the light, as in the present broadcasting system it varies the intensity of the aerial current.

Photo-Electric Pick-Ups Instead of Aerials

beginning to despair of what may happen in the near future. This, together with the type of interference due to electrical apparatus, is largely responsible for the growing popularity of the so-called "wired wireless" method of distribution, particularly in the larger towns.

The "talking beam" has definite possibilities as an alternative to

DETECTOR AND AMPLIFIER

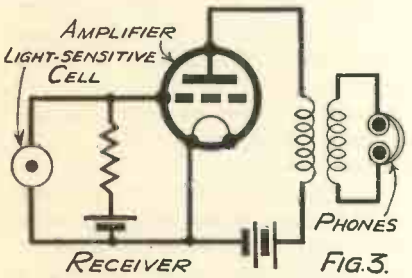


FIG.3.

The beam from the transmitter is "detected" by a light-sensitive cell at the receiver and amplified by means of valves.

"wired wireless." It would no doubt have certain limitations at first, particularly as regards daylight transmission, but this could be overcome in course of time.

In the second place, there is obviously no room in the ether for television programmes as things are at present, even supposing all the other technical problems to be satisfactory solved—as they will be before long.

Picture-transmission makes a far bigger demand on the ether than ordinary broadcasting. At present the side-band allowance for speech and music is approximately 10 kilocycles. At least five times this amount of room will be required for a "worthwhile" television programme. In fact, some experts talk of a side-band "spread" of 500 kilocycles being required.

Both demands are equally impossible at present—unless transmission is limited to the early hours of the morning, when the ether is comparatively free—and when most people are naturally sound asleep.

Looking Ahead

The use of "wired wireless" for distributing television programmes, though possible, would prove much more expensive than "radio-light" transmission, owing to the high cost of "loading" the wires to enable them to carry so wide a range of frequencies.

Using the prophetic eye, one may imagine the "radio-light" transmitter of the future as a sort of lighthouse mounted well above the highest buildings in the town and spreading its rays equally in all directions over a radius of from 3 to 10 miles.

Over each household—taking the place of the present aerial—will be seen a small photo-electric pick-up, covered by a glass lens to protect it

A FLEXIBLE LIGHT-SOURCE

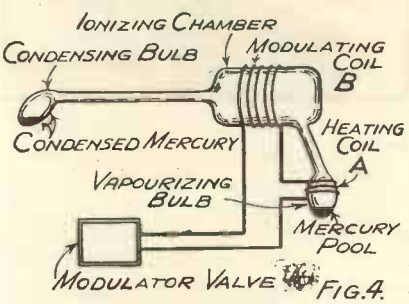


FIG.4.

A recently developed mercury-vapour lamp is so flexible that it will vary its intensity in response to modulation frequencies as high as 50,000 per second.

from the weather and rotatably mounted to face the transmission. The energy it receives will pass through a valve amplifier to the loudspeaker or television receiver as the case may be.

During the daytime a service of ordinary broadcast items could be distributed in low-frequency form over the electric supply wires, in much the same way as in the present "wired wireless" systems. At night the greater flexibility of the radio-light beam would be available to distribute both sound and television programmes.

ABOUT ELECTROLYTIC CONDENSERS

There are certain differences between ordinary and electrolytic condensers with which the constructor should make himself familiar before attempting to incorporate these components indiscriminately in a receiver.

ONE or two points should be clearly understood when considering whether or not an electrolytic condenser will be suitable for a particular job.

Although possessing the unique advantage of a large capacity at moderate cost, as compared with ordinary condensers, it must be remembered that the principles and characteristics are very different in the two cases.

Thus it is generally known that the electrolytic condenser is a *polarised* device—the aluminium electrode having an oxide film dielectric coating, must always be the *positive*. In other words, this type of condenser is suitable only for *unidirectional* voltages, having a definite positive and negative polarity.

The output from an A.C. rectifier, of course, fulfils this condition, yet it is not advisable to use an electrolytic condenser for smoothing in this case. On the other hand, there is no reason whatever why it should not be used, with advantage for smoothing D.C "ripple."

The explanation lies in the fact that there is a limit to the amount of A.C. ripple that can be handled by the

DANGEROUS RIPPLE

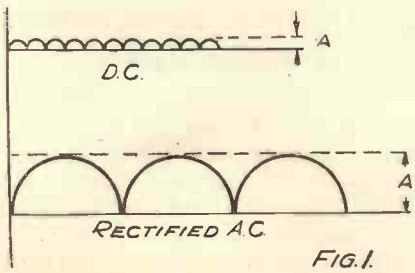


FIG.1.

The large amplitude of the "ripple" of rectified A.C. as compared with the variations in D.C. may be sufficient to damage an electrolytic condenser.

condenser without causing serious overheating. It will be understood that this is quite a different matter from *maximum voltage*. If the latter is fairly steady, we can use a voltage right up to the maximum specified for a given condenser, but we must not send too much *varying* or *alternating* current through it.

The A.C. component superimposed on a D.C. supply is always of small amplitude as compared with the large variations found in a rectifier output. The two curves in the diagram will make this clear, where A is the amplitude, or *amount of variation* in each case. Therefore, in addition to "maximum voltage," manufacturers usually specify also the maximum ripple voltage that can be used without damage to the condenser.

Another point of difference between these condensers and ordinary mica or paper dielectric types is their much lower insulation resistance. In fact, the insulation resistance of an electrolytic condenser is far from being a constant factor; it varies widely with the working voltage.

FRANKFURT'S RADIO OFFSPRING

The old Leipzig transmitter has come to life again at Trier, the station that is synchronised with Frankfurt. But there's nothing old-fashioned about the Trier apparatus, as our correspondent shows.

EVERYBODY knows about the new Frankfurt and Leipzig Regional transmitters; but there is a side of the 17-kilowatt Frankfurt station which is unknown except to the good folk living near the Trier station, which relays the Frankfurt programmes.

The Mystery Relay

I was at Frankfurt on an official Press visit a month or so ago, but just recently on an informal visit one of the engineers had time to initiate me into the mysteries of Frankfurt's relay: for the rumour had been going round technical circles that the Trier station isn't a new transmitter at all, but elsewhere and under another name had been one of the "stars" of the ether in its time.

The fact is, Germany has relays in its Regional scheme just as we have; and some of these, which are now connected up with the new big German Regional transmitters, are quite interesting.

Frankfurt's relay at Trier is the most interesting of them all, Trier is not a new station, as the rumour went. It's the old Leipzig transmitter come to life again in the new guise of a relay!

The parent station Frankfurt is connected by cable with Trier, and I had the opportunity, when at Frankfurt, of seeing the Trier remote control panel at the Frankfurt end and also of renewing acquaintance with the Leipzig transmitter now operating "under new management" as it were, at the Trier relay.

I dare say you remember Leipzig in the old days when it was a 2-kilowatt broadcaster. The transmitter actually was several years old and externally looked like the sort of apparatus which the B.B.C. had at Marconi House in 1924 and thereabouts; exposed air-cooled valves, open bench construction, and all that sort of thing.

A Model of Efficiency

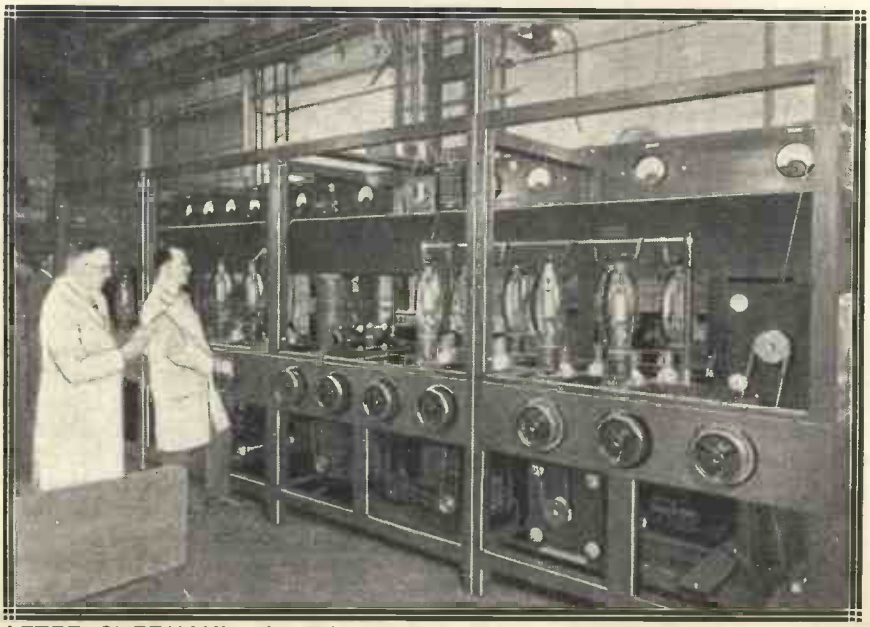
But it was the creator of a good signal, that old 2-kilowatt Leipzig; and when the Lorenz engineers came along with their new 120-kilowatt plant, the old broadcaster was not forgotten. It was sent back to the factory, reconditioned, and then fitted up at the Trier relay.

Now it is a model of efficiency, even if you can't honestly say that it is modern to look upon. It is still putting out 2 kilowatts on Frankfurt's wavelength of 259·3 metres.

Mounted in Frames

Can you picture a laboratory bench full of large air-cooled valves, air-dielectric condensers, and solenoid tuning coils? And can you picture above this four wooden frameworks dividing the transmitter off into its sections of drive, modulator and power output? For the Trier relay the engineers have fitted new valves, meters, controls, and have made other detail improvements.

The power comes from a bank of valves, air-cooled in parallel. These have the Continental type of air-spaced base pins, but the valves plug-in just like ordinary receiver valves and have a terminal at the top for the anode, like a screened-grid valve. Each valve is capable of handling about a sixth of Trier's output power, and the whole valve bank in parallel is very much under-run. These "bottles" are in two rows, with flexible leads to the anode terminals, ending in rapid connectors.



AFTER OVERHAUL, the Trier station appears as a fine new transmitter. But old Leipzig engineers recognise the gear!

(*Continued on page 479*)

INDOOR VERSUS OUTDOOR AERIALS

Our contributor discusses the pros and cons of different types of aerials and gives helpful practical hints on their erection.

By G. E. MOORE, A.M.I.E.E.

MOST users of radio receiving sets employ as an aerial a simple suspended wire insulated at the supports. The reason for this is, in the main, an economic one, though the method also has considerable technical merit which appeals to the more scientific devotee.

Miscellaneous Arrays

This, of course, is not to say that satisfactory results are not obtained from frame aerials, roof "birdcages," the electrical installation, and the entirely self-contained and self-sufficient set, but the picking up for most listeners is by the first-named method. The use of uncommon antennæ, of fenders and iron bedsteads, of mysterious canisters and disconnected gaspipe runs, is now more a matter of history or of playful experiment.

As to whether the aerial should be fitted within or outside one's house much can be argued. Like many topics, no decision that will satisfy everybody is possible. The writer's experience and opinions have, however, made him lean in one direction, and as it is a good subject for debate he will present his views.

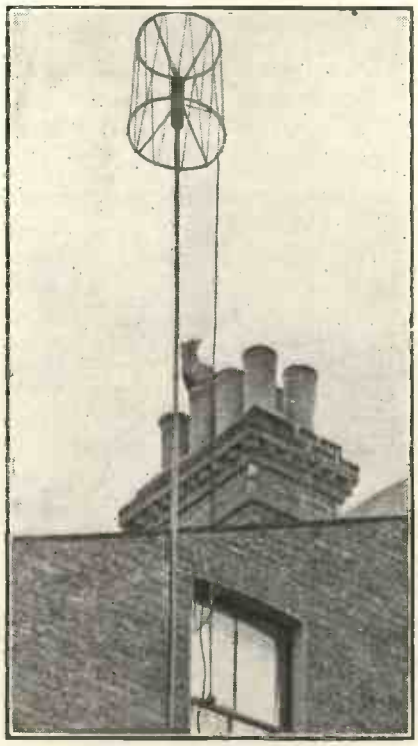
Height is Important

The outdoor aerial is, in general, regarded as the first and almost inevitable choice. There seems to be a feeling in some quarters that the provision of such form of aerial is incumbent upon the listener, the fact that the aerial must be efficient being of quite secondary importance.

Given a short aerial which is mounted at such a height that all neighbouring objects are cleared is a condition which may be regarded as ideal. For the majority of town-dwelling listeners, however, this must appear as impossible of realisation—particularly in mixed neighbourhoods where one- and two-storey houses predominate.

It is an easier matter to advocate than to provide higher poles. Yet one surveys the host of short and low aerials, many worsened by badly-disposed lead-ins, one cannot help but urge that if aerial poles are necessary, then let them be made higher in the first instance. In so doing the provision of the really stout poles which will be necessary should give a better appearance than with the existing flimsy erections.

EASY TO ERECT



Cage aerials are often of value when there is insufficient space available for the erection of an aerial of conventional type. The "cage" should be mounted as high as possible above the roof.

By-laws and landlords are not always helpful, but much can be done by dispensing with ineffective poles and suspending aerials between houses. The writer's own preference is for an aerial slung as high as possible between chimney stacks on the listener's own roof. This provides an arrangement which looks well, works well, and truly belongs to the house. The fitting of a couple of hold-fasts and the aerial parts (prepared in readiness) is soon effected by a builder or slater; the cost is a few shillings only, and it is less still if advantage can be taken of roof or chimney repair work.

Facts to Remember

Sufficiency of both insulation and of spacing from near-by erections are also important matters with the outdoor aerial. Protection from static effects, too, must be regarded as inevitable—if only for the sake of the set.

Now, as opposed to the outdoor aerial, the claims for the internally-mounted one may be considered. The form which appeals to the writer is that which is fitted as high in the house as possible.

It is erected in the roof void (or attic). In this position it is actually higher than many an outdoor aerial, and obviously not far below the chimney stack type. In many houses, and especially in the bungalow type, a surprising amount of space is available. With due care the span can be kept well clear of the roof or other "ground."

Inside Advantages

The significant advantages are that the insulation is of a high order and remains so; that corrosion is negligible and any dry joints hardly susceptible to change; that no protection against static effects need be provided; that the experimenter can work in greater ease; that it is cheaper; that there is more freedom with regard to placing the set; and that the appearance of the property and neighbourhood remains unaffected.

These advantages naturally apply to the aerial which is slung in the room containing the radio set, and also, of course, to those "all in" and kindred arrangements mentioned at the beginning. However, one cannot conceive that such an aerial will ever receive the willing sanction of the *average* domestic authority.

The indoor aerial is not without its detractions. It can be urged that it is not so effective *in what it picks up*

(*Continued on page* 480)

WATCHING THE WAVES

How wireless and speech waves can be photographed with the aid of the cathode ray.

From a Special Correspondent.

I HAVE just been permitted to see some interesting tests made in photographing wireless and speech waves.

The laboratory gear used is really quite simple, and the basic part is an ordinary cathode-ray tube, as in some television apparatus. Owing to the immense speed, it is impossible to see the waves moving, but they are photographed on to a strip of cinema film which gives a permanent record.

Recent Development

The absence of any appreciable inertia in a beam of fast moving electrons gives the cathode-ray oscillograph an advantage over all other types.

However, frequency response does not in itself guarantee a useful picture, and it is only recently that tube limitations have been overcome and satisfactory auxiliary equipment developed to make possible study up to 50,000 or 100,000 cycles per second.

The cathode tube is like a large valve, and is worked with an H.T. voltage varied between 500 and 2,000. It has a filament, and a number of deflecting anodes—four plates which pull the electron stream from side to side.

There are two pairs of electrostatic deflecting plates; one to produce horizontal deflection, and the other to produce vertical deflection. If an alternating voltage is applied to either pair the beam will be deflected rapidly so that a straight line appears upon the screen.

Providing a Time Base

Obviously, some means of providing a time axis so that waves may be seen in their true amplitude-time relationship is needed. The rotating mirror has been used with vibrating-element oscillographs, and is also useful with the cathode-ray instrument.

When the line produced by voltage across one pair of plates is viewed in a rotating mirror arranged with its axis parallel to the line on the fluorescent screen, the wave-form may be seen, if the mirror is turning at a suitable speed.

Cinematograph Method

The use of the rotating mirror with the cathode-ray oscillograph is limited, since careful observation of the higher frequency waves to which the cathode-ray tube will respond would involve very high mirror speeds.

The most serious disadvantage of the rotating mirror is its inability to keep in synchronism when the frequency shifts. Although the mirror speed may be adjusted so that a stationary pattern is obtained of the constant-frequency wave, any change in the frequency will cause the pattern to move. If the frequency changes appreciably, the pattern will probably move too quickly to be of any value.

Another method of obtaining a time axis is the moving-film camera. Where a photographic record is desired, this undoubtedly is the most satisfactory equipment.

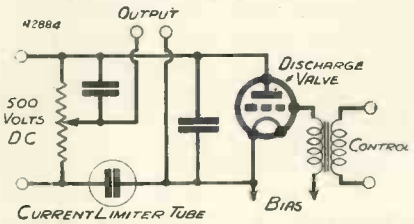
Camera Limitations

The camera is, of course, limited by mechanical and photographic factors, including maximum velocity at which the film can be driven without tearing and the maximum film "speed" at which records can be obtained.

The latter depends to a great extent upon the optical system and the type of film or sensitised papers as well as upon the brilliancy of the

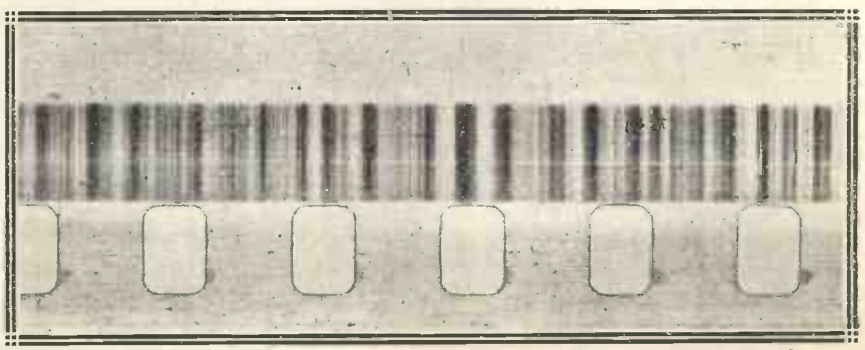
(*Continued on page* 476)

SPECIALLY DEVELOPED



"To provide a source of controlled timing wave or 'sweep,' the engineers have developed a special 'sweep' circuit . . . which uses a mercury discharge tube."

HOW THEY LOOK WHEN CAUGHT BY THE CAMERA



This section of a 35-mm. film depicts an actual photographic record of a group of waves obtained by means of a cathode-ray oscillograph.

THE STORY BEGINS

New readers should start here.

★ ★ ★

AT precisely twenty minutes past ten one evening, the red light—indicating the progress of a broadcast play—on the wall of the Dramatic Control Panel Room on the eighth floor at Broadcasting House went out.

JULIAN CAIRD, B.B.C. Dramatic Director, and **DESMOND HANCOCK**, the Balance and Control Engineer, went down the stairs to join the actors in the studios. Hancock, going into Studio 7C, to see if anyone was still there, found **SIDNEY PARSONS**, an impoverished actor who had been taking part in the play, "The Scarlet Highwayman," lying dead—strangled—at the foot of the microphone standard! They supposed that he had been killed during an actual strangling scene in the play—in fact, his murder might even have been heard by listeners!

GENERAL SIR HERBERT FARQUHARSON, the Corporation's Administrative Controller, immediately took charge of the proceedings, and before long **CENTRAL INSPECTOR SPEARS**, a detective with an excellent record, arrived at Broadcasting House.

Meanwhile, the general discovered two facts. First, that **HIGGINS**, a studio attendant with an attachment for a girl in the basement canteen, had left his post in the corridor leading from Studio 7C during the play; and second that **LEOPOLD DRYDEN**, the principal actor, had been wandering in the corridor when he should have been waiting in the studio for his cue.

In the studio, Spears questioned Dryden and his wife, **ISABEL**, but Dryden refused point-blank to answer questions until the next day, and Spears allowed them to go home.

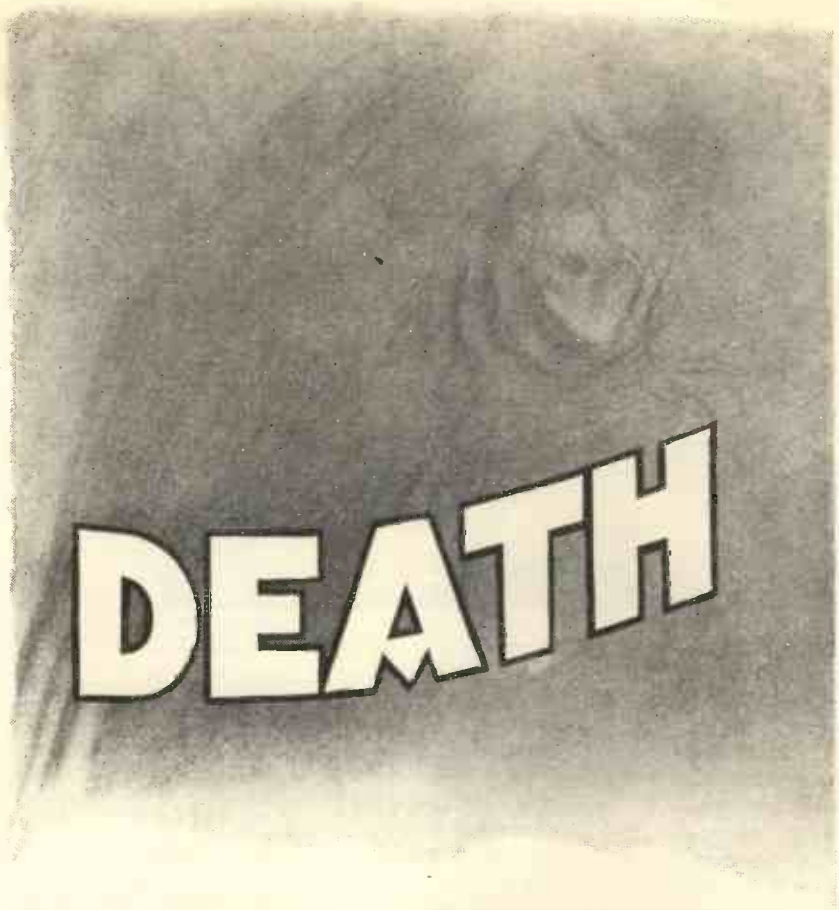
Spears, accompanied by Caird and **RODNEY FLEMING**, the author of the play who, during the broadcast, had been waiting for a telephone call in the Listening Room between the main studios, made a thorough examination and found, amongst other things, that Parson's copy of the script of the play had been mysteriously torn across.

Later they went down to the canteen in the basement where **STEWART EVANS**, a subordinate of Caird's in the Programme Research Department, was found wandering in the corridor. Evans and Caird had a strong dislike of one another and Evans did not attempt to disguise his disdain for his superior.

Just before Spears left Broadcasting House he was told that "The Scarlet Highwayman" had been recorded on the blattnerphone. "You mean we can hear that actual sceue over again?" he cried. "We can hear that scene," said Caird, "not only over again, but over and over and over again. As often as you like. I wonder if the murderer thought of that?"

★ ★ ★

NOW READ ON



Continuing our fascinating new Radio "Thriller"

IX.

EXAMINATION OF ISABEL

LEOPOLD and Isabel Dryden lived in a flat in Upper St. Martin's Lane. Central Inspector Spears called there at precisely eleven o'clock on the morning of the day following the tragedy at Broadcasting House. Although he had not got to bed until nearly six and had been in his office at Scotland Yard by nine: and although every news bill between Whitehall and Seven Dials had screamed "Death at Broadcasting House" in enormous type, he looked as usual the embodiment of briskness and efficiency.

A white-coated manservant answered the door, and led him up a flight of uncarpeted stairs, past two suites of offices, and through an inner door which separated the Drydens' flat from the rest of the building. Ultimately Spears found himself shown into the dining-room, offered a cigarette, and asked to wait. He sat down, looked about him, and not for the first time wondered why the members of the theatrical profession seemed invariably to live such remarkably private lives.

Out in the streets it had seemed unusually hot, but in the dining-room Spears felt chilled to the bone. For it was decorated entirely in white. It had bare white walls, white curtains of American cloth, artificial flowers, made for the most part of wax and white feathers, on the mantelpiece. Spears' gloomy impression of a morgue was intensified by the heavy table in the middle of the room, consisting of a single malachite slab, supported on curiously carved white legs; far more appropriate, thought Spears, for the laying out of a body than the laying of a meal. Over the mantelpiece a singularly vital charcoal sketch of Leopold Dryden as Iago in "Othello" leered down at him sardonically.

The door opened, and Isabel Dryden came in.

It was clear that her night's sleep, too, had been short, and Spears thought she had been crying. But the shadows under her eyes and the general air of agitation which she made no attempt to conceal only accentuated her fair prettiness. She was skilfully made up and beautifully dressed, but Spears noticed a slight disorder about her hair, a lack of polish on her tinted nails, and stockings that did not quite tone with the pair of shoes she was wearing. It was as if she had begun to armour herself for the interview, but somehow had lost conviction in her ability to carry it off before the job was completed.

"Please don't get up," she said at once. "Mr. Spears, I can't tell you how dreadful I'm feeling about all this."

"Of course," said Spears soothingly. "It must have been a great shock. It was actually your husband I came to see this morning."

Isabel bit her lip.

"I'm afraid he can't see you," she said in a low voice.

"Can't, Mrs. Dryden? Or won't?"

" Oh, you're thinking of his attitude last night. Please don't. He's—he's rather used to getting his own way——"

" No doubt," Spears interrupted, " he indulges his temperament, like all artistes."

" Exactly," said Isabel. " Besides, he *was* ill, and this morning he didn't feel equal to getting up. I've rung up his doctor, and he's coming to see him before lunch."

" Of course he realises," said Spears, " that he will have to tell the facts he knows about this matter, if not to me, to a coroner. Most people prefer to avoid that sort of publicity, but I suppose Leopold Dryden is used to being featured in the newspapers ? "

Isabel flushed.

" But he has nothing to tell you ! " she said. " How could he have ? He was in the studio all through the play, and as I told you, he was feeling wretchedly ill. You must have seen for yourself that he was in pain, and you can take my word for it, Mr. Spears, he was far too anxious about whether he would be able to last out the broadcast to be able to pay attention to anything but the handling of his part."

" Well," said Spears briskly, " perhaps you would be good enough to remind him that he'll have to give evidence at the inquest, and it'll probably be to his advantage to see me beforehand. If he—er—feels well enough to talk to me this evening, or to-morrow, perhaps you would telephone me at Scotland Yard ? Meanwhile, I should like to ask *you* a few questions, if you don't mind."

" Of course," said Isabel. " But I'm afraid there's nothing I can tell you. Do you mind if I smoke ? "

" By all means," said Spears, slipping out his notebook. " First of all, Mrs. Dryden, did you know this Sidney Parsons ? "

" As an actor, yes," said Isabel.

" You had acted with him before ? "

" No, never. I only meant that I knew of him as an actor. He had been on the stage some time, and I think I had heard of him as a member of the Thespian Club."

" Did you like him ? "

" It was hardly a question of liking, Mr. Spears. I had only seen him in the course of this broadcast play, and it wasn't as if we had any scenes together—he was just one of the cast."

" I see. And nothing happened during the course of rehearsals to give you an idea that another member of the cast disliked him ? "

" Oh, no. He was a quiet, rather shabby little man. I don't think he spoke much to anybody, and he really only had that one scene, which he played by himself in that separate studio. So he spent most of rehearsals in sitting about reading a newspaper."

Spears nodded. He was watching Isabel carefully, and in spite of her straightforward, almost glib, answers, her lips and hands were damning evidence of apprehension that could not be put down altogether to the fact that she was being questioned by a detective as a matter of routine.

" Have you any idea, Mrs. Dryden, what it was that upset your husband last night ? "

" Upset ? Do you mean, what had he had for dinner ? "

" Yes—if you think that it was his food that upset him. But it seemed to me, Mrs. Dryden, that although he was certainly not normal, the disturbance was rather emotional than physical."

He paused for an instant, and then shot out :

" Are you happy with your husband ? "

" I don't see that you've any right to ask me that question ! " retorted Isabel with spirit. " Leo and I have been married for four years. Stage marriages seldom last as long as that, if they're unsuccessful. We don't believe in that particular sort of conventional misery."

Spears said nothing, merely lifted his eyebrows, waiting for more. The pause had the desired effect. More came.

" As you said yourself, Mr. Spears, my husband is temperamental, like

all great artistes. I'm not pretending that we're candidates for the Dunmow Flitch, you know."

"In fact, your husband is, perhaps, inclined to be jealous? I think I've heard gossip to that effect."

"Yes, he is jealous," said Isabel. "But a man who's in love with his wife should be jealous, don't you think so? But he wasn't jealous of Sidney Parsons, if that's what you mean."

She smiled and stubbed out her cigarette into a white ashtray.

Which, thought Spears, looks to me uncommonly like a smile of relief after trailing a red herring.

"I'm sorry to harp on this point, Mrs. Dryden, but could his demeanour last night have been accounted for by one of these periodical attacks of jealousy?"

"No. We had a cheese savoury at dinner, and I think it had disagreed with him."

"Nothing happened, at any rate, apart from the food? I would much rather hear it from you, Mrs. Dryden, than from your servants."

It was a flagrant shot in the dark, but Spears was banking on the strange way in which people are inclined either to forget or ignore their servants when engaged in a domestic quarrel.

Isabel was moistening her lips with her tongue.

"Well, I *will* tell you," she said. "But don't begin to draw false conclusions from it, because it's absurd. My husband and I *did* quarrel at dinner—nothing serious."

"What in other circles they call 'having words,' perhaps?" said Spears helpfully.

Isabel nodded.

"It was only that someone had written me a silly letter, and I was foolish enough to show it to Leo. He lost his temper—he's always touchy in hot weather—and rather implied that it was my fault that anyone should have written me such a letter. We were both a little nervous about this play—we had never done any broadcasting before. We got rather childishly heated about it."

"This letter," repeated Spears thoughtfully. "Was it a love letter?"

"I suppose you might call it that."

"Would you mind showing it to me?"

"I'm afraid I tore it up."

"Was it in answer to one of yours, Mrs. Dryden?"

Isabel jumped up.

"I told you, Mr. Spears—or at any rate, I thought you realised—that this was the silly sort of letter that any actress is liable to get from a perfect stranger. How can any of this affect the horrible thing that happened last night? I'm sorry. I suppose you're hardened to horrors. But to someone like myself, the shock was terrible. I've hardly slept at all, and I'm really worried about my husband."

Spears leaned forward, with one elbow on the malachite top of the table.

"Mrs. Dryden," he said. "You must believe me when I say that I sympathise with you. But I have my duty to do. I'm trying to get to the bottom of a very difficult case. I need all the help I can get. Active hindrance may have to be construed as participation in the crime after the act."

Isabel swayed a little on her feet.

"I don't know what you mean!" she whispered.

"Your husband refuses to see me," Spears went on remorselessly. "It's possible that he may be ill. I shall be able to judge of that in twenty-four hours or so, or as soon as I can get in touch with his doctor. You, probably from the best possible motives in the world, are deliberately doing your best to mislead me. You said that your husband was in the studio during the whole of the broadcast. I know for a fact that he was out of that studio for at least five minutes. You only admitted under pressure that he was a jealous man. I know that his jealousy concerning you is one of the principal table-topics of theatrical London. Again, it was only under pressure that you admitted that you had quarrelled with your husband yesterday evening at dinner. Finally, I believe you have told me a deliberate falsehood with regard to this letter which you say was written to you by a perfect stranger. Do you still assert that that letter was not one written to you in reply to one of your own?"

Isabel took a step forward.

"I've done my best," she said, "to be patient. But you've gone too far, Mr. Spears. However much you may think you've wrapped it up, you've called me a liar to my face. I don't choose that anyone should do that in my own house." She turned to the bell.

"Before you ring," said Spears, "would you mind looking at this?"

He put a piece of folded notepaper on the table.

"Do you still deny in the face of this that it was in answer to this letter, or one like it, that the letter came which you showed to your husband?"

Isabel turned, and Spears stood up and held out the letter towards her.

For an instant she stared at it, and then her brown eyes widened with stark terror. She made a feeble half-hearted little snatch at the letter, and then, as Spears stepped back, burst into tears and stumbled blindly out of the room.

Spears rang the bell.

"Would you mind giving me the name and address of Mr. Dryden's doctor?" he said to the manservant when he appeared.

"Doctor Chesney, sir. Two hundred and forty-three Wimpole Street."

"Thank you," said Spears. "After he has seen Mr. Dryden, would you kindly let him have my card, and ask him to telephone me?"

He picked up his hat and clattered briskly down the uncarpeted stairs into the glare of the sunlit street.

X.

BANNISTER HAS IDEAS

IT is regrettable, but true, that little work was done in Broadcasting House that morning. Members of the staff, who had read of the death of Sidney Parsons in their morning papers and had hurried officewards from their haddock or eggs and bacon, found themselves the embarrassed cynosures of a considerable gathering outside the Langham Hotel and the Round Church.

A special force of police had to be drafted to Portland Place, a special meeting of the board of governors was convened; and at eleven o'clock in the Concert Hall, the Director of Internal Administration addressed the whole staff on the subject of studio discipline and relations with the Press.

Reporters swarmed in the entrance hall, badgering the reception clerk almost out of his wits; while their editors simultaneously, by their continual telephone calls, compelled the head of the section responsible for liaison with the newspapers to give his secretary a formula of *non possumus*, and himself to take his departure hurriedly for Margate.

Meanwhile, Prospero and Ariel stared incuriously upon the dumbly-gazing crowd of sightseers, who waited for they knew not what; and overhead, hardly toning with the bright blue sky, the Corporation's blue flag fluttered gaily in the sunshine.

Following upon the official address in the Concert Hall—an address which he felt to be directed most unfairly against his own devoted department—Julian Caird retired to his office on the fourth floor, sat down at his desk, and bit savagely at his pen-holder. His stenographer tactfully found something to occupy her elsewhere, and left him alone. He stared out across Portland Place into the windows of the nursing home

on the other side of the road, and wished fervently that he was a strong silent man, for this business promised to be the very devil, reflecting upon himself in particular, several people whom he knew well, and the Corporation in general.

And Caird was old-fashioned in so far that he was jealous of his own reputation, fond of his friends, and loyal to the organisation which paid his salary. He knew perfectly well that he ought to be spending his time in drawing up a schedule of dramatic productions for the last three months of the year. He also knew perfectly well that he had neither the wish nor the power of concentration to do anything of the kind.

"Why the devil," he muttered to himself, "did I ever accept that rotten play?"

Actually, he knew well enough. He had been sitting in his office about three months before, when Rodney Fleming had called to see him. He had known Fleming some years before, when they were both unsuccessful touring actors.

They had actually lived together on one tour, for Caird had found something sympathetic in another member of the company who preferred to spend his time in Newcastle, Leeds, Nottingham, Blackpool and the South Coast towns in writing plays and short stories, rather than in the less edifying occupations common to most touring companies.

For a time they had kept in touch; then Fleming had begun to achieve some reputation as a writer, and Caird had joined the B.B.C., and they had hardly seen each other again until Fleming walked into Caird's office, bringing with him the manuscript of "The Scarlet Highwayman."

"Of course you won't believe it, Julian," Fleming had said, slamming down the manuscript on the middle of Caird's desk, "but I've been the perfect listener. I've heard every play that's been broadcast since you took over the job of directing them. And I don't mind telling you, most of them are rotten. I don't say this is a masterpiece, but it's strong dramatic stuff."

"Just tell me," Caird had interrupted, looking at Fleming shrewdly, "why you've taken the trouble to write the thing and bring it to me?"

"Not for what you'll pay me, certainly!" Fleming had retorted. "But I know what I'm doing. Leopold Dryden's accepted a play of mine, and is going to produce it at the Princess's in the autumn, and I've written this broadcast thing for him. If you do it, it's first-rate publicity for me and for Dryden as a combination.

"Besides, I'm only beginning to get my foot in as a playwright. I want all the advertisement I can beg borrow, or steal. All right, Julian, don't look so dreary. I'm not trying to palm nonsense off on you because I happen once to have known you rather well. This play's the goods compared with most of what you do. You can hack it about as you like, but I want a say in the casting, and I want to come to rehearsals. So long."

And he had lounged out of the office, leaving behind him an impression of elegance, amiability and cynical egoism. It had irritated Caird profoundly to find Fleming's confidence justified when he read the script of the play. For the play, of its kind, was good. There was no doubt about it. It told a good story, and it was cleverly adapted to the rather elaborate technique of the microphone, the dramatic control panel, and multiple studios. Rodney Fleming had evidently taken trouble to learn all there was to be learned about broadcast plays. And so the play had been accepted for production.

Someone knocked on the door of Caird's office and entered simultaneously.

"May I come in?" inquired Guy Bannister.

The head of Caird's effects section was a lean, spectacled youth, with a shock of untidy fair hair and a most misleading expression of melancholy. He had been Caird's fag at his public school, and accordingly was on rather more intimate terms with him than his official position in the Corporation warranted.

"Are you busy, Julian?"

Caird shook his head.

"Anything but," he observed grimly. "Sit down, Guy. Have a cigarette. What is it?"

Guy refused the proffered Egyptian, and took out a packet of gaspers.

"You know, Julian," he said, "I've been thinking about last night's business."

"You surprise me," murmured Caird.

"No—but bar rotting, I have—and I don't understand the methods of your friend the detective. Of course, it's all very well, this 'method,' and that sort of thing—and I don't pretend to know what's at the back of his mind—but——"

"Are you proposing to do his job for him, Guy?"

"Of course not. But there *are* one or two things. First of all, about that man Higgins."

"Well? Did Spears see him?"

"Did Spears see him?" repeated Bannister. "I should jolly well think he did. I had to stop till he'd finished, and it was almost exactly three o'clock when we left here. Of course, I wasn't in the room while he questioned him."

"Why?"

"Only this," said Guy, with the air of a conjurer producing a rabbit from a hat, "Higgins was supposed to be on duty on the sixth and seventh floors again this morning. Evans had a rehearsal call for the production of 'As You Like It' on Sunday week. Well, I know everything's at sixes and sevens—and there was that show in the Concert Hall—and if Higgins was grilled until the small hours of this morning it wasn't surprising that he wasn't on tap here at half-past nine. But I've just been up on that floor again. Higgins hasn't shown up at all to-day."

"Oh, he's probably overslept," said Caird.

"Of course, he might have," said Bannister. "But there's another thing which Macdonald's just told me. Did you know that Higgins had a flaming row with Parsons during the rehearsals of 'The Scarlet Highwayman'?"

THE PRINCIPAL CHARACTERS IN THE STORY

General Sir Herbert Farquharson	*Controller.*
Julian Caird	*Dramatic Director.*
Stewart Evans	*Programme Research.*
Desmond Hancock	*Balance and Control.*
Ian Macdonald	*Studio Manager.*
Guy Bannister	*Sound Effects Section.*
Joseph Higgins	*Studio Attendant.*

—all of the B.B.C.

Rodney Fleming, author of "The Scarlet Highwayman."

Leopold Dryden, Isabel, his wife (formerly Isabel Palmer), Sidney Parsons — Members of the cast of "The Scarlet Highwayman."

Central Inspector Simon Spears, of Scotland Yard.

There was a short silence, and outside in Portland Place a heavy lorry thundered past.

"Go on," said Caird.

"It was the third or fourth rehearsal," said Bannister. "The first day you stopped taking the cast in the studio and went up on to the Panel. As you know, Parsons had that scene in 7C to himself. Well, there's that regulation about taking hats and coats into the studio. Parsons, for some reason, chose to disregard it, went into the studio with his hat and coat, and put them on the sofa. It seems that Higgins saw them in there, and proposed to take them downstairs to the cloakroom."

"Well?"

"Well, Parsons abused him with a good deal of pretty filthy language, I gather. Told him to mind his own business, and pretty nearly threw him out. Higgins, very naturally and properly, went down to Macdonald in 6A."

"And he," said Caird, "very typically went to 7C, told Parsons not to be an ass, and didn't even bother to tell me there'd been any trouble at all."

"Exactly," said Bannister, and grinned.

Caird dropped the bitten penholder into his pen-tray.

"Yes, Guy, that's all very well," he said. "But are you trying to pin this on to Higgins?"

"I'm not trying to pin anything on to anybody," said Bannister. "But it's a bit queer. As you saw yourself when you went down from the Panel Room to 6A during the transmission, he wasn't on that door when he should have been. He didn't stay outside the studio on guard when you told him to. He was looking like death—and after being cross-examined by a detective he doesn't turn up this morning."

"He'd got a perfectly good story about his girl," said Caird.

"I should hardly describe it as either perfect or good," said Bannister. "But, then, you never had any morals, Julian, had you?"

Caird got up abruptly.

"Well, Guy, we can theorise as much as we like. Personally, I believe in leaving things to the police. It's their job. Though I suppose you could always track down the miserable Higgins, if you feel that way."

"I'm sorry if I bore you," said Bannister, moving to the door. "Perhaps I will take a cast in the direction of the Higgins' home. If I'm getting hot, I'll let you know. And look here, Julian, there's just one more thing. Did you realise that that performance of 'The Scarlet Highwayman' had been blattnerphoned for the Empire Service?"

"I know it, Inspector Spears knows it, and I imagine most of the London Press knows it by now," said Caird savagely. "What about it?"

"Oh, very well," said Bannister, opening the door. "I only thought it might be helpful and we might perhaps pick up a clue if we heard that strip of steel tape played over again."

"My dear Guy," said Julian Caird, "you're a capital chap, and I like you very much, but we're not all the blazing fools you'd like to make out. If you ask Ian MacDonald, he'll tell you that at the request of Inspector Spears, I have arranged for that particular blattnerphone recording to be played over again to us this evening in Listening Hall No. 1 at five o'clock precisely. If you're very good, and don't try any more to cast me for Dr. Watson, I'll ask Spears if you can come."

But Guy Bannister was impervious to sarcasm.

"That's fine, Julian," he said. "I'll be there."

And as was his usual custom, he slammed the door behind him.

Isabel turned, and Spears stood up and held out the letter towards her.

For an instant she stared at it, and then her brown eyes widened with stark terror.

XI.

VOICE FROM THE DEAD

THE special re-play of the blattnerphone recording of "The Scarlet Highwayman," arranged at the request of Inspector Spears, did not take place at five o'clock that afternoon after all. An actor might have died in a studio and Broadcasting House might hum with rumours and theories, but the service supplied to its listeners by the British Broadcasting Corporation had to be continued without pause or qualification.

It was sufficiently bad that the second performance of the play on the National wavelength had had to be postponed and a substitute found, and that the majority of the personnel of the Dramatic Department, either from shock or curiosity, had been rendered almost incapable for the time being of carrying out their normal functions. Any further disorganisation of routine was out of the question. As the blattnerphone machines were in particular demand for the Empire Service, Caird was instructed to ring up Spears and ask him if he would mind if the re-play was postponed until later that night, when one of the machines would be free. And to this Spears, who was very fully occupied with various other aspects of the case, consented.

It was therefore a little after eleven o'clock when he returned to Broadcasting House and was immediately conducted to Listening Hall No. 1 where he found waiting for him the Controller, Caird, Desmond Hancock, Guy Bannister, Rodney Fleming, and Ian Macdonald. It was a silent, uneasy gathering that he found. Even the general's geniality had worn thin under the day's strain. The governors had been difficult; the Press entirely damnable; and he was not pleased at the prospect of a second late night. Attempts by Caird and the irrepressible Bannister to promote light conversation had failed dismally, and Rodney Fleming alone seemed at his ease. He sat rather apart from the others, very dapper in his double-breasted dinner jacket, with his carefully brushed smooth black hair, and a slightly cynical smile on his face behind the smoke of his cigarette.

"Ah, here you are, inspector," said the general. "Come along, Caird, ring up Control Room and let's get on with it. I confess I can hardly see myself what you expect to get out of this—er—experiment." And he glared at Bannister through his glass.

Caird vanished into the telephone box.

"I imagine it's only that one scene—the murder scene—that you want," drawled Fleming.

Spears nodded.

Caird reappeared, crossed to the loudspeaker and switched it on.

"It'll be through in a minute, sir."

"Was it quite necessary for all these gentlemen to be present?" asked the general.

"I left it to Mr. Caird to decide who should be present," said Spears.

"Well, Caird?"

"Well, sir, as you know, I was not in the Panel Room at the moment when the tragedy occurred. I was down in 6A, talking to Macdonald about the failure of the return light. So I thought Hancock should be here, as he heard the actual scene played. Bannister and Macdonald are more accustomed to hearing blattnerphone recordings than anyone else, as part of their regular work, and they might spot something that a casual listener would not. I invited Mr. Fleming, as being the author of the play, and because he, too, was present at the performance last night."

"You mean in the Dramatic Control Room?" said the general.

"No, sir: in the 6A Listening Room."

"Why was he there, Caird? I thought you made such a point of never admitting anyone to those listening rooms except on staff business."

"Well, sir, the Panel Room's about the worst place for an author to listen to his play, with all the distractions of knobs twisting and switches flicking."

"And the producer swearing," put in Fleming gently, from his corner.

The general smiled, and Caird was encouraged to go on.

"In the normal course of events I would have put Fleming into this Listening Hall, but as he happened to be expecting an urgent telephone message, and they could put it through easily to the 6A Listening Room, I put him in there. Besides, there's another thing, sir. Fleming was very anxious to see how some of the play was done in a studio, and that Listening Room is the only place where you can both hear the whole of a broadcast play and simultaneously watch such scenes as are played in 6A studio through the glass panel."

"I see," grunted the general. "It seems to me very irregular, and I don't think it had better happen again. What's happened to this infernal tape?"

The loudspeaker answered him. There was a curious low hiss, a sound very similar to that of a gramophone record working up to normal speed, and then the music of a minuet against a background of chattering voices filled the Listening Hall.

"What's that?" asked Spears.

"The end of the previous scene," said Caird. "The ballroom scene which was played by the cast in 6A, with its music coming from the orchestra in 8A. It was because I got no return light from the conductor in 8A that I was afraid the return light from 6A might have gone, also. That was why I left the Panel Room and bolted down to see Macdonald."

"We must have another talk about the complications of all these studios a little later on, Mr. Caird, if you don't mind," said Spears. "I haven't got the hang of it yet——"

"Ssssh!" said Guy Bannister suddenly. "Now for it! Listen, everyone."

The chatter and the minuet faded away, and there was a little pause.

"That's where I faded over from 6A and 8A into 7C," whispered Hancock. "Where Parsons was."

For a few seconds there was only the hiss of the running of the steel tape. Then a whining, cockney voice, vibrant with passion, echoed weirdly through the darkened room. Almost furtively, Caird looked round at the faces. Which of them, he wondered, shared his own feeling of horror—almost of incredulity—as they listened to this voice of a dead man—a man most of them had seen alive and well a little over twenty-four hours ago, and whose corpse now lay on a mortuary slab under police guard? To Caird there had always seemed something repellent and almost indecent about the attempts of spiritualists to pierce the veil of the hypothetical after-life, and to drag back the voices of the dead to make suburban holidays over ouija boards and equivalent tomfooleries.

Neither had he ever been able entirely to reconcile himself to the continued use, for purposes of entertainment, of the gramophone records of the voices of celebrated artistes after their deaths. And though he had suggested the re-play of this blattnerphone record of Parsons' murder, now that he actually heard it, he experienced both fear and disgust, combined with an overwhelming conviction that the use of such a method must be unlucky and might well be something worse.

The general sat bolt upright, fingering his moustache. Rodney Fleming stubbed out his cigarette, but otherwise displayed no emotion whatsoever. Guy Bannister leaned forward in his chair, his spectacles half-way down his nose, his hands gripped together with excitement. Macdonald and Bannister shared that expression of mingled strain and enjoyment common to people in a theatre or a concert-hall. The whining cockney voice shrilled to the climax of its final speech.

". . . Didn't I tell yer we'd get yer one day? Didn't I swear the day yer rolled me over in the mud that I'd get even with yer?" A pause, and then "Good 'eavens! You——"

A gasp, a frightful, choking gurgle, and then for a few seconds the hissing of the steel tape. That died away in its turn, and Caird crossed to the loudspeaker and switched it off.

"I think that's all we wanted," he said. "After that we went back to the continuation of the ballroom scene."

For a few moments no one spoke.

"Well," said Rodney Fleming at last, taking out his cigarette-case, "I call that pretty gruesome."

"Well, inspector, is there anything more we can do for you?" asked the general.

"I don't think so, thank you, sir," said Spears. "Except that I should like that bit of tape sealed up and kept so that I can hear it again if I want to. Can that be arranged?"

The general lifted an eyebrow.

"Certainly," he said. "If you really want it. I'll give instructions to the blattnerphone engineers myself. Naturally I'm not going to ask you, now, if you learned anything from this experiment, but I would be glad if you would telephone me in the morning. Good-night to you all."

He got up and marched out of the Listening Hall.

"Oh, curse all this Sandhurst-and-Staff-College good mannery!" burst out Caird, as the door closed. "*Did* you get anything out of it? Personally, I was nearly sick. Poor little blighter!"

"I'm not sure," said Spears. "It rather depends on one or two things which you may be able to tell me. But first of all, I know Sidney Parsons was little, but you're the second person to-day who's spoken of him pityingly."

"He was obviously hard up," said Caird, "like most actors who are down on their luck. And in spite of *de mortuis* and all that, he wasn't a very nice creature. You know how matey actors are with each other? Well, he always sat by himself at the early rehearsals, and usually looked savage as well as seedy."

"Hum," said Spears. "Now, about this recording. If I'm to get any help from it, you must tell me a thing or two. First of all, did anything in it surprise you? You first, Mr. Caird."

Caird rubbed his jaw.

"I don't think there's anything I can say. But, then, when you produce a play, the whole thing gets so infernally familiar to you that you end by only being able to listen to it with half your intelligence. The only thing that really struck me about the scene was that I've never heard it played half so well. I could never make Parsons put anything into it before. But this time, as Hancock told me last night, the goods were delivered."

"In the circumstances, hardly surprising," said Spears grimly. "How about you, Mr. Fleming?"

The latter shrugged elegantly.

"All authors are the same, inspector. They only notice one thing:

the way in which actors and producers mutilate what they write."

"What do you mean?"

"It's obviously quite unimportant, but as I wrote the scene, after 'I'll be even with you yet' there was simply a pause, then 'You, the Scarlet High——' and then the gurgle as the gaoler was strangled."

"I thought this might arise," said Macdonald coolly. "I brought down the script with me."

"Hang the script!" said Caird. "Rodney's right. I know what authors are. I cut 'the Scarlet High——' myself. I thought it weakened the end of the speech."

"Do you mean to say," said Fleming, "that 'Good 'eavens' doesn't weaken it disgracefully?"

"I never put that in," said Caird. "Oh, I remember. Parsons asked me to let him have an exclamation just before the word 'you.' We had rather a row about it."

"A row about it?" repeated Spears. "How was it left finally?"

"He asked me to let him try it at the last rehearsal. I did. Needless to say, he promptly used 'Good God!' I told him he mustn't."

"Why was that?"

"Inappropriate and unnecessary," said Caird. "That's all. I see what happened. He started to say 'Good God!' last night, remembered I had told him he mustn't, watered it down by substituting ''Eavens!' for God.'"

"And," interrupted Fleming, "promptly paid the penalty for misreading the author and disobeying the producer, with his life."

"Shut up, Rodney!" said Caird.

Spears had taken the script of the play from Macdonald, and was making pencil notes in the margin.

"Anything else?" he asked.

"Yes!" burst out Guy Bannister.

"Didn't you hear it?"

"Hear what, Guy?"

"Immediately on top of the strangling?"

"There was nothing to hear."

"There was. And I heard it. You must have heard it, Macdonald, surely?"

The Scotsman shook his head.

"I was listening very carefully," he pronounced.

"I tell you there *was* something," said Bannister, getting up. "Only I can't tell you what the dickens it was."

"Why not try to describe it?" said Rodney Fleming, yawning.

"Don't know how to," said Bannister. "Might have been anything. I'm sorry to seem such an ass, inspector. But you see, in this Effects job of mine I know how different a thing can sound over the microphone from what it really is."

"Go on," said Spears. "Take your time."

"You see, in the old days when we started with sound effects, we did our best to make the real noise in front of the microphone. At Savoy Hill, I believe it's true that people fired blank cartridges along the corridors, and even assembled the greater part of an aeroplane and then dropped it from the ceiling of the studio to get the effect of an aeroplane crash. Now we know better. We wreck ships by crumpling matchboxes, and create avalanches with a drum and a few potatoes."

"Very interesting," said Spears. "But——"

"Well, that's why I can't put an exact name to what I heard. If I give it a name, I may put you entirely on the wrong track, but I'll tell you what I think I heard. *I believe it was the ticking of a watch.*"

There was a short silence.

"Sidney Parsons had not got a watch," said Ian Macdonald."

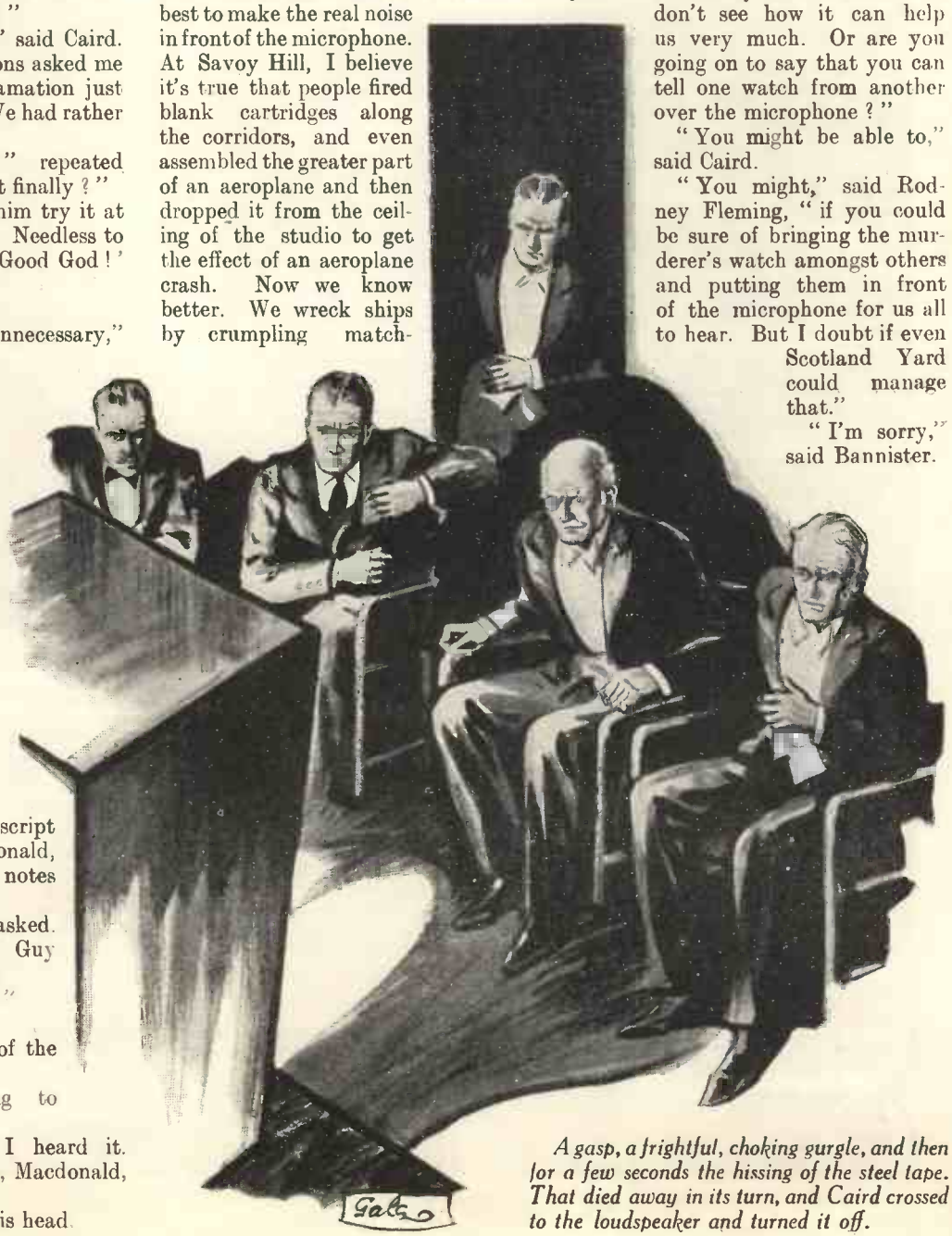
"Yes, don't you see?" said Bannister. "That's the murderer's watch we heard ticking."

"Thank you, Mr. Bannister," said Spears. "I call that pretty smart of you. But frankly at the moment I don't see how it can help us very much. Or are you going on to say that you can tell one watch from another over the microphone?"

"You might be able to," said Caird.

"You might," said Rodney Fleming, "if you could be sure of bringing the murderer's watch amongst others and putting them in front of the microphone for us all to hear. But I doubt if even Scotland Yard could manage that."

"I'm sorry," said Bannister.



A gasp, a frightful, choking gurgle, and then for a few seconds the hissing of the steel tape. That died away in its turn, and Caird crossed to the loudspeaker and turned it off.

"Don't be sorry, Mr. Bannister. These things may not be helpful right away, but they often turn out trumps in the long run. Have you any other ideas?"

Caird laughed.

"Go on, Guy!"

"No," said Bannister. "I *have* another idea. But I think, if you don't mind, I'll keep it to myself for the present. Coming, Macdonald? Good-night, Julian."

"Are you going back to Scotland Yard, inspector?" inquired Fleming. "If so, I can give you a lift. What about you, Julian?"

"I'll walk, thanks," said Caird. "There's something I want to do in my office before I leave. I'll just let Control Room know we've finished down here."

XII.

CAIRD ACTS ON IMPULSE——

ONCE more left to himself, Caird wearily climbed the staircase inside the tower to the fourth floor of the building, passed through the door leading from the tower into the outside corridor, and made his way to his own office. There, he sat down at his desk, lighted a pipe, and not for the first time wished that it was possible to obtain a brandy-and-soda within Broadcasting House; which it was not. He felt tired, depressed, and quite feverishly worried.

For the more he thought about it, the more certain he felt from Spears' attitude that, in spite of the blattnerphone replay and other types of further investigation which might be put in hand, the detective was not really taking any of them very seriously. To Caird, a man of strong nervous imagination and a carefully cultivated dramatic instinct, it seemed clear that Spears had made up his mind. And if he had made up his mind, suspicion must be definitely fastened upon one of two persons. These two persons were the studio attendant, Higgins, and Leopold Dryden.

Absent-mindedly, Caird took up a blue pencil and began to draw fantastic diagrams on his blotting-pad. It was only about a quarter of an hour later that he realised what he was doing and recognised it for several extremely inaccurate attempts to reproduce the ground-plan of the studios on the sixth and seventh floors.

As to Higgins, unfeeling though it might sound, Caird did not mind particularly either way. Naturally he was sorry for him. It had been painful to watch his cringing embarrassment in the martial presence of the Controller. But that story about the girl in the canteen had been as thin as tissue paper; and then there was Bannister's story of his quarrel with Parsons during rehearsal and the fact that he had never appeared at Broadcasting House at all that day.

Caird wondered if Spears had put plain-clothes men on his track already, and shivered a little at the thought of Higgins, shabby and hollow-cheeked, skulking through the meaner streets of the West End with hell in his heart and a hard-faced man in a bowler hat always twelve yards from his elbow.

Still, if Higgins were guilty, the sooner he was caught, gaoled, and hanged, the better; for until the criminal was disposed of existence in Broadcasting House was going to be no joke. Already that day, people were beginning to look at each other in a most curious fashion, and for the first time Caird faced up to the realisation that his unfortunate absence from the Dramatic Control Room during those essential five minutes—a period during which he had passed the door of the studio in which the crime had taken place—must put himself on the list of suspects, however low down on that list. It would be intolerable to have to spend weeks in wondering, every time anyone glanced at you at all singularly, whether you were being regarded as a possible murderer.

And then alternatively—Leopold Dryden. What the devil was Leo doing to be such an idiot; to stand on his dignity and "get fresh" with the police? Caird did not believe for one second that Dryden had done it. He lived far too vitally in his own histrionic world of make-believe to touch stark reality in the commission of murder. But why had he chosen those same five minutes in which to feel ill and absent himself from the studio? For Leopold Dryden personally, Caird did not give two straws, though he had a genuine love of the theatre, and therefore could not contemplate with equanimity the removal of the finest romantic actor of his day, however much of a bore he might be personally. But there was Isabel to be thought of, and that was quite a different story.

For Isabel Caird cherished a long-standing and entirely sentimental affection; sentimental because based on an entirely conventional beginning. Caird had first seen her when he was an undergraduate, and she was the "baby" of a celebrated chorus at the Gaiety. He had gone to watch her across the footlights again and again, with a queer, half-ashamed devotion altogether inexplicable. He had only met her three years later, when she was already engaged to Leopold Dryden, and he had never got to know her particularly well. But the streak of romantic weakness for her persisted, and he always thought of her as hardly more than a child, very lovable and touchingly helpless. He had not meant to cast her in "The Scarlet Highwayman," for Rodney Fleming, who knew the Drydens well, had warned him that their domestic waters were not invariably smooth, and that Leopold was inclined to indulge a weakness for making scenes either with or in front of his wife. But Dryden had made her engagement a condition of his own, and so it had been arranged. That she was in love with her husband, no one, however obtuse, could fail to see. And to Caird the thought that she might have to face Leopold in the dock on a murder charge was grotesque and horrible.

He looked at his watch. It was nearly two o'clock in the morning. Caird had intended to do some work, but imagination and speculation had got the better of him, and it was obviously impossible to think of it at that time of night. And then suddenly an idea struck him. It was something the police surgeon had said—his assertion that Parsons had been strangled by someone wearing gloves. What had happened to those gloves? Had the murderer taken the risk of just slipping them into his pocket, when the crime might have been discovered at once and a general search instituted? Or had he got rid of them—hidden them somewhere? If so, where? It might be a ridiculous speculation, but had Spears appreciated the importance of those gloves? Had they been looked for specifically? As he considered the point, Caird became certain of one thing: that he could not go home to bed without making sure that those gloves were not tucked away somewhere in 7C, or in its immediate surroundings. He would go up to the studio right away and see for himself.

He started. The building was very silent; the vast corridors were dimly lighted. Broadcasting House seemed to brood, sombre and immense, over its secret. On his way towards the studio tower, the shadowy form of a cat skulked past him and vanished—a shadow among the other shadows—making him jump and swear softly to himself. At the end of the passage

he ran into the fireman making his rounds.

"You're very late, sir," said that worthy cheerfully. "I see that cat gave you a bit of a jump. Cunning little devils. There're still two of 'em we've never been able to get 'old of out of that lot that came to live 'ere when the place was building."

"Anyone left in the tower?" asked Caird.

"Empire announcer in 3A, sir. That's all. Were you going to the studios, sir? I'm afraid there are no lights in the tower above the third floor."

"Oh, that's all right," said Caird. "There's something I left in 7C this afternoon. Don't bother about the lights. I've got a box of matches."

The fireman groped in his capacious pockets.

"You'd better 'ave this electric torch, sir. I always carry a spare."

"That's very good of you," said Caird. "Thanks. Don't you find the building a bit gloomy late at night?"

The fireman laughed.

"Gloomy, sir? Nice and quiet, I calls it. Gives me opportunities to do a bit of thinkin'. I live up St. Pancras way, sir, and you don't get much quiet there, I can tell you. I'm not what they call a nervous type, sir."

"You evidently aren't," murmured Caird. "Thanks for your torch. I'll leave it for you at the reception desk in the morning. Good-night!"

"Good-night to you, sir."

And with a parting salute, the fireman passed through the swing doors and down the staircase beyond them, leading to the third floor.

Caird clicked the torch on and off to see that it was in working order, and then made his way into the studio tower. At that time of night the lifts were no longer working. Everything was dark, silent and—to Caird, who knew the studio tower as a hive of continuous, almost feverish activity between half-past nine in the morning and half-past ten at night—disquietingly unnatural. He began to feel the impulse which was drawing him towards Studio 7C to be due either to rank folly or to blatant neuroticism. But then he wondered whether the fact might not be that he was a little scared. That stiffened his lip and confirmed his decision.

Evans uttered a little cry of satisfaction, scrabbled behind the newspapers and dragged out a pair of brown leather gloves. "They're Leopold Dryden's," he sneered. "Fancy having things like that made for you!"

and with the torch throwing a patch of white light in front of him, he went up the three flights of the studio tower staircase that lay between the fourth and seventh floors. Though he did not realise it at the time, he did a curious thing. He walked quite noiselessly on tiptoe, almost as though he knew subconsciously that the quarry waiting for him in the studio might be something considerably more exciting than a pair of gloves.

At the top of the stairs he paused for a moment. Three steps to the left brought him to the swing doors leading to the passage that ran directly through the tower; the passage along which he had hurried the night before on his way from the Panel Room to Studio 6A, the passage whose farther end Higgins should have guarded. Apart from the doors at each end of it, its length was further divided by two heavy swing doors which, when shut, converted its central section into a triangular listening room, from which, through three glass panels, a studio manager could keep an eye on the happenings in Studios 6A, 7B and 7C almost simultaneously. But all these doors had circular glass panes let into their upper parts, so that it was possible to see from one end of

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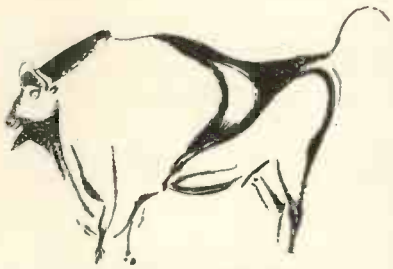

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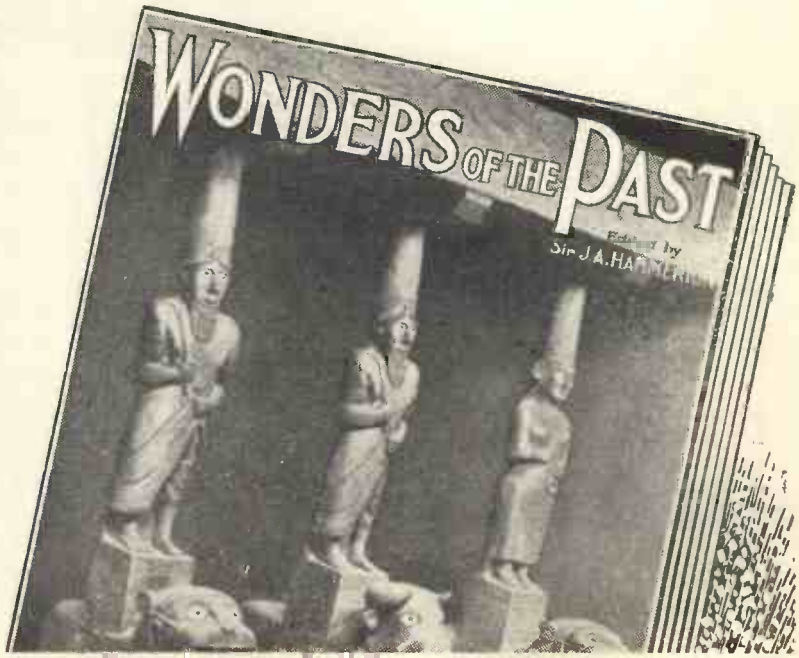

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the passage right down to the other. Now after what the fireman had told him, Caird had expected to be able to see nothing beyond the glass panel of the first door but blank darkness. What he did see was a light, not flickering, but moving steadily to and fro somewhere in the triangular listening room. He snapped out his own torch and stood still, watching and listening. He could hear nothing. There were two doors, practically soundproof, between him and the moving light, and apart from the light he could see nothing. But he knew it was very much his business to get so as to be able to see more; that it was almost inconceivable that two people should have had the same idea of poking about for clues in 7C in the small hours of the morning.

Caird put his torch into his pocket, very gingerly opened the double doors wide enough to slip through, and stole along the passage, cat-like, hugging the left-hand wall and hardly daring to breathe. Through the second door the light now glowed steadily, as if the unknown had found what he wanted and had settled down to examine it. And now Caird felt himself hot on the trail of the murderer, with the very stink of death in his nostrils, as he paused, quivering all over with excitement, his body braced against the door leading to studio 7C on his left—quite dark and undisturbed—6A Listening Room on his right; a few feet in front of him the second passage door, and behind it the mysterious light.

Without giving himself time to wonder too precisely how to act next—for he rather doubted his ability to face up to a purely physical emergency—he wrenched the door open and sprang forward. The light came from an electric torch standing on a fixed table let into the angle of the walls of 7B and 7C, and in its rays stood a man crouched up against a cupboard let into the wall of 6A. As Caird opened the door, there was a startled exclamation, and a snap. The man jumped back, the cupboard door opened, and Caird found himself facing Stewart Evans breathing hard, with a chisel in one hand and a bunch of keys in the other!

XIII.

—AND GETS NO CHANGE

"WHAT the devil are you doing here, Evans, at this time of night?" demanded Caird, when he had recovered sufficiently from his amazement to find his voice. He had anticipated a good many possibilities, but they did not include Stewart Evans with all the appurtenances of an amateur cracksman.

Evans seemed considerably the cooler of the two. He slipped the bunch of keys back into his pocket, and laid the chisel carefully on the table beside his electric torch before bothering to reply. When he spoke it was in his usual affectedly insolent tone.

"Suppose I ask you the same question?"

With extreme difficulty, Caird kept his temper.

"I don't propose to enter into a slanging match," he said. "Departmentally, I am responsible for what you do inside this building. Programme Research covers a wide field, I know, but I'd be glad if you'd tell me what form of research involves breaking into cupboards in the small hours of the morning?"

"Well, of course, if you're going to drag in administrative red tape——" Evans began.

"I'm not dragging in anything," Caird persisted. "But you'll tell me, unless you prefer to explain to the Controller in the morning."

Evans scowled.

"He might like to have the same sort of explanation from you, Caird. As a matter of fact, I haven't the least objection to telling you. Criminology happens to be a hobby of mine."

"Yes," said Caird, "you've told me that on several occasions. Well?"

"Well, you couldn't expect me not to take advantage of it when I find a murder committed in the building where I actually work," said Evans. "It's a chance in a million. I had always thought the police force in this country was an extremely overrated organisation. They are neither practical, like the French, nor psychologically up to date, like the Austrians. They simply work by rule of thumb. I've seen evidence of that again and again. Now I'm taking the opportunity of proving it."

"What do you know about the case, anyway, Evans? It's no business of yours."

"As much mine as it is yours," retorted Evans. "Or are you pretending that you came up here to see if any more dead bodies of actors were lying about in your precious studios? Or to investigate whether rats and mice frequented them during the night? You may as well admit that you came up here to-night to do a bit of amateur detecting."

"Why I came up here is entirely my business," said Caird. "Owing to a set of most unfortunate circumstances, which I would most willingly have handed over to you, I found myself bang in the middle of this revolting business. I can't help knowing as much about it as anyone. But you had nothing to do with the broadcast of "The Scarlet Highwayman."

"No," said Evans. "You had the sense not to allot that sort of tripe to me to produce. But, as I say, I'm *interested* in crime, and after I left last night, I got hold of one of the police photographers. Efficient or not, he was certainly corruptible. It only cost me ten bob to get a very fair *résumé* of the police surgeon's report on the finding of the body."

"We'll leave that for the moment," said Caird. "What were you playing at with that cupboard?"

"It happens," said Evans, "to be Higgins' cupboard, in which he keeps his studio-cleaning materials and odds and ends."

Julian Caird started.

"Higgins' cupboard? What's Higgins got to do with it?"

"Oh, I know they've been grilling Higgins," said Evans wearily. "And he didn't turn up for duty to-day."

Mentally Caird cursed Bannister's cheerful garrulity.

"I thought it would be worth looking into—the cupboard, I mean," Evans went on. "I've noticed that, as a rule, he leaves the door just ajar. And to-day I spotted that it was shut—locked. It's self-locking. Don't bother to ask me how I know all that. I happen to be naturally rather observant."

Caird bit his lip.

"But what did you expect to find in the cupboard?"

"If you must know—a pair of gloves."

"A pair of gloves?" stammered Caird. "Look here, Evans, are you trying to pin this thing on to that poor devil Higgins?"

"Higgins? Ridiculous!" said Evans contemptuously. "He's hardly got the strength to clean out a studio, let alone strangle a man. Besides, if Higgins had done it, I shouldn't be looking for the gloves in his cupboard. Unless he was insane, it would be psychologically impossible for him to have put them there. Yes, and don't bother to quote that at me about every murderer's one mistake, will you?"

"I wish you'd try to be civil for two minutes, Evans. It won't get us anywhere to spit and snarl at each other like a couple of cats on a wall! After all, we both want to get to the bottom of the thing, if we can.

Though I don't share your views with regard to the police, we know more about the inside of Broadcasting House than they do. We *might* be helpful. What made you think of the cupboard in the first instance? And whose gloves do you expect to find inside it, if they don't belong to Higgins?"

"I'm sorry," said Evans ungraciously. "I suppose I'm not very matey," and the scorn with which he emphasised the word made Caird smile. "I thought of the cupboard because, as I told you, its door is nearly always ajar. That's probably because Higgins is lazy and is in the habit of forgetting his keys. Well, I learned by means of my bribery and corruption that the strangling is supposed to have been done by a man with gloves on. Now, the man who planned this crime and carried it out must have been fairly strong, very quick, and very intelligent. He certainly wouldn't have been such a fool as to keep the gloves in his possession a second longer than was necessary. He wouldn't leave them in the studio, because every inch of it would be bound to be searched. He could leave 7C by two doors; either through the door which leads into 7B, or by the ordinary door into the passage. I thought the latter. The door into 7B is solid; the one into the passage has a circular glass panel in it, and he could be sure that the coast was clear. He had obviously reconnoitred the ground very carefully. In that case, he must have known that on leaving 7C by the door into the passage, he only had to push open the swing door into the triangular listening room with his left hand for the open door of that cupboard to be within arm's-length. To dump the gloves inside, and slam the door might add five seconds to his time, not more. It would be worth it."

Caird nodded. In spite of his personal antipathy to Evans, he had to recognise that the reasoning was cogent, clear and sensible.

"He could reasonably hope to count," Evans continued, "on Higgins being the first to reopen the cupboard. He wouldn't be looking for gloves, would he? He'd probably do the obvious thing, on finding a pair of expensive gloves in the cupboard. He'd take them to a pawnshop. Then, either they would be forgotten among the usual jetsam of those establishments, or else—if the police are as efficient as they make out—Scotland Yard might have got to know of them, and Higgins would have been for the high jump. In either case the murderer's on velvet."

"All right," said Caird. "You've almost convinced me. But the point is, are the gloves there?"

He turned to the cupboard, but before he could look inside Evans had snatched up the torch, pushed past him, and flashed its rays along the shelves. There was an accumulation of dust; some brushes, a pile of newspapers, and a collection of dusters. And for a moment Caird thought he would have the supreme satisfaction of seeing Evans' theory falsified to his very face. But at that moment Evans uttered a little cry of satisfaction, scrabbled behind the newspapers and dragged out a pair of brown leather gloves.

"There you are!" he said.

"Good for you," said Caird, trying his best to make his voice sound cordial. "The next thing is, whose are they?" But his heart sank as he spoke, for he knew very well the owner of those expensive gloves of dark brown leather. They were unusually small for a man's gloves. They had scalloped gauntlet wrists, and a good deal of rather exotic black stitching on their backs. And, unfortunately, it was impossible that more than one man in London could wear gloves like that. But it was possible that Evans might not know who that man was. . . .

"That question's easily answered," sneered Evans. "I should have thought *you* would have known, at any rate, with your wide circle of theatrical friends. They're Leopold Dryden's gloves. Affected, extravagant idiot! Fancy having things like that made for you!" And he flipped the gloves with his fingers.

"A man can be affected and extravagant without committing murder," said Caird. "Are you seriously trying to make me believe that you suspect Leopold Dryden?"

"Suspect him? It's as plain as a pikestaff. He's got just the sort of limited intelligence combined with colossal vanity that all the showy murderers have. Look at Mahon. I shan't shed any tears for him. Rude, domineering brute! He can't even be civil to a guest in his own house."

"Oh, rot!" said Caird angrily. "Leo's got his faults, like most actors. He *is* rather vain, and he's liable to be temperamental and difficult. But he's quite a good chap, if you take him the right way."

"I'm afraid we've got different standards, Caird. I don't call a man a 'good chap' when he makes scenes with his wife in front of her friends—humiliates her, and makes them feel uncomfortable. A man who behaves like that is a cad, I don't care how good an actor he is!"

"Well, don't finger those gloves more than you can help," interrupted Caird sharply. "I'm seeing Spears to-morrow, and I'll hand them over to him. But I never knew you were a friend of—Isabel's."

"You're not omniscient, Caird. I've known her for some time. I think I can say that I know her considerably better than you do."

"Well, we needn't argue about

"DEATH AT BROADCASTING HOUSE"

—continued

that. If you're a friend of hers also I don't imagine you want to do anything to cause her unnecessary pain. Look here, we've obviously got to hand these gloves over to the police, but I don't see why we should tell them that we know they belong to Leopold Dryden."

Evans put his hand down on the gloves. Leaning forward a little, and with his lips curling so that his teeth were partly bared, he gave the impression of an animal crouching to bite.

"Don't take too much upon yourself, Caird," he said fiercely. "I know what I'm doing, and it doesn't come within the scope of your department. I'll take these gloves to the police myself, and I'll tell them what I like! As for giving Isabel pain, it would be the best thing that had ever happened to her in all her life if Leopold Dryden were hanged as high as Haman!"

He thrust the gloves into his pocket, snatched up his torch, pushed open the other swing door of the triangular listening room savagely, and disappeared, leaving Caird alone in the darkness listening until his footsteps had died away along the passage.

(*To be continued next month.*)

LOOKING BACKWARD IN TIME

A great work on wonders of the past.

WE are inclined to think that our modern world, with its wonders of wireless and television and so on, is unique. Of course it is, so far as these particular wonders are concerned. But there were wonders of the past just as marvellous in their way as those which stagger us to-day.

We often speak of the Seven Wonders of the Ancient World, but there were far more than seven. There were literally hundreds, and we ought to know something about them if we are to appreciate rightly the life and history of past centuries, as well as those of the present time.

The great art of building magnificent palaces and temples and cities was understood and practised far more in ancient times than in modern, for the wonders of the past were mostly in the sphere of building.

We do not have to rely merely upon written descriptions to know how marvellous they were. In almost every land men are to-day uncovering these buildings, and we can see how gloriously the ancient Babylonian and Assyrian and Persian and Egyptian and Greek and Roman housed themselves and their gods. We can gaze upon their masterpieces, which have been buried in the earth for centuries, but are now being brought to light by the archæologist.

It must indeed have been a marvellous world all those centuries ago, and we may learn all about it in a great new work which has been prepared telling us of the glories of the Ancients.

Available for All

This book is called WONDERS OF THE PAST, and is edited by Sir J. A. Hammerton. It gives descriptions, with magnificent illustrations, of the walls of Jericho, the palaces of the Romans, and the homes of people of many races. The work is of enthralling interest, and has 2,000 illustrations, including 60 magnificent colour plates. No such book has ever been prepared before, and it is being made available for all, for it is issued in 52 weekly parts at sixpence.

Place an order for Part 1 (on sale Thursday, November 2nd) with your newsagent, and you will realise what a fine record this great work is.

THE DETECTOR STAGE

—continued from page 434

The anode current of the valve follows the fluctuations of grid voltage, and so on smoothing out the H.F. we get an almost distortionless L.F. output. To get this, however, it is necessary to adjust correctly.

Choosing the Grid Leak

Thus the grid leak resistance must be such that, used in conjunction with the grid current characteristic and the correct bias voltage, it gives the straight line curve showing, and also the input must not be allowed to exceed the value at which the curve begins to bend over. Usually 1-meg. grid leak and zero bias will be suitable with a maximum H.F. input of 1 volt.

For power grid detection the anode voltage is increased and the resistance of the grid leak decreased, so that a greater input voltage can be handled without distortion. Some grid bias is usually advantageous in this case in order to reduce the anode current.

The grid-leak detector imposes a moderate load on the preceding H.F. stage, but it is not serious unless the input is too great, in which case the damping is excessive.

To sum up: the detector to use for distortionless detection for any reasonable input voltage is the diode valve or H.F. metal rectifier, its limitations being that it does not give any amplification and so must be followed by an L.F. stage before the output valve. The anode bend detector provides this amplification and can handle a fairly large input voltage, but distortion is always present. The grid-leak detector gives plenty of amplification and almost distortionless detection, but it can only cope with small input voltages.

HOW TO GET THE LAST OUNCE FROM THE K4

—continued from page 396

again with the aid of reaction, and it is in connection with this adjustment that I have a hint to offer.

First, set the tone-levelling control at the maximum brightness end, i.e. turn it fully to the right. Now adjust the reaction and volume controls *simultaneously*. A little practice will enable this to be done without any apparent change of volume, all that occurs being a steady drop in tone and a gradual disappearance of the interference. When the desired condition has been achieved, make a final check by ear on the setting of the tone-leveller, and the operation is complete.

THREE AMERICANS ON AN INDOOR AERIAL

Remarkable Transatlantic Reception on the K4

At approximately 5 a.m. on the morning of the 13th October, Mr. Kendall received at good loudspeaker strength, stations KDKA and WGY, and at somewhat lower strength another medium wave station, which although undoubtedly American, was not identified. The respective dial-readings were 102, 133 and 147.

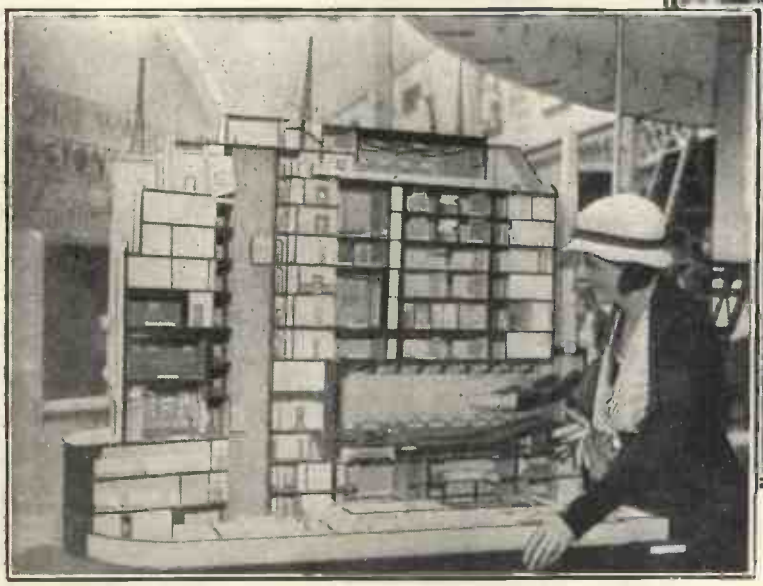
If you set about it in the way I have suggested, you will find the whole business takes only a few seconds; yet it is something which can be done with no other receiver, just as correctly balanced tone on all stations can be given by no other set of less than five or six valves.

HERE— THERE AND EVERYWHERE

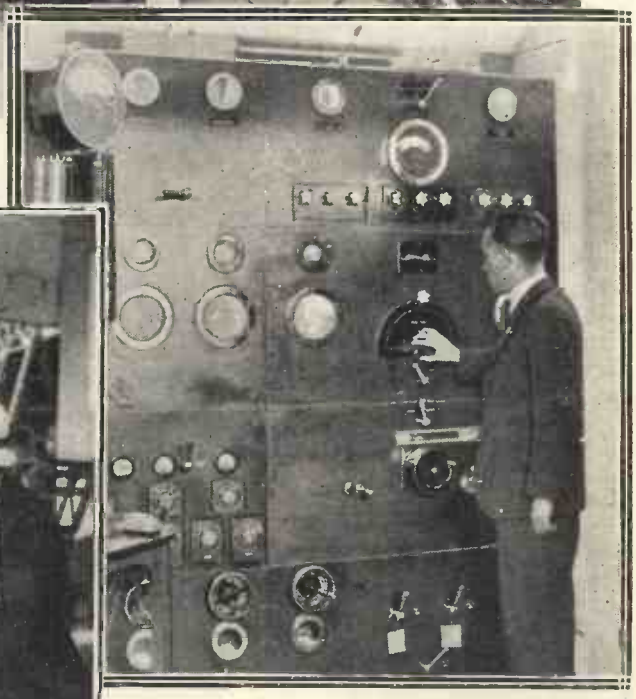
Radio news in pictures

SAMUEL SPITZ, retired officer of the U.S. Navy, with the apparatus he has invented for locating aeroplanes with coloured lights on a map. Mr. RUDYARD KIPLING (left), who, after many refusals, was at last persuaded to speak into the microphone at a recent luncheon in London.

ZOO STARS arriving at Broadcasting House for a rehearsal of a television programme. A lizard, a cockatoo and a monkey were included in the party.



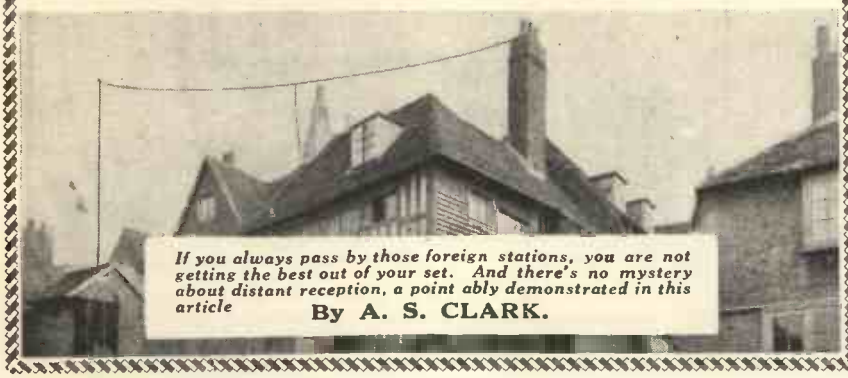
BROADCASTING HOUSE in miniature, seen this year at Radiolympia. It is a perfect scale model showing the exterior and interior planning of the hub of British broadcasting.



THE NATIONAL PHYSICAL LABORATORY is always in the forefront of radio research and progress. This transmitter has recently been installed in the Teddington (Middlesex) Laboratory for studying the properties of the upper ionised layers. One of its features is an ability to change its wavelength in 30 seconds.

MAKING A START IN

DISTANT LISTENING



If you always pass by those foreign stations, you are not getting the best out of your set. And there's no mystery about distant reception, a point ably demonstrated in this article

By A. S. CLARK.

"OH, that's some foreign station." What a common remark, and how often it is followed by the rapid turning of the tuning knob until some British station, generally one of the locals, is brought in!

It is usually the user of a commercial receiver to whom all distant stations come under the category of "——some foreign station." Most home constructors are aware of the interests of distant listening, and so this article is written mainly for those non-technical listeners who look upon the intelligent tuning-in of foreigners as a closed book so far as they are concerned. If it succeeds in persuading a few that distant reception is simple and worth while, it will have served its purpose.

Dial Readings

The first thing, and almost the last, that has to be grasped is the meaning and object of the figures on the tuning dial. Of course, a few sets give the names of the stations against certain dial readings; but these may prove a snare and a delusion where changes in wavelengths are concerned, especially with the Lucerne wavelength plan coming into operation next year.

To be interrupted by "Ici Radio ——" when explaining that a certain orchestral selection is coming from a German station is enough to make anyone stick to their local with its perfect English. But such mistakes will never worry you if a list of stations and a pencil are always handy to the radio receiver.

Looking for Stations

Suppose your skill ends at tuning in the National and Regional programmes from the nearest B.B.C. station. How do you go about crashing in on the distance stuff? First of all, take a look at the tuning dial.

It is numbered from, say, 0 to 100, or it may be 0 to 180. The figures are really arbitrary. What matters is the direction in which you turn the tuning dial to increase the reading and vice versa.

Unless the set employs very old condensers, so old that the possibility may be neglected, wavelength will increase with the dial reading. Now look at the list of stations, you will see that they are arranged in order of wavelength.

Any station with a wavelength higher than that of another would tune in at a higher dial reading than the other.

Quite likely you will already have noted this fact in connection with the two local transmissions. Then you are well on the way to placing other stations.

You know what two points on the dial correspond to the names of the local programmes on your list. Consequently, suppose you want a station two or three names below the National programme, you simply tune around two or three degrees lower than the particular dial reading of the National. You will probably recognise the station by the language or strength. Perhaps you will be able to identify it definitely by some announcement.

Keep a Record

When you are sure of a station, make a pencil note of its reading on the station list. You will then have another landmark from which to "spot" some other transmitter. Thus, you will soon get to know your way round the dial.

Take careful note of such items as nationality, power, distance, etc., in finding stations. And *don't* forget that there is no connection between dial readings and wavelengths—unless, of course, your dial is calibrated in wavelengths, when your task will be so much simpler; in fact, almost done for you!

When you have got used to the dial readings, you will probably find that what worries you most is separating stations from one another. This, of course, is largely dependent upon the set and the locality in which it is used, but there is one way in which you can effect a certain amount of improvement.

Your set is almost bound to have a volume control and will most likely have a reaction control as well. When you cannot separate two stations, reduce the volume with the volume control and then bring it up again with reaction.

Increased Selectivity

The application of reaction will increase selectivity. If the set is provided with an actual selectivity control, use this instead of the volume control and proceed in the same way.

Once you have reached this stage you will have discovered the "fun" of distant listening, and will go on aiming for more and more stations.

INTER-ELECTRODE OSCILLATIONS

"Lower and lower" seems to be the motto for wavelengths. But when one gets down to about two metres, ordinary circuits refuse to work, and the entirely different method of obtaining oscillations explained in this article has to be adopted.

By G. LENNIE, B.Sc.

THE recent interest in 5-metre waves suggests the question: Why stop at 5 metres? Can we not go lower?

Of course we can. But viewing the problem from a frequency standpoint we immediately realise the difficulties. A wavelength of 5 metres corresponds to a frequency of 60,000,000 cycles a second. The fact that amateurs to-day are successfully controlling this frequency indicates a high standard of experimental work.

With existing apparatus and quite conventional circuits it is possible to reach a frequency of 150,000,000 cycles per second or a wavelength of 2 metres.

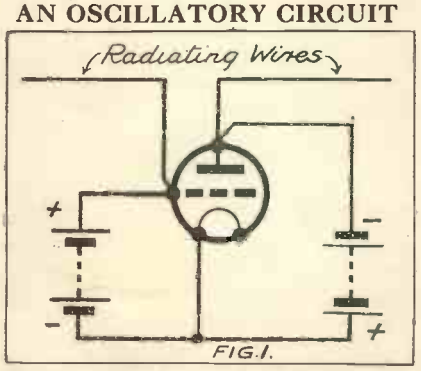
When the Valve Fails

At this stage we must cease being conventional and become revolutionary. This parting of the ways is not necessitated by our design of set or layout, but because of inherent limitations in the valve. In other words, no matter how the apparatus external to the valve is arranged, the valve itself refuses to co-operate, and will not oscillate below 2 metres.

How to overcome this difficulty was a problem solved, indirectly, by Barkhausen and Kurz in 1919. At that time these investigators were concerned with the testing of the vacuum in valves. And it was during these tests that they observed the production of very high-frequency oscillations. The tests themselves were quite straightforward, yet this secondary effect was noticed and came as a surprise.

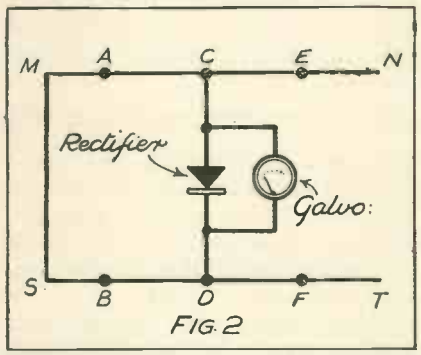
The effect is known as the "Barkhausen-Kurz" effect. Let us examine it.

AN OSCILLATORY CIRCUIT



No tuned circuits are necessary in this transmitting circuit, the oscillations being produced entirely within the valve.

TO MEASURE FREQUENCY



Illustrating the use of Lecher wires to measure wavelength, the galvanometer indicating nodes and antinodes along the two leads.

The frequency of oscillation in any circuit is determined by the speed at which the electrons can be induced to move, back and forward, in the circuit. The electrons themselves being very small are capable of moving at very high speeds and, given the opportunity, are quite able to produce the oscillations. But the use of the valve under normal circumstances prevents them attaining an extremely high velocity.

A Revolutionary Method

What Barkhausen and Kurz did was this. They applied a potential to the grid of the valve which was much higher than the potential at the anode. This was the method they used in the testing of the vacuum of the valves, but its use as a means of generating high-frequency oscillations was, as I have said, revolutionary. To put it in every-day talk, H.T. plus was connected to the grid, while the grid-bias battery was connected to the anode.

Extremely High Frequency

In this seemingly topsy-turvy way of working they observed that oscillations were set up and these oscillations had an extremely high frequency. These observations were made with the apparatus indicated in Fig. 1.

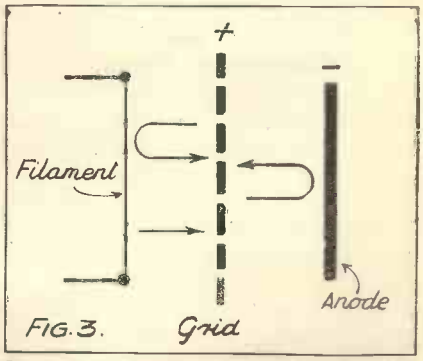
The wires leading from the grid and anode represent a radiating system. The receiver used to detect these oscillations was a Lecher wire resonator. This resonator consists of two parallel wires connected at one end. At any point on the wires a rectifier and galvanometer can be coupled, as shown in Fig. 2. At certain distances along the wires there is no potential difference, while between these points is a maximum potential. These distances depend on the wavelengths of the received signals.

How It Works

However, to the "B.-K." effect. This effect can be explained thus. In Fig. 3 I have represented the

(*Continued on page 482*)

THE ELECTRON PATH



Some electrons shot off by the filament pass through the grid and are repelled again towards the cathode by the negatively charged anode.

WATCHING THE WAVES

—continued from page 453

cathode-ray spot and the speed with which it moves.

Higher frequencies produce fainter records than lower frequencies, since the actual length of the record will be considerably greater for a given length of film, consequently reducing the amount of light to which any particular spot of the film is exposed.

Since the oscillograph is arranged with deflecting plates so that two dimensional figures may be seen upon the screen, the possibility of being able to see a wave-form without the use of external mechanical equipment is obvious, and is used by the laboratory engineers I have met.

Frequency Comparisons

If alternating voltages are applied simultaneously to both pairs of deflecting plates in the cathode-ray tube, Lissajou's figures will be formed, remaining stationary when one applied frequency is an exact multiple of the other. By proper interpretation of these figures, frequency comparisons can be made, but except to a skilled observer, little knowledge as to any deviation in the wave-forms can be gained.

This type of pattern can frequently be made more useful when the wave being observed has a high frequency compared with the other or timing wave. If, for instance, a low-frequency timing wave, say, 60 cycles, is impressed across the horizontal deflecting plates, and another recurring 600 times a second is impressed on the vertical plates, a pattern will be formed upon the screen which with a little imagination can be visualised as the 600-cycle wave.

Many Applications

If some system is used whereby the cathode-ray beam can be deflected across the screen at a constant velocity, an actual representation of any wave may be seen in linear relation with respect to time. Furthermore, if the beam can be made to traverse the screen at the desired speed, in one direction only, and then return instantaneously to its starting position, only a single representation of the wave-form will be seen, whereas with the sinusoidal timing wave previously mentioned two views of the wave are seen, one going in each direction.

The frequency at which the cathode-ray beam sweeps across the screen must, of course, coincide with the frequency of the observed wave or some submultiple of it, or the pattern will appear to move.

To provide a source of a controlled timing wave or "sweep," the engineers have developed a special "sweep" circuit which is made up by the American General Radio people, and uses a mercury discharge tube.

It is rather a complicated gadget, and a detailed description of the actual sweep circuit is not of general interest, but the main feature of it is that the flash in the mercury discharge tube (the rate of it, that is) is varied by a grid-bias supply. The laboratory people can make the circuit "sweep" the cathode-ray tube at any particular frequency.

A Special Camera

It can even be controlled by the actual wave being photographed, and so a continuous film strip of the wave is obtained. It works up to a frequency of 100 kilocycles.

The camera used is, for convenience, not a standard 35-mm. job, but is a pocket-type Ansco Memo using a 16-mm. sensitised strip. The film photographs even show the harmonics of music!

VALVES FOR 1934

—continued from page 426

practically synonymous characteristics with the famous M.S.4, V.M.S.4, M.H.4 and M.P.T.4, and carry the same designation except that "Catkin" should be specified when the valves are ordered. Eventually, of course, they will completely take the place of the glass valves of those names. The first three can be obtained in either open or shielded anode types.

Universal Types

So much for the pure A.C. valves—what about the D.C. and the universal (D.C. or A.C.) types? The ordinary D.C. valves such as the Mazda ·5 and ·1 amp ranges and the Marconi and Osram ·25 variety have been supplemented by Mullard with a ·18 amp. series, by Tungsram with a ·18 universal series, and by the Ostar Ganz full voltage valves, to say nothing of many additions to the Marconi and Osram ·25 amp. ranks.

The Mullard ·18 amp. valves and the Tungsram ·18 series include the usual S.G. (straight and multi-mu), double-diode triode and tetrode respectively, detectors and pentodes, while the Ostar Ganz (Austrian make, but obtainable in this country) are worthy of special notice.

These valves are for universal working and take the full mains voltage of 200–250 volts on their heaters. Thus no heat waste through a breakdown series resistance or barretter occurs, the whole of the mains voltage being usefully used in heating the cathode.

The current passed is small, and need not be the same for each valve, as in the series variety, for the valves are connected in parallel across the mains. The latest released include four S.G. types: S.100, S.25, M.S.18 and M.S.70, the latter two being of the multi-mu type. Then there is the D.130, a specially heater-screened detector with a slope of 3·5 and impedance of 40,000 ohms; the P.T.3, a pentode, and the K.3560, a high wattage output valve capable of giving up to 5 watts undistorted. It has a mutual conductance of 6 ma./V. and an impedance figure of 500 ohms.

In order that these valves shall be available for A.C. operation, two full-voltage rectifiers for the H.T. are provided, thus doing away with the need for a power transformer. They are the E.G.50 and the E.G.100 and will give outputs of 50 and 125 milliamps. respectively.

A Useful Barretter

Several additions have been made to the Marconi and Osram ·25 amp. series-heater D.C. valves, including a barretter that is suitable for four valves, or with an auxiliary resistance for three. The new valves include H.F. pentodes, and make the full-range up to ten valves. Here they are: V.D.S.—multi-mu screen grid with 30-volt grid base; V.D.S.B.—multi-mu S.G. with 15-volt base; D.S.B.—a "straight" steep slope S.G.; D.S.—a medium slope S.G.; V.D.P.1—a multi-mu H.F. pentode; D.S.P.1—a "straight" H.F. pentode; D.H.—the well-known triode for detector or first L.F.; D.L.—a low-impedance triode; D.H.D.—a double-diode triode; and the D.P.T.—the output power pentode.

These valves will probably be augmented by equivalents to the corresponding A.C. valves, as and when

(Continued on next page)

VALVES FOR 1934

—continued from previous page

such appear on the market, thus forming a very comprehensive array of D.C. valves. The barretter to go with them is type 251.

I have endeavoured in the foregoing to give a brief description, not of all the multitudinous individual types of valves on the market, or shortly to appear, but of the main varieties, with details of some of the more outstanding examples. There are valves that have been omitted, not because they are of any inferior efficiency, but because they do not come into the general run of things, or because they are not outstanding examples of modern design.

Indirectly-Heated Rectifiers

For this reason many new rectifiers have been omitted, though we have recently had a number of indirectly-heated rectifiers, from Mullard and Mazda, for it is not possible to go thoroughly in a few pages into the whole gamut of the valves available for your 1934 sets.

Many of the old stagers are apparently still being included in the makers' lists, but close inspection of characteristics shows that a large proportion of them are improved models. Some have been dropped, except for replacement purposes, and have been replaced by valves that will do the same job better, such as the replacement of the old P.M.12V. by the P.M.12M. Here we have the multi-mu long-grid-base Mullard 2-volt battery valve put aside in favour of the short-base variety, giving better control and, incidentally, improved stage gain.

More Than Five Hundred!

And so I could go on till the reader was in a mental maze at the number and shades of variety of the valves proffered him by the various manufacturers. I believe the number of types of radio receiving valves available on the British market reaches more than 500, so it will be seen that a complete study of them in detail is a task that would occupy a very long time.

The "M.W." Super Five

We learn as we go to press that the new Heayberd power-pack which we recommend for the "Super Five" is to be designated the M.W.60.

"M.W.'s" RECORD REVIEW

— continued from page 420

(*Nutcracker Suite*), words sung by Emmy Bettendorf with a chorus and orchestra (Parlophone R1605). Often these vocal versions of some well-known piece are starkly horrible, but this is really delicious. Everything is in perfect taste and the singers and players are artistes to a man and woman. Do not miss this for anything; it's only half-a-crown!

All Sorts

America Calling! is the title of a record by Eddie Pola and Company (Columbia DX499). It is clever, wagging a satirical tongue at the sponsored programme. Imitations of all the popular American stars are given, and if their names were not but lightly disguised by the "announcer" you would still recognise them all.

Ronald Frankau is always good. His latest Parlophone record (R1613) is more than ever for the worldly. You may hear, *A Protest* and *Don't Pretend to be Innocent*, and mildly protest, but you certainly will laugh. Next, Elsie and Doris Waters in *Mrs. Flotsam and Jetsam* and *Mrs. Henry Hall*. Again these clever ladies put it over. A wireless turn well worth preserving (Parlophone R1585).

There are two organ records (H.M.V. B4484–5) which must be mentioned. They are *Peer Gynt Suite*, played by G. Thalben Ball on the Kingsway Hall Organ. An excellent idea to do it thus; the result is an artistic triumph.

Josephine Baker's last record *If I Were White* and *Madiana* (Columbia DB1175) is a bright effort. She sings, of course, in French, and brings the right atmosphere with her. Collectors of the exotic record should hear this.

Now one of two Hawaiian numbers. Kanui and Lula not only make their guitars sing instead of whine, but *they* sing the most comical-sounding "skat" ever to be heard on this globe. You have an undoubted novelty of high entertainment value in *Oua, Oua* and *Tomi, Tomi* (Parlophone R1614).

Columbia, having produced the best sketch ever put on a record (*Flat-footed Jean*), have tried again with very great success. A little cameo done from Midland Regional some time ago was chosen, called *The Invalid*. The "plot" centres round a cantankerous octogenarian who will *not* be washed. It is really excellent fun. Percy Edgar is in the name part (DB1179).

THE CHRONICAL WIRELESS ANNUAL

Eleventh edition of a complete handbook for the constructor.

THE excellent work done for radio by the "Manchester Evening Chronicle" was most clearly demonstrated during the Northern Radio Exhibition.

And not the least excellent part of this work is the issue every year of the "Chronicle Wireless Annual," the eleventh issue of which is now on sale at the price of 1s. Almost 200 pages comprise this new edition, which contains, in addition to technical articles written by leading research engineers in the Radio Trade, full details and diagrams for building more than a dozen complete receivers and units. These range from a Home-Made Trickle Charger and a Class B Adaptor, to a Six-valve Superhet and a Class B Radiogram.

The "Chronicle Wireless Annual" is, without any doubt, the best manual of its kind.

FRANKFURT'S RADIO OFFSPRING

—continued from page 451

As Trier is putting out only 2 kilowatts against Frankfurt's 17, on a common wavelength, the engineers have had to devise a really practical system of wavelength stabilising.

And the connection between the drive of the Trier relay and the wavelength stabiliser at Frankfurt marks really a new idea in relay station control.

B.B.C. stations are synchronised by a tuning-fork oscillator, and American stations generally by a quartz crystal. Trier uses a very clever oscillator system, the " key " of which is at the Frankfurt end.

The Trier Drive

There is a metal rack let into the wall, near the oscillator drive stage of the Frankfurt station, and this carries twenty-one metal-shielded compartments, each containing a section of the Trier drive. Each section of the harmonic selector and landline apparatus is completely screened.

There is a separate cubicle for each valve stage. Vernier dials are used on the front of these cabinets to tune the harmonic selectors, and in the anode circuit of each mains stage there is a milliammeter to show that the valve is operating on the correct part of its characteristic to produce harmonics. And a dip in the needle reading shows that the stage is accurately tuned.

The vital stages of the harmonic selector are in duplicate, so that by just adjusting the shielded connections at the back a new valve stage can be brought in and re-tuned in a few minutes. Press-button controls and indicator lights on the front show that each stage is working, while the whole board is full of labels marking the particular job of each shielded stage—a typically German radio idea !

Warming Up

As Frankfurt transmits at intervals from 5.15 in the morning (physical jerks, of course) on weekdays, the relay gear is working almost continuously. The valve stages at the Frankfurt end are switched on ten minutes or so before the main programme begins, so that everything is warmed up before the programme begins. The valves, not being water-cooled, warm up in a couple of minutes.

A. A. S.

FIVE POUNDS' WORTH OF OPERA RECORDS

—continued from page 403

Mozart's "Within This Hallowed Dwelling," from *The Magic Flute.* This record is H.M.V. DB9802, and its price is four shillings, bringing the total expenditure up to exactly five pounds.

It is quite clear that a dozen lists of this sort might be prepared and that some of these might give an even greater variety; but look this list carefully through and it will be seen that every item is well-known and generally popular, and that it includes a considerable number—to be exact, ten—of the best known composers of opera.

Wagner tops the list with seven individual numbers, Mozart comes next with three, and after these come Verdi with two, and Rossini, Bizet, Leoncavallo, Saint-Saëns, Weber Gounod and Puccini, the last two with two each.

The artists and conductors include some of the most famous in the world, Toscanini and Beecham, Caruso and Kipnis, Leider and Schumann, Melchior and Schorr, Rethberg and McCormack.

This will do for a beginning. Later I may have something else to say on the subject.

FAULTS I HAVE FOUND

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which give a rough indication of the likely causes. Some of these headings are amusing, some enlightening and nearly all unprintable!

Most service organisations use this method of "cataloguing" receiver troubles, and the office staff make rough deductions from the symptoms that set owners describe, and so pass the complaint along to an engineer under the indicated heading.

A Good System

A great deal of time and trouble is saved in this way in practice.

It was as a result of this system that I received instructions under the heading "Temperature breakdown."

This heading gave me the information that the fault occurred only after a certain working temperature had been reached or, in other words, after the set had been running for some considerable time.

Faults of this kind are nearly always traceable to partial breakdown in wire-wound resistances or in valves.

In this case, the fault was in one of the welds inside a large output valve.

Providing the valve was reasonably cool, the welding made excellent contact, but as soon as a certain temperature was reached inside the bulb, the contact failed and remained so until the set had been left switched off sufficiently long for the electrodes of the valve to cool down again.

Slow to Develop

Incidentally, the time taken for heating up and cooling down was considerable, for the weldings were near the stem of the valve and, being inside the vacuum, were subject to the radiant heat from the filament only.

Usually a fault of this nature can be produced artificially by giving the suspected part a sharp tap with a screwdriver handle, but it is not at all safe to allow the results of such a test to be conclusive.

INDOOR VERSUS OUTDOOR AERIALS

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as the outdoor one, but to prove this requires that conditions must be made truly comparable. And apart from questions of height or size, it is the net effect which matters.

The running of the down-lead is likely to doom many an indoor aerial scheme. Yet with due care and ingenuity it is surprising how unostentatiously and efficiently this lead can be installed. By employing a stout cable such as "V.I.R." (vulcanised indiarubber cables, as used in house wiring), and taking full advantage of lath and plaster walls (but avoiding brick or other solid walls as far as possible), the lead down can be well and truly installed.

Many Advantages

Though the writer is a keen advocate of the outdoor aerial, he merely urges that the indoor aerial has more advantages than are realised. Naturally there are many listeners in flats and small houses, as well as those living in sparsely inhabited regions, who for one reason or another will continue to favour the outdoor aerial.

Nevertheless, the tendency in radio practice is towards the provision, with more and more economy, of powerful receivers that require diminutive aerials. Thus is the way to the indoor form (with its special advantages) made easier, and with the vanishing of a multitude of ugly outdoor erections our towns will benefit in appearance.

KENDALL'S CORNER

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mould would be only just over a penny, and since the mouldings themselves would cost something of the order of fourpence each, it is quite possible that in some instances the moulded case might actually be the cheaper method!

This, I agree, is another extreme example. There are others in which a skeleton type of construction can achieve a definite saving, but the point I wish to demonstrate is that economies produced in this way are necessarily small ones.

Unnecessary "Goodness"

In any case, these are times of the most intensive competition in all industries, and the problems of price reduction can safely be left to the people whose business they are. The surest way to commercial success is to be able to offer an article as good as that of your competitors at a substantially lower price, and you may be very certain that any manufacturer who can see a practical way of doing that is not going to lose much time in setting about it!

If I felt impelled to tell the radio manufacturer how to get his prices down (which I don't!), I should suggest that he should look with a more discerning eye upon the question of the necessary or unnecessary "goodness" of his components.

I do not want to elaborate upon this topic, for it does not seem to be really my affair, but it really is a fact that if certain people would stop turning out components with quite uselessly "super" electrical properties, it might be possible for the industry to settle down to sensible and quite adequate standards which would permit prices to be kept within bounds in a manner which is out of the question at the moment.

A Very Rare Event

Our hard-working friend, the L.F. transformer, must serve me for purposes of illustration yet again, if the reader will bear with me while I explain that I do not wish to decry any genuine attempt to give us better quality, but merely to urge that such endeavours should be confined to those properties of components which do really give us better results *in practice*, and not merely on paper.

Here is an example: there are quite

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KENDALL'S CORNER

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a number of L.F. transformers on the market which will, under suitable conditions, give faithful response down to something like 20 cycles, yet how many loudspeakers are there which can deal properly with notes of frequencies below about 50 cycles? Very few, indeed! Again, how often do notes of much lower frequency than 50 cycles actually occur in music? Perhaps some musician will tell us, but I have a strong suspicion that it is a very rare event.

Yet to make a transformer which will do this is a most difficult thing, and costs much money. Any amount of earnest effort must be put into it, but the final result is merely a component costing more than another which gives results indistinguishable to the ear under practical conditions!

It is hard to blame the component manufacturer for doing this sort of thing, however. So long as he finds that he can sell his goods on the strength of such properties he will obviously go on doing so. The remedy really lies with the purchaser, who should realise what is worth paying extra for, and what isn't.

Here, I suggest, there is scope for sensible propaganda work which would be of far more benefit to all concerned than the peevish, uninstructed wailings which have been heard from certain quarters.

A Praiseworthy Service

Now, here is a mystery of radio which has been puzzling me for some time. A while ago the B.B.C. put out from certain of their stations a series of calibration signals which made it the easiest thing in the world for the average experimenter to plot a comparative response curve for his set which covered the whole range of audio frequencies, and for the first time made it possible for him to learn the real truth about its quality performance.

Surely a most praiseworthy service, and yet so far as I am aware it has never been repeated. To do it just once was merely to whet our appetite for more, for the essence of such test transmissions is that they should occur at definite and very widely known times. I know that a good deal of trouble and expense is involved, and it would not be reasonable to ask for the tests more often than perhaps three or four times a year, but if we could only have them *regularly*, at no matter what intervals, they would be of enormous value.

Why, then, do it just once, and then (apparently) let the idea drop? I have a dark suspicion that I know the reason, but I must think it over before I decide to explain my horrid fears! Perhaps next month?

INTER-ELECTRODE OSCILLATIONS

—*continued from page* 475

filament, grid and anode of a three-electrode valve. The anode is given a negative potential, while the grid is highly positive.

Electrons, leaving the glowing filament, are attracted to the high potential grid. On reaching the grid some of the electrons adhere to it, while others pass through the interstices.

Those which do pass are now in a region where they are repelled by the negative anode, and at the same time are being attracted back by the grid. The resultant effect is that they are slowed down and reverse their direction, once again travelling to the grid.

Moving, now, in the opposite direction again, some electrons adhere to the grid, while others pass through to the grid-filament space. Here they reverse again and travel with a fresh lot of electrons to the grid.

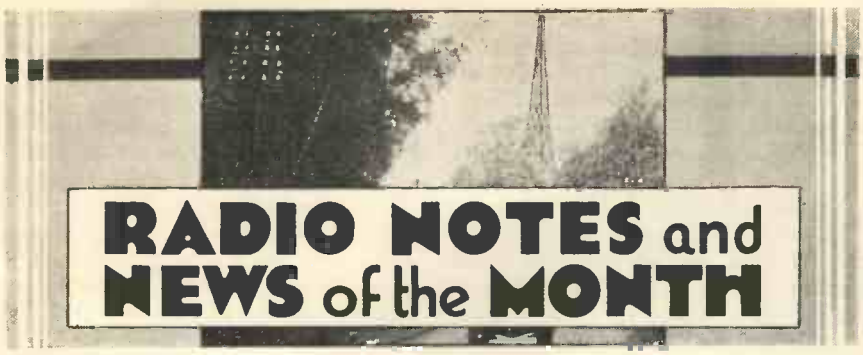
Not Fully Developed

It can be seen, therefore, that there is a swinging or oscillating of electrons, back and forward, between filament and grid, grid and anode, and filament and anode. Also, the time it takes for an electron flow to travel, for example, between grid and anode will determine the period of the oscillation.

As the distance between grid and anode can be made small, and by a proper control of potentials, it follows that we can generate a very high frequency. The associated equipment will, of course, require to be designed to utilise this high frequency.

It may be difficult to coincide the statement that electrons do not actually reach the anode with the fact that oscillations are set up between these elements. But it must be realised that the theory of these oscillations is not fully developed.

Personally, I am inclined to believe that there may be a condenser effect in the valve which maintains the oscillations—that is, the electron swinging back and forward between a positive and negative plate sets up the alternating anode current, a current which may be likened to a displacement current.



RADIO NOTES and NEWS of the MONTH

ONE of the giants of American broadcasting has been on a visit to this country during the last few weeks. He is Mr. W. L. Paley, President of the Columbia Broadcasting Company of America, which controls about ninety stations throughout the United States.

Britain Ahead of America

In an interview with a Press reporter, Mr. Paley said he was particularly interested in discussing British Radio Drama. He thought Britain was ahead of America in this respect. Mr. Paley said that in America they had concentrated on the provision of first-class music, whilst drama on the air has not kept pace with this musical excellence.

Big Developments Coming

Mr. Paley also admitted that in America they had not got the best script writers or actors, but he thought that a big development in American Radio Drama was coming shortly.

Second to None

"There is a great admiration for the B.B.C. in America," said Mr. Paley, "where the general opinion is that from all points of view, the technical quality and programme layout, and so on, the B.B.C. stands second to none."

Mr. Paley on Television

Mr. Paley had also some interesting things to say on television, and gave it as his opinion that we shall have television in two years, and that it will revolutionise the entire broadcasting business as much as sound revolutionised the films.

Considerable Activity

As we reported in a recent issue, there is a good deal of television activity going on now, not only in this country, but in America and also Germany. Over here the Baird Company is now carrying out tests with transmitters working on ultra-short wavelengths from the Crystal Palace; whilst in Germany television is being developed, using an ordinary cinema film as an essential part of the receiving and transmitting apparatus. At the sending end attempts are being made to film a scene and then pass the film through a lightning developer and so feed it into the television transmitter.

A Question of Wavelengths

As one important radio manufacturer pointed out to me the other day, what is the situation going to be like when television really catches on? All our present-day wavelength arguments between countries will be child's play compared with the chaos that will be upon us when television becomes an integral part of broadcasting.

Something will certainly have to be done about wavelengths or there will be the dickens to pay.

The Lucerne Plan

Talking of wavelengths reminds us that as we go to press with this issue the members of the International Broadcasting Union, now meeting at Amsterdam, are still squabbling amongst themselves as to what shall be done to modify the Lucerne Plan—which comes into force in the New Year—so that it will be reasonably workable.

Russia seems to be more amenable, and, according to the "News Chronicle" Wireless Correspondent—who is attending the Amsterdam Conference—the Russian representative, whom he interviewed, said: "My country has signed the Lucerne Wavelength Plan and will stand by it, and any suggestion that Russia is unwilling to co-operate is without foundation. We have signed. Is not that enough?"

A Stumbling Block

The Dutch have given a good deal of trouble at Amsterdam, for that well-known station Huizen has been regarded by the sixty delegates attending the Conference as "the greatest stumbling block of the European ether."

Dry Land Difficulties

Again quoting the "News Chronicle" Wireless Correspondent,

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RADIO NOTES AND NEWS OF THE MONTH

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we are given to understand that the failure of the Amsterdam Conference—for undoubtedly it is a failure—may be attributed to the Dutch attitude on Huizen.

It appears that the 1,000 to 2,000-metre band is of most use to countries with difficult dry land to cover, and as Huizen has none of these drawbacks it was proposed at the Conference that Huizen should give up its long wavelength and let Roumania have it.

The Dutch Attitude

But the Dutch attitude was this: Holland was one of the first countries in Europe to adopt broadcasting, so why should Holland give up its best wavelength to a country that has only just started to take an interest in broadcasting?

Holland or Roumania?

Well, one can't blame Holland. It does seem rather unfair that Roumania should be given a wavelength which Holland has made admirable use of for the last ten years. One famous Dutch scientist suggested that Holland would welcome arbitration on this matter, but the B.B.C. took the line that arbitration would take too long, for it is essential to get an amicable settlement about wavelengths before January 15th.

To Crash In!

Greece also wanted the 1,153 metre wavelength at present used by Kalundborg, arguing that Denmark did not really want such a long wavelength; whilst Luxembourg, although no place has been found for her on the long waves, has stated her intention of crashing in regardless of the Conference on about 1,200 metres.

So it looks as though chaos in the New Year is pretty well guaranteed.

Sir Walford Davies

Listeners will learn with regret that Sir Walford Davies, who has been responsible for musical broadcasts to schools since 1925, is to retire temporarily from his B.B.C. activities—at least, for six months. It is probable that Sir Walford will start his long holiday from next June.

Licence Increases

Latest licence figures show that there are now 4,524,643 wireless listeners in Germany, representing an increase of 50,000 since the beginning of September.

News from Japan

The latest news about giant wireless stations is that Japan is to build a transmitter at Kurume City, with a power of 100 kilowatts, and at a cost of £100,000.

When this station is completed it will be the biggest in the Orient.

An Essential Feature

Mr. C. A. Siepmann, the Director of Talks, recently addressed a London gathering of journalists, and in the course of his speech he stated that the B.B.C. were convinced that speakers must talk simply.

The B.B.C. always endeavoured to find speakers who could not only talk simply but who had distinct microphone personalities.

Mr. Siepmann also stated that seven years ago the Talks syllabus had a circulation of 70,000, but this year 189,000 copies had been sold in three weeks.

Four thousand schools listened regularly to the courses, and this winter another 300 had registered, while wireless discussion groups had grown from 263 in 1928 to 1,350.

New Vaudeville Studio

The B.B.C. has taken over a temporary lease of St. George's Hall, London, known for many, many years as the home of mystery. Thousands of children know St. George's Hall and the exciting and magical performances staged there by Messrs. Maskelyne.

St. George's Hall will be the new vaudeville studio, and the famous No. 10 Studio, near Waterloo Bridge, is to be given up.

St. George's Hall will be fitted up by the B.B.C. as a studio and listeners may expect to hear the first vaudeville programme from there towards the end of the month.

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