RADIO CONTACT & TELEVISION

ENTERTAINMENT AND TIPS FOR THE FAMILY
TECHNICALITIES FOR THE ENTHUSIAST & CONSTRUCTOR

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THIS MAGNIFICENT ISSUE INCLUDES
4 NEW CIRCUITS
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an entirely new range of Valves for

HOME CONSTRUCTORS

THIS ANNOUNCEMENT MAKES RADIO HISTORY . . . . . .

Graham Farish now enters the arena with an amazing range of valves designed and produced exclusively for home constructors. Every valve is designed to give 100% efficiency—tolerances are now guaranteed which were hitherto unknown, even to the professional set maker.
Whatever your set, Graham Farish Ring Valves will improve reception. A comparative table showing how to replace your present valves with Graham Farish Ring Valves is free for the asking.

A REVOLUTIONARY SHORT WAVE SCREENED GRID H.F. VALVE

Known as type SWG2, this valve has many unique features and is the only one of its type available. The normal screened grid valve is entirely unsuited to the special requirements of short wave reception, due to the losses introduced by the bakelite insulation between anode and grid. In the SWG2 valve we have developed a special no-loss grid connection which is taken to the top glass insulated contact, whilst the screen is attached to the normal grid connection on the base. A further improvement is the complete screening of the anode, which renders the valve absolutely stable without loss of efficiency.

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CONSTRUCTORS!

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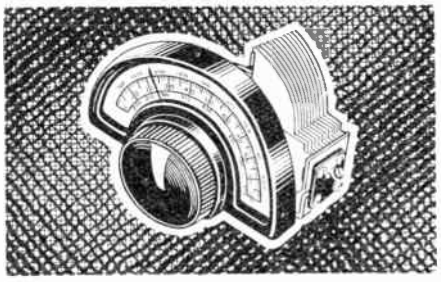
Graham Farish

RING VALVES

FROM 5'6

On Short Wave or Broadcast Band



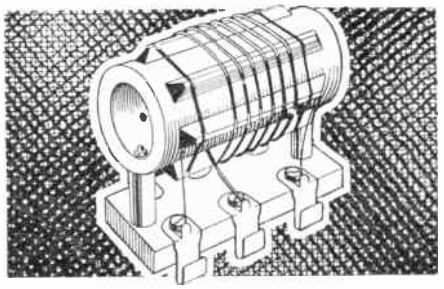
SINGLE UNIT TUNING CONDENSER

Type SU5. A really substantial slow-motion condenser of ·0005 mfd. capacity, supplied complete with full vision Mystic Drive which requires no special panel cut-out. The full vision floodlit scale is engraved in dual colours. Price **6/6**

SNAIL DUAL RATIO DRIVE AND ESCUTCHEON

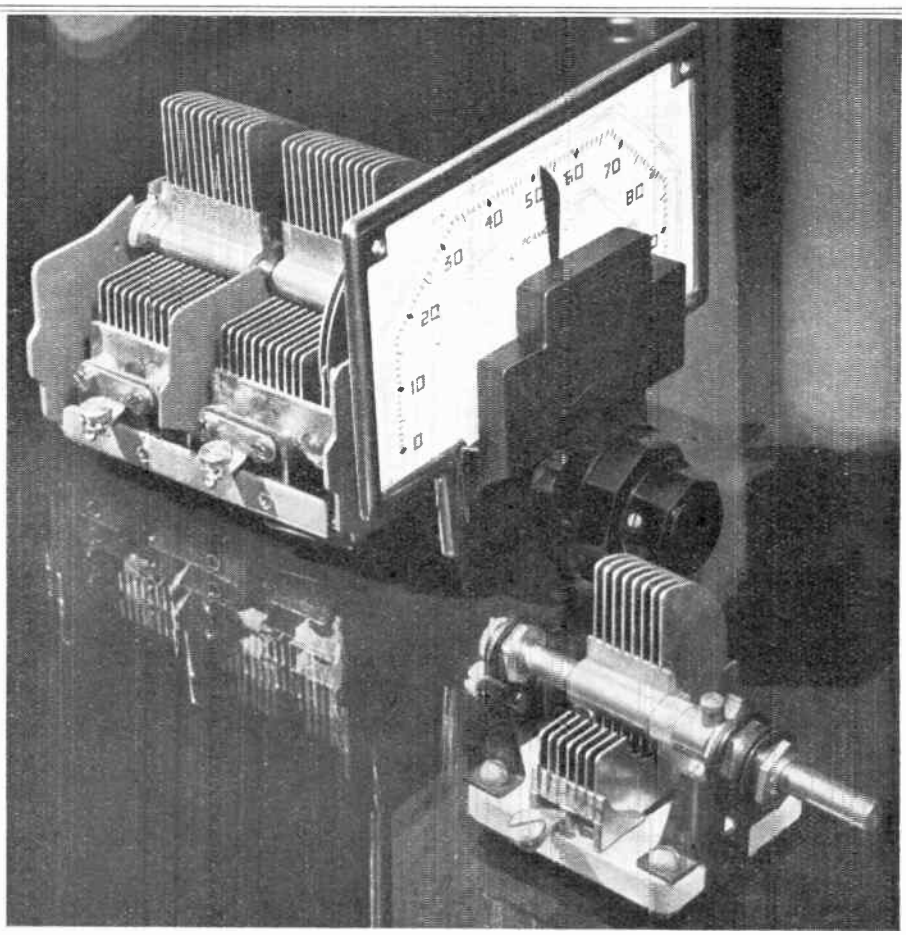
Can be suitably used with the short-wave variable condenser, or with the twin-gang condenser, Type DL5. The Drive is all-steel and provides ratios of 8-1 and 64-1 with a dial movement of 270°. Cost of Drive only **3/-**

Escutcheon, domed scale, pointer, lamp holder and fixing screws are supplied separately at **3/6.**



FORMO SHORT-WAVE COILS

Are wound on formers of Frequentite ceramic material. Undoubtedly the most efficient short-wave coils available. Designed to plug in to the Formo single or 2-way coil stands. Type B 12/25 metres, Type C 21/50 metres, Type D 38/102 metres. Each **3/6**



AMONGST designers, constructors and experimenters in all parts of the world, the name FORMO is the first that comes to mind when choosing tuning condensers and coils. This famous name stands for all that is best in British design and workmanship. By closest contact with those who build their own radio, and by strict adherence to an unswerving policy of quality at all costs, the supremacy of FORMO productions remains unchallenged.

TWIN GANG CONDENSER

This ever-popular model is now re-designed with die-cast rotor and stator assembly. Constructed on really sound and robust lines with a minimum of insulating material, resulting in losses of a particularly low order. **Type DL5** with trimmer on end section but without dust cover or drive, **9/-**

Type DU5a as illustrated, complete with Mystic Drive and escutcheon and with additional air-di-electric trimmer on the front section **11/-**

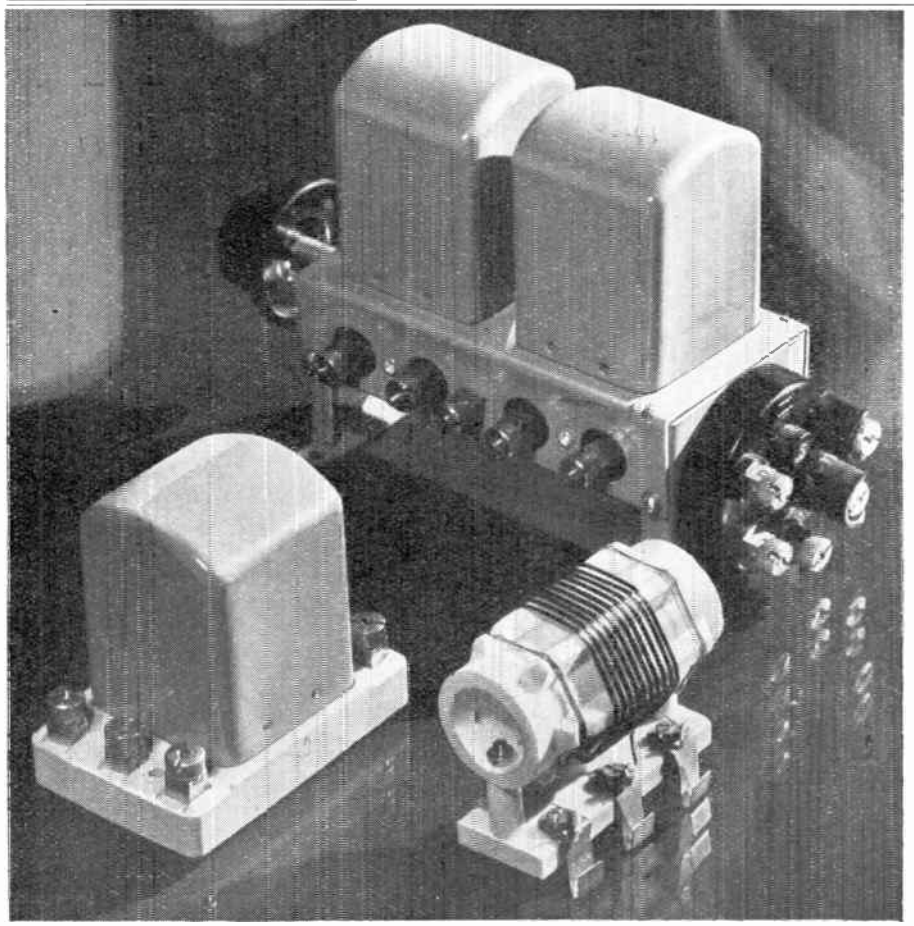
Type DU5 as type DU5a above, but supplied complete with dust cover. **12/6**

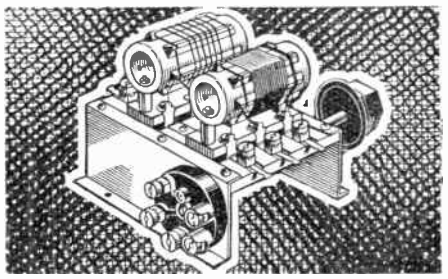
SHORT-WAVE VARIABLE CONDENSER

Has die-cast rotor and stator vanes on a spindle insulated with ceramic material. The bank of vanes is mounted on a ceramic base, resulting in extremely low minimum capacity. Maximum capacity ·00016 mfd. **3/6**

REFER TO PAGES 50-1 FOR COMPLETE LIST OF PRICES

FORMO *must be your choice*

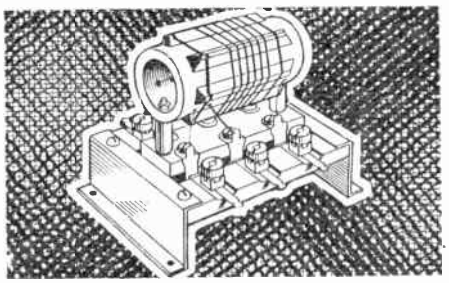




TWO-WAY SHORT-WAVE COIL STAND

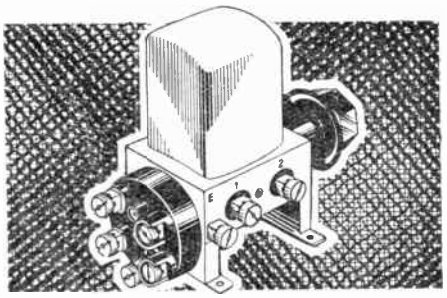
Accommodates two Formo short wave coils and so avoids constant coil changing. Frequentite ceramic insulation used throughout. Either of the two coils can be switched in or out at will by means of the switch incorporated. Price **2/6**

Auxiliary Switch (for filament and phones-to-speaker) 2/- extra.



FORMO SINGLE SHORT-WAVE COIL STAND

Designed to accommodate any one of the single Formo plug-in short-wave coils as illustrated. Extremely low loss construction, Frequentite ceramic insulation being used throughout. Price **1/-**



SENSITY SINGLE COIL UNITS

Similar in characteristics to the Sensity single iron-cored coils, but accommodated on a chassis with the necessary wave-change switching. **6/6** Each

With additional switch for filament and radio-gram 2/- extra.

SENSITY IRON-CORED COILS

Represent the greatest advance in scientific coil design in recent years. Litzendraht windings on a bobbin of entirely new low loss material mounted on Frequentite base having negligible H.F. losses.

Type UI, Universal coil, which can be used in all aerial and anode circuits, has full transformer winding complete with reaction

Type TI, aerial coil without reaction.
Type AI, aerial coil with reaction . Each **5/-**
Type PPI, H.F. coil . . .

SENSITY GANGED COILS

Comprise a variety of ganged and matched units of similar construction to the single coils, but mounted on a chassis complete with wave-change switching.

Type AH, matched aerial and anode coils, both with full transformer winding. Switching in both primary and secondary windings **10/6**

Type AH/G, as above, but with auxiliary filament and radiogram switch. Price **12/6**

Type BP is a band pass ganged unit suitably matched for a band-pass circuit preceding the 1st valve Price **10/6**

Type BP/G, as above, but complete with filament and radiogram switch. Price **12/6**

FORMO PRODUCTS LTD.

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MASONS HILL, BROMLEY, KENT

REFER TO PAGES 50-1 FOR COMPLETE LIST OF PRICES

ENTERTAINMENT & TIPS FOR THE FAMILY
TECHNICALITIES FOR THE ENTHUSIAST & CONSTRUCTOR

CONTENTS.

EDITORIAL & ADVERTISEMENT OFFICES:
"RADIO CONTACT," 153, MASONS HILL,
BROMLEY, KENT.
September, 1935.

PROBABLY the most interesting and exciting thing in an editor's life is his morning post-bag. One might suppose that constant correspondence on the subject of radio would become monotonous, but this is hardly the case. In my last letter in these columns I invited correspondence from readers, and the resultant response has been astonishing. Letters from all over the world touching on an infinite variety of radio subjects arrive by every mail, but what is perhaps more pleasing to me than anything else is the wealth of evidence that CONTACT designs are responsible for a vast increase in the number of home constructors.

The Battery-operated "Sensity Super," which was fully described in our last issue, certainly revised all standards of home constructed receivers, and every mail brings further evidence of magnificent results achieved with this circuit.

The most popular request from *all* readers is for short-wave circuits and components. In this issue we show our first short waver, and once again we are relying on the Graham Farish and Formo people for most of the components specified. Their new range of short-wave components is a grand effort and will undoubtedly open up a tremendous demand amongst constructors who have hitherto found first-class components of this nature to be absolutely prohibitive in cost. The ultra short waves will add a thrill to constructing and listening such as you cannot experience on a standard broadcast receiver. In England the ultra short waves are commonly regarded by constructors, and even by the manufacturers of complete sets, as something extremely difficult to handle. This impression is entirely wrong, and although technique differs somewhat from reception on the broadcast bands, the finest results can be obtained if due care is given to the construction of the set and the choice of the components.

Once more may I say that I shall be very interested to hear from you again, particularly to receive your reports on the first of the CONTACT short-wave receivers.

The Editor

Radio Gossip

By THE EDITOR

CONTACT ANNIVERSARY

I feel sure my readers will agree that this, the first birthday number of RADIO CONTACT, is a really bumper issue and fully justifies the reputation we have acquired since first coming into action at the 1934 Olympia Radio Exhibition.

I am going to confess that in the early days of the first issue CONTACT was regarded purely as an experiment. Disappointment has been expressed in some quarters that during the first year of its existence only two issues were published, but I should remind readers that this in itself was part of the great experiment. It was considered that new developments in radio were so few and far between that a magazine published purely for home constructors could hardly justify a weekly or even a monthly edition.

CONTACT has created just the atmosphere which was necessary, and every issue is now awaited with the keenest possible interest.

SETS FOR EVERY TASTE

In this issue I really feel our designers have excelled themselves. One of the finest and most eagerly awaited developments is obviously the "Discovery" S.G. short waver.

As I mentioned in these columns in CONTACT No. 2, I knew of the pending developments in moderately priced short-wave components by one or two manufacturers, and I had in mind particularly the Graham Farish and Formo organisations. I say without hesitation that without their magnificent efforts in this respect such simple, business-like and efficient designs as the "Discovery" short waver could never have seen the light of day.

It is a pity so many constructors are under the impression (an entirely erroneous impression) that short-wave reception is a hobby only for the expert and not for the novice. A little common sense plus blind faith in the advice and instructions given by the designer will give you the finest possible results.

Short waves have literally brought the ends of the earth together. It is, in fact, simpler to listen to America or Australia on a short waver than it is to listen to many of the moderately powered Continental stations on an ordinary broadcast receiver. Problems of selectivity are unknown, and when the time arrives for general reception on the 5–20 metre band there will be no such thing as an unselective receiver, as it is almost impossible to overcrowd the ether at these frequencies.

A NEW RADIO TECHNIQUE

The introduction of ultra-short waves has called for an entirely new technique in the art of circuit design and set construction. Developments of incalculable value to short-wave listeners are taking place in the laboratories of the raw material suppliers. In particular, low-loss ceramic materials are fast becoming the vogue. This is not just a worthless fashion, but something which has proved itself in every respect. I understand that the manufacturers of ceramic materials are working at terrifically high pressure, and only those component manufacturers who were far-sighted enough to book their requirements many months in advance will be fortunate enough to incorporate this material in their 1936 range of components.

THE ALL-ELECTRIC BOOM

Until quite recently, home constructors consistently ignored designs for all-electric sets. It was apparently considered that they had sufficient work in hand to satisfactorily construct and operate a battery receiver, without having to worry about the intricacies of mains supplies.

Many thousands of you are now beginning to realise that a battery set has obvious limitations and, further, that handling the ordinary house-lighting supply is quite a simple matter, calling for no special experience or technical knowledge.

The release of the battery operated Sensity Super in our last issue immediately brought forth thousands of requests for a similar receiver operated from the mains, and our designers have, therefore, obliged with designs for the A.C. Sensity Super.

I must not attempt to describe the set in these columns, but I will say that for the enthusiast who requires an easily operated family set capable of receiving home and foreign stations with a minimum of effort at good quality and exceptional strength, no finer set is available than the A.C. Sensity Super.

A NEW DEPARTURE

It may appear strange to you that a radio journal such as CONTACT, hitherto regarded and intended as an exclusively constructors' paper, should give valuable space to the subject of factory-built sets.

The departure from our usual policy is brought about by the introduction of the Graham Farish Model No. 333 battery receiver recently placed on the market by Graham Farish, Limited. Incredible as it may appear to you, dear reader, as an enthusiastic constructor, there is a very large number of listeners who freely admit their inability to build even the simplest straight two. It is to these people, therefore, that the new set will largely appeal.

This, happily, does not mean that the Graham Farish interest in the component market is lessening in the slightest degree. Rather does it mean that they are being guided by popular public opinion and making available to the non-constructor many of the circuits developed in this magazine.

FINANCIAL HELP FOR THE CONSTRUCTOR

Another stage in the expansion of this go-ahead concern is the development of hire-purchase facilities on kits and components, as well as complete sets. It is believed that many otherwise enthusiastic constructors have been talked into buying a complete factory-built receiver by a commercially minded dealer who has had the backing of the set manufacturers' hire-purchase schemes.

These facilities are now available to all home constructors, and I cannot help feeling that an enormous expansion of sales will result.

TELEVISION

Those of you who anticipated a peep at the latest television developments at Radiolympia will by now be getting over what must have been a very keen disappointment.

The Exhibition authorities decreed that since television was not yet a commercial possibility or a proposition which was developed far enough to be administered to the public, nothing in the nature of television apparatus, or even literature, should be allowed in the Exhibition.

As I hinted in these columns some time ago, all sorts and conditions of people connected with television are making statements in the national and in the technical press, but none of them appear to have the stamp of real authority, and as these lines go to press the position of television seems to be much in the same state as it has been for many weary months past.

May I again assure my readers that everything possible will be done to give you the earliest news in these columns, and that although our designers and technical men are in closest possible touch with each stage of development, we do not desire or intend to puff these columns with television articles of mere passing interest. Our aim is to give you constructional articles upon which you can act and develop your knowledge of the new science. This can only be done when the B.B.C. transmission system is made known, and when the necessary components and accessories are available in appropriate form.

One can easily foresee the tremendous strides which television will make as soon as any sort of start is made. When the radio bomb-shell burst over an astonished world more than a decade ago, it embraced a science completely new to all except a favoured few. To-day, radio is almost a commonplace, and much of what we have since learnt will apply to the science of television.

RADIOLYMPIA AND THE CONSTRUCTOR

So far as the ordinary listener is concerned, and by the ordinary listener I mean the type of person who only understands that somehow music and speech is made to come out of a beautifully polished box, they were adequately catered for by 90 per cent. of the manufacturers showing at the Exhibition. To the serious-minded constructor, who enjoys his radio as the ordinary listener can never understand enjoyment, the centre of attraction was undoubtedly the combined effort by Graham Farish and Formo Products in the Main Hall.

For sheer efficiency and interest this display needed a lot of beating. The entire magnificent range of constructor components was displayed in well-lighted windows at eye level on two long sides of the stand, and at both ends of the stand counters were so arranged that all who were interested could immediately help themselves to literature on every conceivable radio subject. Efficiency and courtesy were pleasantly mingled by the three technical assistants stationed at one of these counters, where any constructor requiring assistance or information of a technical nature could have his every question answered on the spot.

The assistants at the other counter, who were primarily there to deal with hire-purchase enquiries, told me that the new hire-purchase system on components was causing enormous attraction, and it will be interesting to see how this innovation reacts on constructors during the busy time of the year.

Incidentally, I had the pleasure during my visit of making the acquaintance of Elsie and Doris Waters, otherwise "Daisy and Gert" of radio fame, who were seated at a table in what appeared to be a Dutch garden lay-out in the centre of the G.F. stand, absorbed and thrilled over the construction of the Sensity Super Kit. Apart from a few odd spots of bother, such as treading in the fountain pool and swallowing a few screws, they made a fine job of this very popular kit. Anyway, if you hear undue oscillation down Regent's Park way you will know who and what to blame!

Won't Walter be pleased! Two of our most popular radio stars, Elsie and Doris Waters, putting the finishing touches to their own Sensity Super. Daisy (or is it Gert?) wields the screwdriver, while Gert (or is it Daisy?) follows the blue-print.

"CONTACT" STILL LEADING!

It is quite usual for the sub-editorial staff to accuse their venerable chief of "stealing all the thunder," and letting his pen run riot on hot items of news which might justifiably appear in the technical columns. Nevertheless, I know that when the time arrives for all the "subs" to be full-blown editors they will do exactly as I am doing. My particular piece of news on this occasion refers to yet another of the far-reaching arrangements with various manufacturers which the technical staff are constantly making to keep CONTACT plumb in the front of radio journalism.

As you are doubtless already aware, Press designers have never been able to "call the tune." They have had to rely, so far as valves and components generally are concerned, on the standard productions of various manufacturers. We have now been able to make satisfactory arrangements with Graham Farish Limited (whose range of Ring Valves is used for the first time in this issue) whereby any special type of valve required by our technical department can, within reasonable limits, be produced for our use. As you can imagine, the possibilities are endless, and we feel sure readers will welcome this innovation.

THE 1936 STENTORIAN THREE WITH MONO CONTROL

TWELVE months ago, when the first number of RADIO CONTACT was being produced, the Editor asked me to write an article and to describe a type of receiver having a wide and popular appeal. The utter astonishment and consternation of my colleagues when I produced the 1935 Stentorian defies all description. In their anything but humble opinions, a radio receiver without one or more H.F. stages is *not* a radio set at all, but just a reproducer.

However, the Editor being wise in his years, and ignoring the blandishments of his H.F. high-brows, passed the article for print. From the time that CONTACT No. 1 made its bow, I have been able to say "I told you so." There can be no room for regret that the Stentorian 3 was published, the component manufacturers concerned having ample evidence that this type of receiver still has a very large following and that the Stentorian 3 was, in fact, built by thousands of constructors.

In most of the correspondence received from those who built the receiver the outstanding feature was undoubtedly the tribute paid to quality of reception. Therein lies the secret of the success of this particular circuit, and therein also lies the reason for the 1936 Stentorian which I am about to describe.

It is well known that the requirements of constructors vary enormously. Some want superhets, others want one or two stages of H.F., but a true census will show that there are still thousands who regard quality of reproduction as of paramount importance. With this latter class I heartily agree. Very few people can realise how much has been done at the transmitting end of the broadcast system to make it possible for even the humblest receiver to give decent reproduction of speech and music. It is incredible that so many listeners prefer to chase the elusive foreigner rather than listen in peace and quietness to broadcasts from purely local stations, with a few of the higher powered Continental broadcasts thrown in as a stand-by, when the B.B.C. educationalists run riot.

I am not trying in this article to convince the confirmed knob-twiddler that his point of view is all wrong, but I would like him to put the 1936 Stentorian together and compare the quality of reproduction with that of, say, a superhet.

The receiver won't be wasted anyway, because there are always the old people to consider who like to listen to music, and by that I mean beautifully reproduced music, merely by simply turning the switch.

Talking of switches brings me to one of the fundamental changes in this design. Mono control, introduced by Formo Products, Limited, earlier this year, is now incorporated in the 1936 Stentorian, and although most of you know the exact meaning of mono control, I am going to explain it briefly to those who do not.

In short, a multiplicity of switch controls is now completely eliminated. The on-off filament switch, the switch from medium wave to long wave, and also the switch over from radio to pick-up, is now incorporated in the Formo Sensity iron-cored coil unit. This makes for simpler and neater construction, and a somewhat less complicated and more symmetrical lay-out.

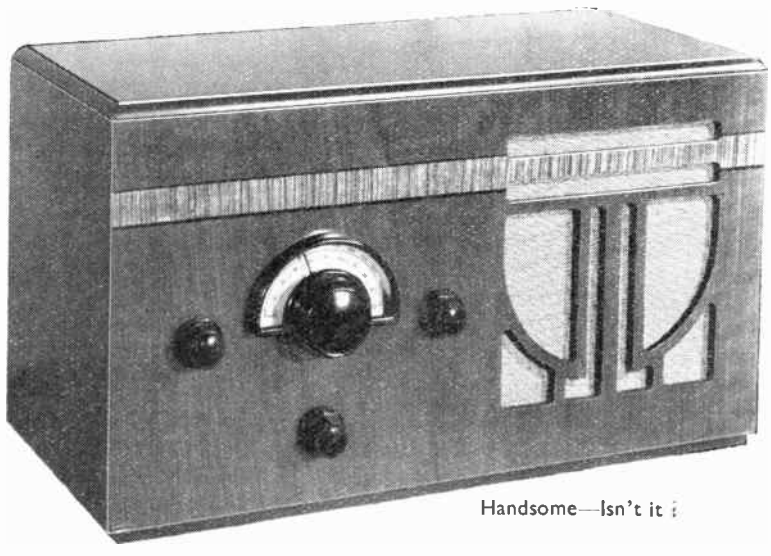
Of the circuit itself I am going to say very little, simply because there is very little that can be said. Before getting down to the job of constructing, however, I feel that I should not be doing justice to the manufacturers without making reference to the new valves specified in this circuit. I refer, of course, to the new Graham Farish ring valves, from which range I have chosen the detector valve No. DX2, the first amplifier valve No. LF2, and last, but by no means least, the medium power pentode No. PT2. The latter valve is included in the new circuit in deference to the wishes of those who asked for a somewhat greater output, and less current consumption than that of the large triode power valve previously used. But now to work.

THE BASE-BOARD

First of all you must make up your mind about the base-board. The illustration on page 11 will show you how to construct your own from three pieces of wood although I take it that having decided to build the set you will want to house it in one of the very attractive and dignified Laurence cabinets specially designed for Contact circuits. In this case the base-board is supplied free with the cabinet. I do strongly advise that you order the complete cabinet and base-board before you begin the constructional work, because, bearing in mind the beautiful finish of the cabinet, I can imagine no better incentive to induce you to take a little care with your assembly and make it worthy of its housing. However, in case you already have a suitable cabinet, here are the directions for putting the base-board together. A piece of $\frac{3}{8}$" plywood must be obtained which is sufficiently large to cut into three pieces of exactly the dimensions shown. The $11\frac{1}{8}$ in. by $8\frac{1}{4}$ in. piece forms the base-board, while the $2\frac{3}{4}$ in. by $8\frac{1}{4}$ in. pieces form the two sides which support the base-board. Certain wires are allowed to pass through the base-board through holes which can be drilled in suitable positions after the components are screwed down.

CONSTRUCTION

The reduced size wiring diagram accompanying this article is so extremely clear that hardly any instructions are necessary. For the benefit of those who prefer to work

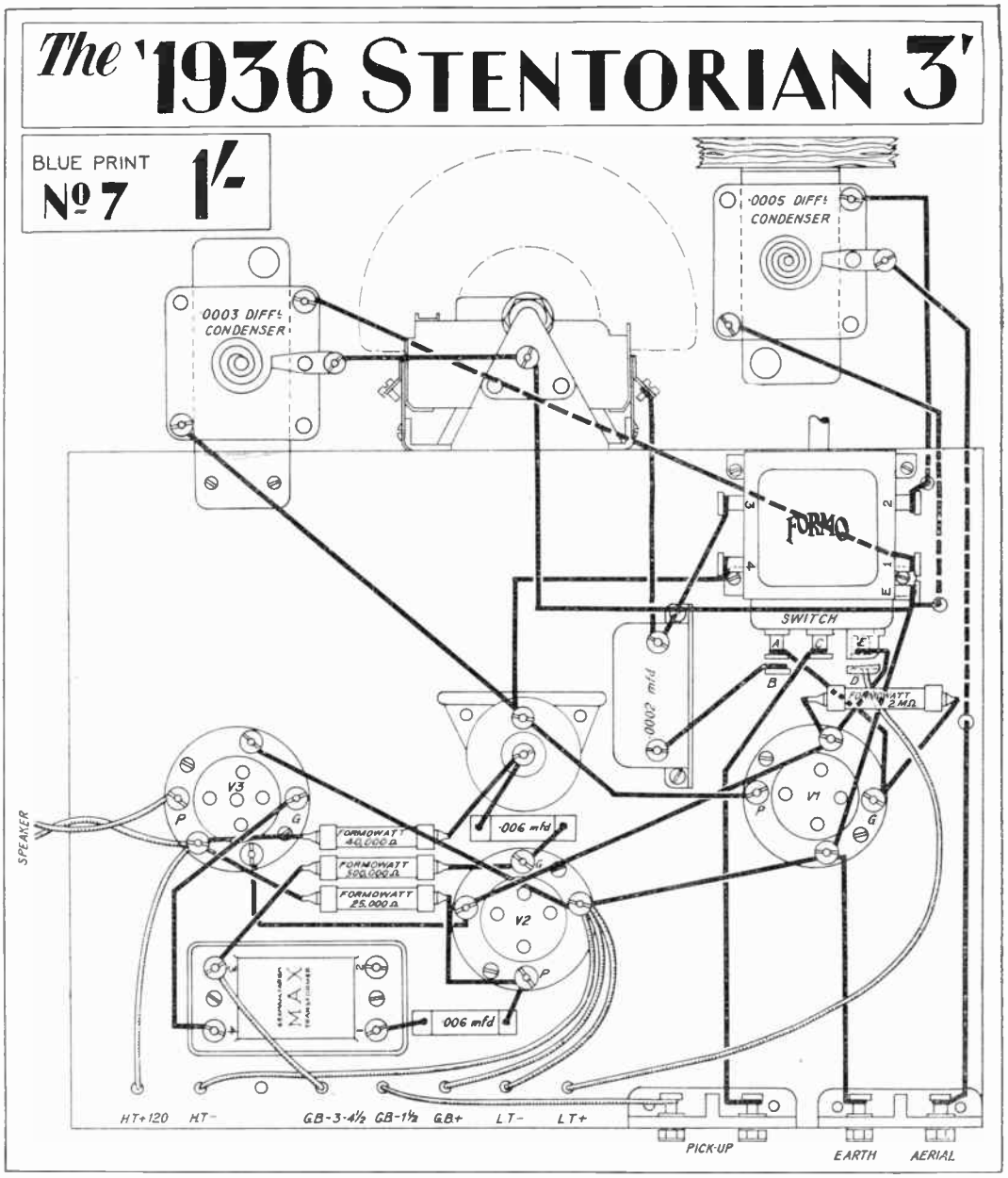


Handsome—Isn't it?

from a full-size blue-print, I understand that copies are available from the Editor, price 1s. each post free.

First screw down to the base-board the bracket holding the 0·0005 mfd. aerial condenser which is mounted underneath the chassis. This small job will not be quite so simple if you leave it until after you have mounted some of the other components on top of the chassis. Next screw down all the other components on the base-board as indicated on the lay-out. Care should be taken to mount the Max transformer with the lettering the right way round, otherwise your terminal connections will differ from those shown in the blue-print and may lead you into a spot of bother. This can be very easily checked off as the 0·006 mfd. tubular condenser can be connected up by its own wire ends from the plate of the middle (or first L.F.) valve to terminal 1 of the Max transformer.

To make the wiring quite clear in the wiring diagram it was not possible to show the exact positions on the base-board of the four components which project through the front panel. The coil, the variable reaction condenser, and aerial condenser, should all be mounted flush with the edge of the base-board, but if you find that the spindle of the coil switch projects further forward than that of the reaction condenser, thus making the knobs appear not quite symmetrical, then mount the coil slightly further back so that the knob will fit almost flush with the panel.



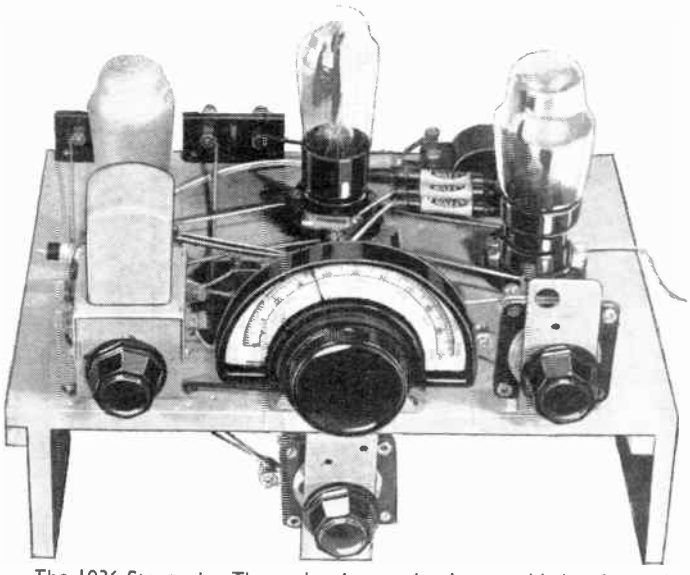
THE 1936 STENTORIAN THREE PRACTICAL WIRING DIAGRAM
A full-size blue-print can be obtained from the Editor, price 1/-

WIRING

It is a good plan to put a small cross over each wire on the wiring diagram as you fix its counterpart to the receiver. In this way you can check off your own wiring with the wiring diagram without any possibility of error. The Formowatt resistors and the tubular condensers are provided with their own connecting wires, and the base-board lay-out has been carefully arranged so that these components can be wired straight to their respective terminals. Quite a lot of juggling had to be done in order to make this great simplification in the wiring possible, without impairing the perfection of the layout from the electrical point of view. If you find you cannot easily fit the resistors and tubular condensers, it means that you have not screwed down the components exactly in their right position.

Bear in mind that the connecting wires to these small components are not insulated, and you should, therefore, slip a small piece of Systoflex sleeving over them in order to prevent any possibility of their touching any terminals for which they were not intended. When fixing the flexible battery leads to their respective terminals it is important to twist the strands together tightly, because any loose strands may get caught in the screw thread, and if you tighten up when this happens you may twist the whole terminal, and you will then have to unscrew the component from the base-board and tighten up the terminal from underneath.

By the way, if you are interested in nice straight wiring with clean corners, I recommend the use of Glazite or a similar insulated wire, which is usually purchased from your radio shop in coils. Uncoil the whole length of wire and stretch it as taut as possible. This will take out all those nasty little kinks which will otherwise appear in your finished wiring. To bare the ends of your lengths of wire, cut through the insulation with an old razor blade. This will give a very clean and professional appearance to your wiring. Further little refinements can be added to your job by fixing indicating tags on the flexible leads to the



The 1936 Stentorian Three chassis completely assembled and wired

batteries and accumulator, and while these refinements may not be necessary, they do make for ease of construction and may be necessary if the set is to be operated by somebody who has not built the set or who does not understand the circuit. I must now assume that your wiring is complete and that the chassis has been safely fixed in the cabinet.

TESTING OUT

First of all connect the speaker leads from the chassis to the two terminals of the loudspeaker transformer. All my tests were carried out very satisfactorily on a W.B. Baby Stentorian loudspeaker, and I found that correct matching to the output valve was obtained by connecting to the terminals marked 0 and 2. If you are fortunate enough to possess the new type Baby Stentorian speaker, you will find the correct matching can be obtained by merely plugging in the small wanderplug provided with the loudspeaker in its appropriate socket. You can best determine the correct socket by changing over while listening to a programme.

Next connect the aerial and earth to the terminal mount on the back of the chassis. The former should be as high as possible and approximately 50 to 60 feet in length, including the lead-in. Take care to keep the lead-in well away from the walls of the house, and bring it in through a window by means of a well-insulated lead-in tube. The earth connection should also be as short as possible, preferably to a ground connection outside the house. In many ways a water pipe earth is quite efficient, but unless you understand the exact location of the water pipe, you can never tell how far the pipe runs before it actually reaches earth. Quite a good scheme is to use a Graham Farish Filt earth which will remain damp and provide a good earth connection, even in the driest possible weather.

The next step is to fit your Graham Farish Ring valves into their proper valve-holders. The DX2 valve is fitted into the detector position, marked on the wiring diagram V1. Next comes the L.F. amplifier valve, No. LF2, which is marked on the wiring diagram V2. The pentode valve is fitted into the 5-pin socket marked V3, and you will observe that the flexible lead from the plate of this valve-holder goes direct to the loudspeaker.

And now we come to the H.T. battery, the L.T. accumulator and the grid bias battery. These can be of any sound and reliable make, but do not try to economise on the H.T. battery. Whilst the current consumption of the 1936 Stentorian is not excessive by any means, it is necessary to feed adequate power into the set to get maximum results. The connections to the batteries are extremely simple, and are very clearly shown on the wiring diagram, and I do not think it is necessary to dwell on this subject at any length. The bias applied to the last valve should be chosen with care, for it is here that the question of quality is often decided.

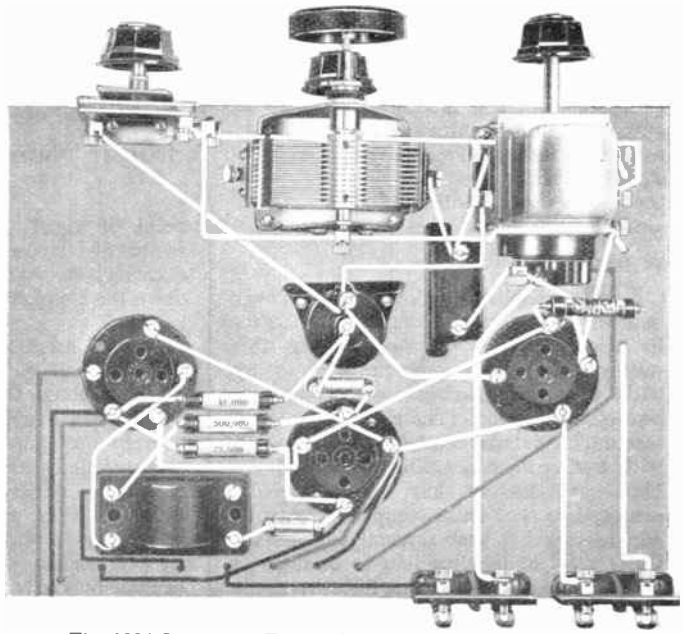
RECORD REPRODUCTION

Before leaving this business of connecting up, may I add a few words for the benefit of those who wish to use their Stentorian for electrical reproduction of gramophone records. The circuit is ideal for this purpose and all you require is a spring motor and a pick-up with a built-in or separate volume control of approximately 50/60,000 ohms. I obtained perfectly amazing results with an old portable gramophone which had one of the new Graham Farish compensated all-bakelite pick-ups fitted in place of the usual tone-arm and sound box. All that I had to do was to take the two leads from the pick-up to the terminal mount at the back of the receiver, and my gramophone records were reproduced perfectly through the W.B. Baby Stentorian loudspeaker. By the way, don't forget either to disconnect the aerial or de-tune the receiver, before you put your records on, otherwise you are likely to hear a peculiarly interesting mixture.

If you are in any doubt at all about fixing or using the pick-up, let me give you a tip. In front of me as I write I have one of the finest pieces of literature any constructor could wish to handle. I refer to a leaflet dealing with the Graham Farish compensated pick-up, which is called "The Pick-up and its Uses," and it explains in really readable and non-technical language how the pick-up may be used with any type of battery, A.C. or D.C. receiver, and how the best results can be obtained. The Editor will be pleased to send any of my readers a free copy on request, and whether you intend using your pick-up right away or in the dim and distant future, you should certainly make sure of getting a copy.

I am afraid I have wandered from the job in hand mainly because I am really enthusiastic about the 1936 Stentorian as a record reproducer. But to proceed. First make sure that the mono-control switch on the Formo coil unit is turned in an anti-clockwise direction as far as it will go, before you connect up your accumulator. This is the filament switch portion of the control and your receiver will now be off. Turning the control switch one stage in a clockwise direction will bring you on to the medium wave broadcast band. Before proceeding further, just disconnect the wanderplug from the H.T. battery and replace it in position. This should produce a loud plop in the speaker, and if it does not you should check over the wiring again as you have probably made a mistake, such as leaving a wire out, or connecting one or more wires with the insulation not properly removed.

However, we will assume that you have not been slip-shod in your assembly and

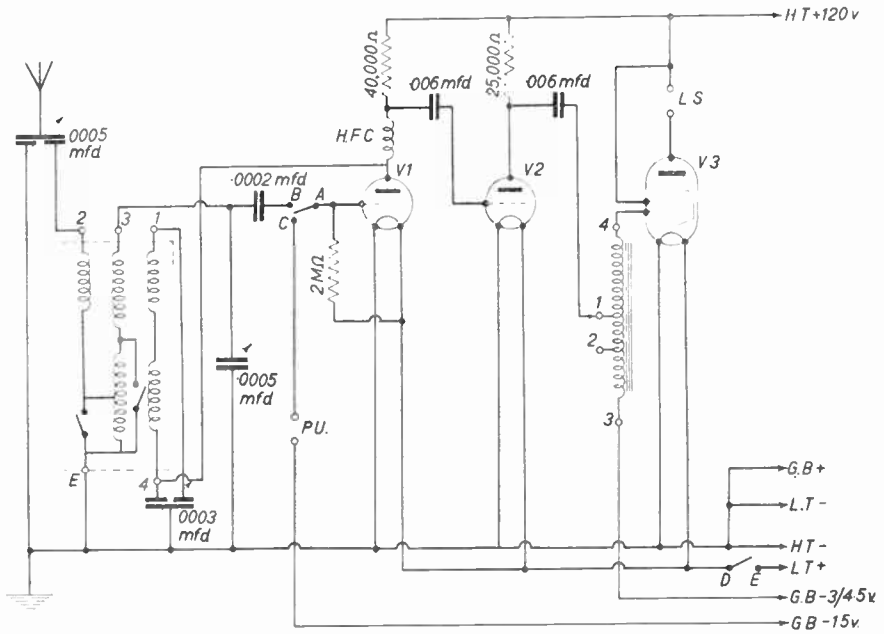


The 1936 Stentorian Three plan view of chassis assembly

that everything is now correct, and you are ready to make a preliminary test on actual broadcast. The Mystic dial control in the centre is the station selector, whilst the small knob on the right of the panel is the reaction control. Use this latter with care, and only when it is necessary to build up volume from a weak signal. The small knob below the main station selector provides variable selectivity. In effect this enables you to adjust the length of your aerial to suit the coil. It entirely depends on the conditions under which you are operating the receiver, and by this I mean the locality in which you are operating, as to whether you will find the use of this control really necessary or beneficial. It is, nevertheless, just one of those little refinements which help to make this an outstanding circuit of its type.

Revolving the main tuning control of the Mystic drive will tune in nearby stations with the reaction control and the variable selectivity control at minimum. To locate more distant stations increase reaction by turning the control in a clockwise direction, then retune with the main dial. At certain points on the dial a whistle will be heard, and at these points stations can be tuned in by turning the reaction control in an anti-clockwise direction. The ability to tune a receiver of this type efficiently, largely depends on practice, and half an hour with the controls will teach you far more than I can in these pages.

Going back to the mono control, the second turn in a clockwise direction will bring you on to the long waveband, and a third and final turn will switch you over from radio to pick-up. In the latter position none of the panel controls need be used when your aerial is disconnected, although the same purpose is served by merely detuning the main control knob or station selector. Here, then, you have the ideal family set. It is extremely simple to build and even more simple to operate, and can be relied upon through many years of service to give you a quality of reproduction which will be the envy of all your listener friends.



The 1936 Stentorian Three circuit diagram

COMPONENT PARTS REQUIRED FOR THE 1936 STENTORIAN

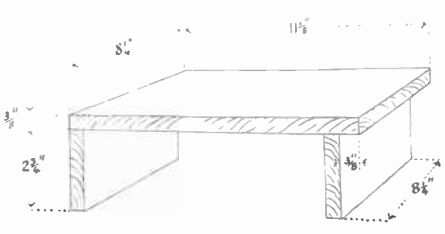
	s.	d.
1 Formo 0·0005 SU3 type condenser with Mystic Drive	6	6
1 Graham Farish 0·0005 mfd. differential condenser	2	0
1 Graham Farish 0·0003 mfd. differential condenser	2	0
2 Graham Farish component brackets	0	8
1 Formo CA/G coil unit	8	6
2 Graham Farish 4-pin valve-holders	1	0
1 Graham Farish 5-pin valve-holder	0	8
1 Graham Farish Disc H.F. choke	2	0
1 Graham Farish 0·0002 mfd. Mica condenser	0	6
1 Graham Farish Max transformer	4	6
2 Graham Farish 0·006 mfd. Tubular condensers	2	0
4 Formowatt resistors :— 1 2-megohm, 1 40,000 ohm, 1 500,000-ohm, 1 25,000-ohm — at 10d. each	3	4
2 Graham Farish Pop terminal mounts	1	0
The following accessories are recommended by the designer :—		
Laurence walnut cabinet with baseboard (Graham Farish)	25	0
120 V. H.T. battery, 4½ V. G.B. battery, 2 V. 40 Ah. accumulator — Any good make.		
W.B. Baby Stentorian loudspeaker	23	6
10 ft. connecting wire.		
VALVES.		
Graham Farish Ring detector type DX2	5	6
Graham Farish Ring L.F. amplifier, type LF2	5	6
Graham Farish Ring output pentode, type PT2	13	6

If, on the other hand, you intend to start with an entirely new set of parts "as specified"—take my tip and buy one of the Graham Farish Approved Component Kits. These very lively people have decided to market the complete range of components necessary for the 1936 Stentorian in kit form, and the component only kit will be known as Kit A.

The component kit complete with specified valves will be known as Kit B and this is where you can save money. The Kit A costs 34s. 8d., and the specified Ring valves 24s. 6d., or, in other words, a total of £2 19s. 2d. If you buy Kit B, you will find that your total outlay is £2 15s. only.

I understand that the manufacturers make this reduction for two reasons. Firstly, packing and distribution costs are considerably reduced and the saving is passed on to you. Secondly, and most subtly important, you are encouraged to buy brand new valves and components and so give your set a fair chance to show its paces under the best working conditions. It may be hard to put on the retired list a trusty old valve which has done yeoman service for years past, but you are bound to find new valves more economical and certainly far more efficient.

If there is anything further I can do to help you—if any little problem arises before or after you have started, just drop me a line via the Editor.



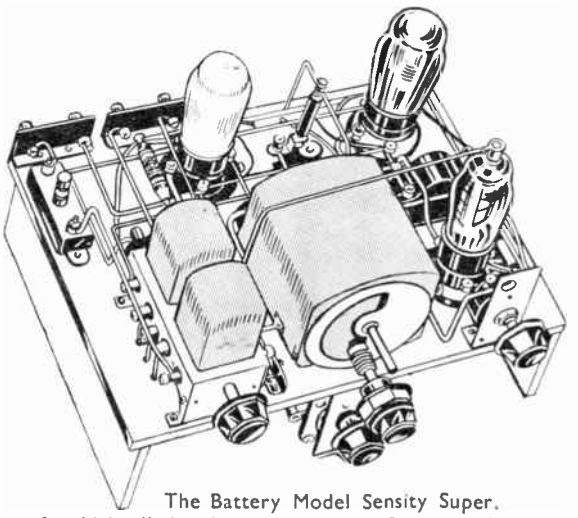
Baseboard dimensions and construction

More about the SENSITY SUPER S.G.3

AS this heading conveys, this article is written on the subject of the experiences we, the designers and constructors, have had with the Sensity Super.

It might be thought that having put over a successful design—one that can without doubt be called universally popular—we should be content to "let sleeping dogs lie" and quietly pat ourselves on the back. The latter we certainly have done, but we do feel that to those who have built the set, and even to those who have not, a little more might be said about it.

Let us first assume that you are one who has constructed the Sensity Super. Are you getting the results that you undoubtedly should? A survey of the reports from our Service Testing Department indicates that although we have made it as simple as we possibly can on the average about 1 in 300 has made some slight slip. Slight as this might have been it has been sufficient to either (*a*) reduce considerably the sensitivity of the receiver or (*b*) made it impossible for the receiver to work at all.



The Battery Model Sensity Super, of which all details were given in CONTACT No. 2

If you are one of the "*a*" class then it is quite possible that at the outset you were a little disappointed, but that you have continued to work the receiver in this condition, assuming that you could not expect anything better. By this I do not mean to say that you should immediately say "I wonder if I have really got this right?" and commence to disembowel your Sensity Super in the hope that you might even get something better. What I do mean is that if your receiver does not appear really lively and does not give more than adequate strength for your requirements, both on the locals and on some of the stronger foreigners, then there must be something wrong.

Again, referring to our Service Test Department, we find that amongst the faults in receivers are: reversed transformer connections; wires not bared before being screwed under terminals; badly ganged condensers, this also covers damaged condensers which are consequently untrimmable; faulty valve leg contacts; faulty components. Of course, there are other causes, such as one in a receiver which was actually inspected by us in which the constructor, having apparently run out of wire, used some *string* to finish the connections!

We are only concerned with what the majority do, since it would not be possible in the space devoted to this article to give you a fully detailed report. So much for the receiver itself.

The troubles due to bad aerials and their dirty connections, long trailing earth wires of high resistance, use of obsolete and worn-out valves, new but defective valves, run down high-tension batteries, accumulators not up to standard, worn-out grid bias batteries, decrepit speakers, also are very much in evidence, and this might cause a stirring of conscience even to you. Please try to be honest with us who have endeavoured to be honest with you by giving you really sound designs based upon months of careful experimenting. Use only efficient and good accessories for this and other CONTACT receivers. It will not only repay you handsomely in the results obtained but will in the long run be true economy.

One thing that strikes us as very evident when dealing with correspondence is that although we have laid particular stress on the importance of accurately ganging the receiver this is still not being carried out with sufficient care. Although we have given you full details of how this should be done, I will give you a simple experiment to carry out. Tune-in your local station, using a fair amount of reaction. Then, by putting your hand into the back of the receiver, see if any adjustment of the star wheel trimmer improves the results. If it does it means that you were not correctly trimmed. I should add that the front trimmer should be about mid-way between its clockwise and anti-clockwise movement for the test. If anything, err a little on the anti-clockwise side, since the law is not truly straight line capacity: but the capacity of the trimmer increases slightly in relation to its rotation more as you approach the "fully in" position. This is when the knob is turned fully anti-clockwise. This little experiment is well worth carrying out, and it may make all the difference in the world to your results.

How can I find out whether my valves are up to standard? This is a question often put to us and, incidentally, unless you have some means of comparison it is an extremely difficult one to answer. The ideal, of course, is to test by substitution of valves which are known to be in good order. If you cannot beg, borrow, or steal a complete set of valves it is worth while at least trying the screen grid valve only, since this has a most important bearing on the performance. A steep-slope valve is specified, and any type of screened grid valve will NOT do.

If you are unable to substitute the other valves, then the next best thing is to check the anode current with a milliammeter. If you can, put the milliammeter in the anode circuit of the S.G. valve and remove the bias plug. The change in the anode current should be approximately 1·3 m/a for every volt change on the grid. This may sound a little complicated, but if you regard it in the light that if, with the 1½ v. bias plug disconnected, you get a reading we will say of 4 m/a, then when the bias plug is in position at 1½ v., the reading should only be approximately 2 m/a. This means that the anode current has changed 2 m/a for a change of 1½ v. on the grid, which gives a slope figure of approximately 1·3. If the change in anode current is less than this then you can assume that your valve is not fully up to standard, or, alternatively, is not of the type specified for use with this receiver.

By switching over to radiogram position and using the same bias plug again and the milliammeter in the anode circuit of the detector valve, the same procedure can be followed, and in this case the change in the anode current in m/a should be no less than 1·1 times the change in grid volts, i.e., 1½ v. The output valve we must leave to look after itself, but in any case it is quite easy, generally speaking, to borrow one of these from your dealer if you suspect it. The output valve, whilst having a bearing on the volume and power of the set, will not affect to any great degree either the sensitivity or the selectivity.

With regard to the above, it will probably interest you to know that Graham Farish, Limited, have produced a range of valves to ensure that the constructors get valves which are guaranteed within certain limits. In view of this, they are now specified in all CONTACT circuits, and all Sensity Super Kits are available with this type of valve.

There is just one other thing in connection with our Service Department, and it is this. While the technicians who read your letters do not like to wade through a whole pile of closely filled notepaper, on the other hand they do like to have everything clearly set out in order that they can speedily answer your questions, or form a diagnosis of the trouble. It is not enough to write and say: "My set will not work," or "I can't get signals on Timbuctoo." We quite realise that you would not be writing unless you had some trouble, but on the other hand, it is not very helpful, and if you can at least answer a few of the questions that are likely to crop up in diagnosing faults it will be of great assistance and will render the service we endeavour to give far more effective.

Say in your letter that reaction does or does not work on either wave-band or to what extent it works. Describe whether the volume control seems O.K. If possible, state whether the filaments are alight in the valves and, if not, put a flash lamp bulb in series with your set to make sure that the L.T. is working. By removal of one valve at a time it can be readily ascertained by the variation of the light of the bulb, whether the valves are each getting their share of filament current. If it is possible to measure their anode current, so much the better. If not, say whether disconnecting the screened grid cap gives a noise in the speaker, and also whether disconnecting the screen H.T. terminal from the battery makes a similar noise.

Another method whereby one may check a portion of the receiver is to connect (preferably through a condenser above 0·0001 mfd.), the aerial to the anode of the S.G. valve, and operate the receiver as a detector and amplifier. You should, when thus connected, receive local stations at moderate strength, and if this is so it can be assumed that the fault lies before the detector, i.e., in either the S.G. valve, aerial coil, or aerial condenser, and connections associated with part of this circuit.

If you do not receive signals, remove the S.G. valve and try again, using the cap as aerial connection through the condenser. The condenser is included because the anode is connected to H.T. and, although your aerial should be well insulated from earth, it is possible, this not being so, to short circuit the H.T. battery.

If you are still unable to obtain signals, then it can be assumed that your trouble lies in either the detector or the amplifier circuit. Information concerning this can be used when sending technical enquiries and, in common with the above remarks, is useful to enable us to form a diagnosis.

Any information of this nature is extremely useful in diagnosing faults, and while in many cases you may not be able to carry out such tests, they will all have a direct bearing on the accuracy of the diagnosis our Service Department will give you in the event of trouble.

All the above may sound very depressing to those of you who have not built the Sensity Super, but there is one point which should give you the utmost confidence to go ahead with its construction, and that is that, as I originally pointed out in Contact No. 2, this set is designed to serve every district, to meet every possible contingency with regard to locality, and will work under the most diverse conditions. There is no doubt that this statement has been proved time and time again by the reports which we have received from all over the country. In places which were recognised as being most difficult for the reception of certain stations, and with aerials of all types and sizes and construction, the Sensity Super has proved its sterling worth.

It is, of course, absolutely impracticable, and will probably bore you after reading any number of them, to give you anything like the number of letters we have had relating to its operation, but I cannot help, with some pride, referring you to the following letters which I have chosen from as widely varying districts as possible. They say that the "proof of the pudding is in the eating," and if you have not sampled this yourself, judge by the taste of those who have, and read their comments set out overleaf.

(Continued on page 14)

PROOF From constructors all over the British Isles—come these letters of praise, each one bearing testimony to the amazing performance of the battery operated Sensity Super, each one definitely proving in the words of the designer that "the Sensity Super is suitable for use under *any* conditions in *any* part of the country."

Here are just a few of these astonishing letters taken from the postbag at random.

Tynemouth.—I have just built your latest set, the Sensity Super, as shown in CONTACT No. 2, and wish to tender a few words of appreciation to you for making it possible for one to construct such a wonderful set. It honestly does come up to all the standards stated in your magazine, and the performance is truly magnificent. In fact, some of my friends, coming into the room while it was on, thought it was a new "all electric set" and were quite surprised to learn that it was a 3-valve battery set. I am using it at present as a radio-gram., and it also gives very good results on the gramophone side. I may add that housed in a modern radio-gram. cabinet, it looks very neat, with the flood-lit chromium dial, and altogether proves a very valuable asset to a home. Wishing you the best of luck for CONTACT No. 3.—C. H. P.

Gt. Yarmouth, Norfolk.—I have bought one of the Sensity Super Kits and I have found it a great and very satisfactory outfit.—J. H. B.

Dagenham, Essex.—I must tell you how pleased I am with my Sensity Super set, as it has not given me any trouble at all and the stations simply roll in. I built the Sensity Super myself after I had a good look at all the other sets at this year's Radiolympia, and for the money I prefer mine. My wife won't have it changed for anything, and she can work it as good as myself. I am perfectly satisfied. "It's a champion set," as they say in Yorkshire. If you care to publish this letter in your next issue of CONTACT you have my full permission.—T. T.

London, E.6.—I have just finished your Sensity Super and am very pleased with it. It is rather marvellous for a three-valve set. I have another receiver, but for tone, selectivity and volume, compared with the Sensity set, it is only fit for the dust-pail. I do not see the need for any more valves when such results can be obtained from three valves.—M. L. B.

St. Jude's, Plymouth.—I have made up your Sensity Super set as described in RADIO CONTACT and am delighted with the results.—A. G. D. P.

Portsmouth.—Having made up your Sensity Super set which I got from CONTACT No. 2, I am hoping you will soon bring out an all mains set of the same design. The Sensity Super certainly goes splendidly. It is without doubt the best set on the market.—A. J. W.

East Ham, London.—I must confess that I have only been a wireless fan for two months, and your magazine No. 1 took my fancy, so I bought No. 2 and was tempted to make the Sensity set. I have used a few parts that I had in my box, also I am using a detector valve from my old set. Nevertheless, the set is still marvellous to me. I have had praise from a few friends already. One has an all-mains set, and I believe he is rather jealous of my set. I made my own cabinet and am using an indoor aerial and a cone speaker, so you can gather that everything is really against the set working properly. I consider the set is worth spending some money on, so I will buy the specified Stentorian speaker and change the odd components for the right ones. I apologise for ill-treating your circuit, but it is really more to your credit that it works under such adverse conditions.—L. B.

Chippenham, Wilts.—Now I have a set that I am more than pleased with. The coils are the finest anyone could have. Good selectivity, good volume and plenty of stations.—W. G. T.

Brockley, S.E.—I should like to compliment you on the excellent performance of the Sensity Super.—B. D.

Glasgow.—Nothing to approach it (Sensity Super) for selectivity and good quality at less than twice the price.—M. D.

N. Wales.—Have built the Sensity Super into a radiogram. More than satisfied and very proud of it. A credit to your firm.—J. J. N.

Manchester.—You have understated the case for the Sensity Super—the grandest set I've ever handled.—N. D. H.

Taunton, Som.—I am more than pleased with the results. The Sensity Super is the envy of all my friends, and I don't doubt you will be getting quite a lot of orders from this part of the country.—B. B.

Newcastle.—It's a marvellous circuit, and I can't imagine one possible improvement.—J. M.

Sheffield.—Please let me have all details of the Sensity Super. I heard one at my friend's house last night, and must say that it is one of the finest sets I have ever heard.—K. T. J.

Bedford.—I have logged 34 stations on it (Sensity Super) at real loudspeaker strength, but feel sure I can do better after a little practice.—T. S.

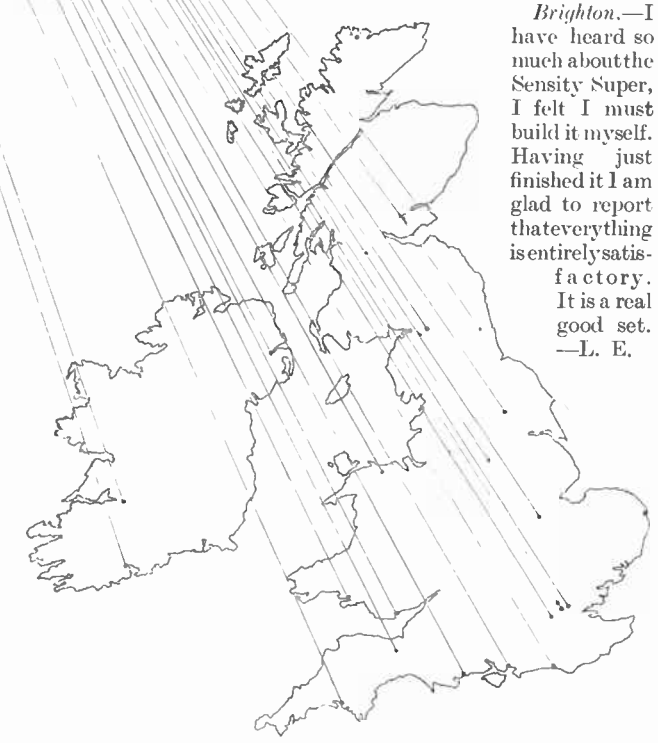
Belfast.—The Sensity Super is one of the few sets up here that will give anything like decent results.—R. D.

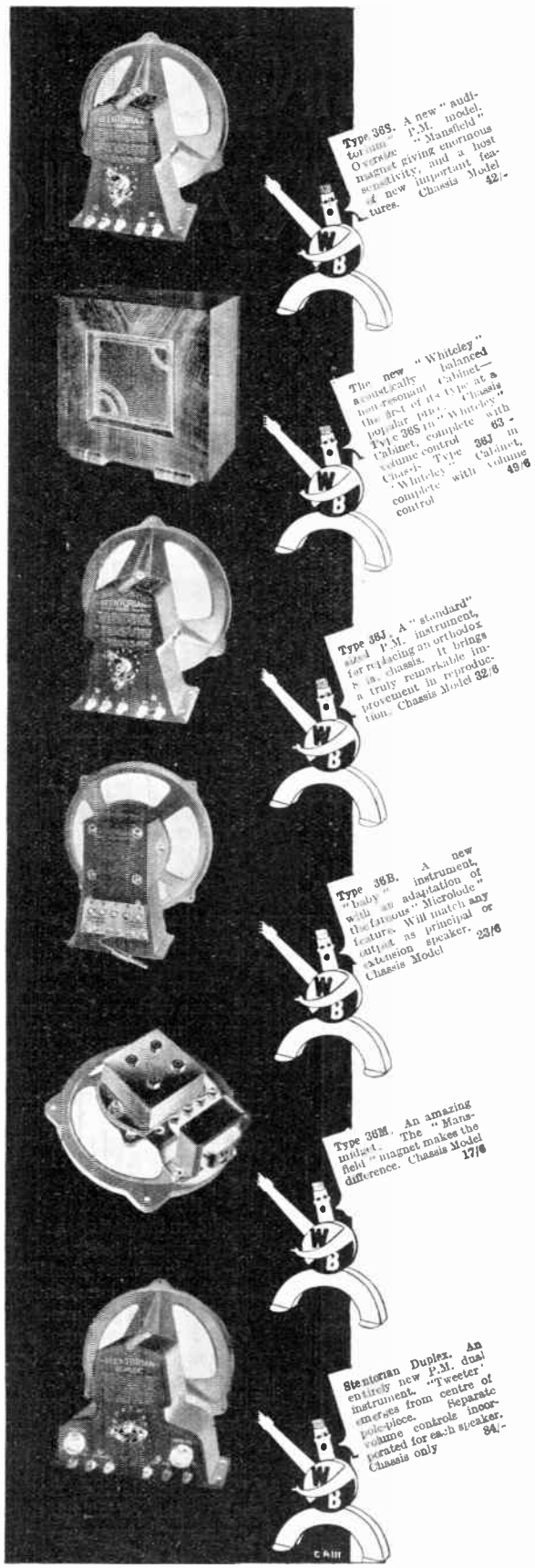
Limerick.—It is grand to have so many stations brought in with such beautiful tone.—J. O. M.

Cork.—I have taken a lot of care over building it (Sensity Super), and I must say that the results have made my trouble worth while.—S. D.

Bournemouth.—I have just built the Sensity Super and I shan't want anything better. The results on this part of the South coast are really extraordinary.—F. H.

Brighton.—I have heard so much about the Sensity Super, I felt I must build it myself. Having just finished it I am glad to report that everything is entirely satisfactory. It is a real good set.—L. E.





NOW-

ANOTHER MOMENTOUS ADVANCE!

● Bristling with new and important improvements on orthodox design—larger and more powerful than before, the 1936 "Stentorians" represent an historic triumph for W.B. research engineers. These startling new models enable the "quality" enthusiast to attain a "laboratory" standard of reproduction at a price which only the great W.B. resources, coupled with important new methods of precision manufacture, could bring within the realms of possibility.

● Whether your receiver be a modest two-valver or a full-sized quality instrument, you *must* hear the difference a 1936 Stentorian will bring. The impressive volume, beautiful balance of tone, and new incisive realism will give you a new conception of what radio reproduction should be.

Ask your Radio dealer to-day, and hear one for yourself. You will be amazed!

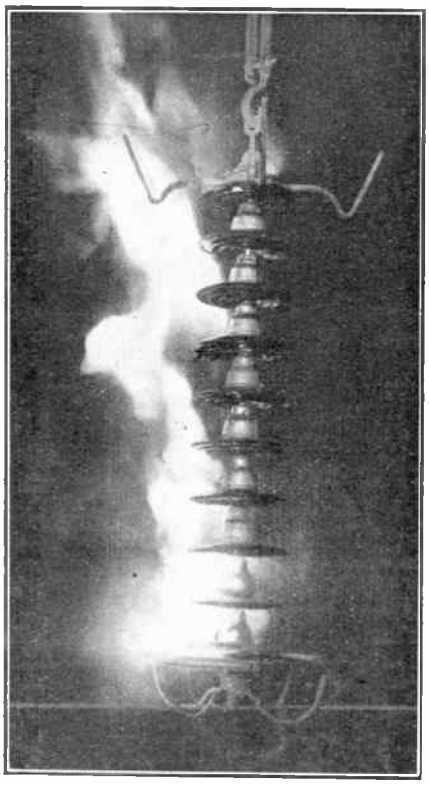
1936

STENTORIAN-

EXCLUSIVELY SPECIFIED FOR ALL "CONTACT" RECEIVERS

WHITELEY ELECTRICAL RADIO Co., Ltd., Radio Works, Mansfield, Notts.

Sole Agents in I.F.S.: Kelly & Shiel, Ltd., 47 Fleet Street, Dublin



CERAMICS *in* RADIO

THE technique of radio has progressed out of all recognition in the past ten years, and still the goal of finality recedes. Each season sees substantial improvements in component and circuit design. The approach of television and the increased interest in short-wave reception have now focused the technicians' attention on the all important matter of dielectric losses in insulating materials.

It is common practice in short-wave superhets to make up for the loss of efficiency in the signal frequency circuits by high intermediate frequency gain; in "straight" receivers the same purpose is achieved by the use of a high degree of low-frequency amplification. In both cases the result is a set with an extremely noisy background, making weak signals most difficult to read except under favourable conditions. Furthermore, poor signal frequency circuits in a superhet will lead to serious second-channel chirps and whistles; while in a "straight" set the resulting flat tuning will, with the ever growing crowding of stations, cause intolerable lack of selectivity.

In the early days of broadcasting, both the amateur experimenter and the set manufacturer relied almost entirely on ebonite. While good ebonite is superior in the matter of losses to many of the everyday insulating materials, it leaves much to be desired in the way of strength and rigidity, it does not resist heat at all well, and it is not easy to apply neatly and economically in design.

For several years ebonite has been supplanted by bakelite in various forms—moulded, punched, and in tubes. The losses in bakelite vary widely, according to its quality, but its mechanical properties make it a very useful material for many radio purposes. In all parts of the circuit where H.F. does not penetrate, for instance, the question of dielectric loss hardly arises, and there is no need to look further for an insulating material. Even in the H.F. stages, the losses introduced by the judicious use of good bakelite are not serious above about 300 metres, and on the long-wave band they are quite small.

There is a different story to tell, however, when we consider the short-wave band between 15 and 50 metres, where of all the familiar insulating materials, only mica makes a respectable showing. Unfortunately, mica is limited in the form in which it can be used. It is not easy, for instance, to employ it as a coil former.

When we come to the "ultra shorts," below 10 metres, which will be employed for television, the question of losses becomes vital, and special insulating materials are essential.

Fused quartz is known as a first-class insulating material at high frequencies, and has been widely used on the transmission side and in high-grade apparatus for laboratory work, but its high cost and great difficulty in working severely restrict its commercial use. With the growing demand for a higher standard of performance and greater selectivity in broadcast receivers, and the vital need for elimination of losses in short-wave circuits, more practical materials have been sought.

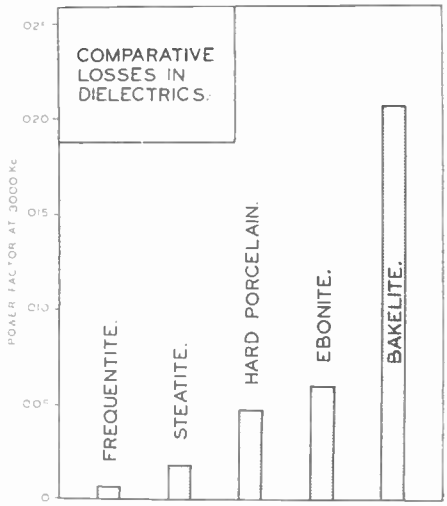
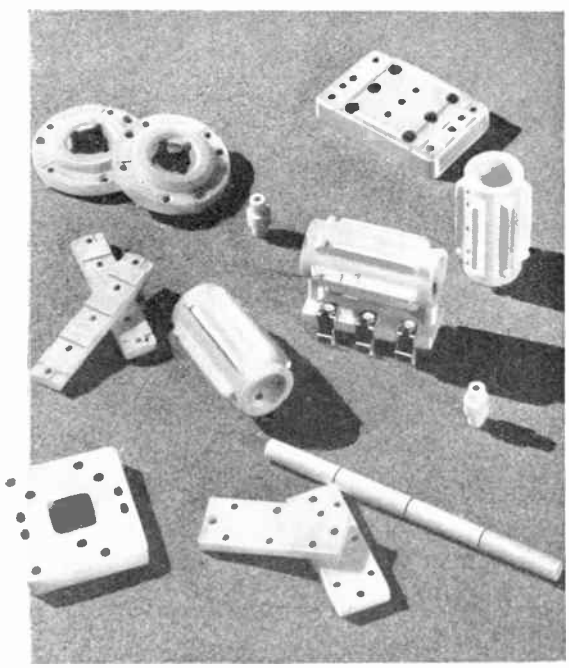


Fig. 1

Ordinary porcelain has been used with some degree of success. Certain ceramic materials of the steatite group, derived chiefly from natural soapstone, proved very promising. Steatite itself was first found to have superior properties to ordinary porcelain when used in a short-wave transmitter, in which inferior materials heat up seriously, causing loss of power, if not breakdown. Research followed on insulating materials based on the mineral soapstone, and resulted in the new material Frequentite, possessing really excellent properties, both electrically and mechanically.

The low-loss characteristics are truly remarkable, being comparable with those of expensive fused quartz, and roughly *fifty times* better than the ordinary materials used for broadcast reception. Fig. 1 gives an interesting comparison of the losses in different insulating materials. In practice, the effect of these losses increases with frequency, so that the advantages of using the high-grade ceramics are not important on long waves (150–300 kc.); they are quite evident on the medium-wave band

(*Continued on page 52*)



Examples of Ceramic Coil Bases, Formers, Valveholders, etc., used in Graham Farish and Formo Components

"NATION shall speak unto NATION"

A Prophecy fulfilled by the

DISCOVERY

SHORT WAVE S G THREE

Span - THE

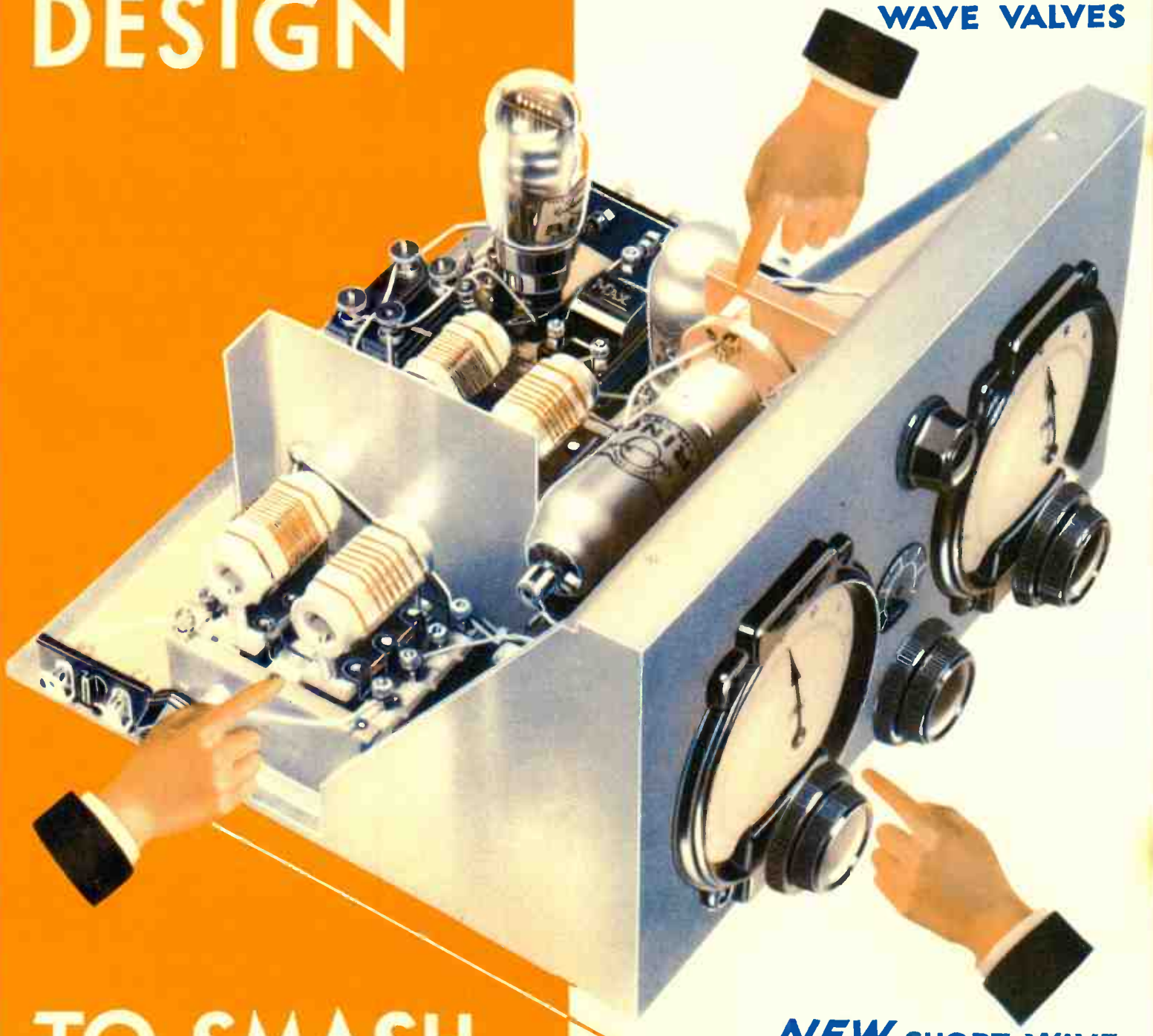
EUROPE
AFRICA
AUSTRALASIA

IN THE COMFORT of

5 CONTINENTS

YOUR OWN HOME

A SHORT WAVE DESIGN



NEW SHORT WAVE VALVES

NEW SHORT WAVE CONDENSERS & DRIVES

NEW SHORT WAVE COILS

TO SMASH ALL RECORDS

SPACE — TIME — DISTANCE — Conquered!

THE Discovery Short-wave Three will give you a new outlook—a new angle—on the affairs of this amazing world. Build it—and open the door to a new thrill which must be experienced to be believed.

IN this jaded world of listening to chamber music, dance bands, and fat stock prices, interspersed with talks, it is not to be wondered at that a guest of mine became wildly enthusiastic over ultra-short-wave listening, simply because he was able to sit down to a receiver and, whether during the hours of daylight or darkness, listen to the nations of the world, irrespective of their distances. That receiver was the original model of the Discovery Three.

Let me tell you briefly how it came into being. I have long been convinced that short-wave broadcast listening would never become anything more than a hobby for the technically minded, apart from the commercial use, until it was possible to dispense with the knob-twiddling and delicate reaction adjustments usually associated with it. Any kind of receiver that relies upon one's ability to hold a station while the slightest expansion of the abdomen causes oscillation, thoroughly annoys me, and can only be regarded as freak and unreliable reception.

With the development of new components and insulating materials, I saw the possibilities of such a receiver as the Discovery Three. I got down to the design with the impatience of a boy on his first crystal receiver. I knew that if it were possible to construct a short-wave receiver which had not the background mush and noises of a superheterodyne, with its complicated layout, but which gave equal selectivity and sensitivity, I would again enjoy the short-wave enthusiasm that I had in the early day when it made its first appearance.

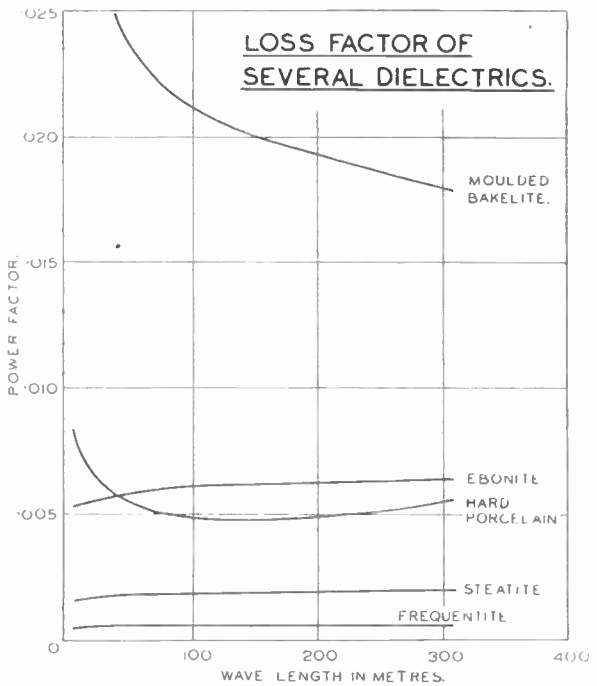


Fig. 1

Many people, especially those who have listened to short waves as I did in the old days, still imagine that it is accomplished only by loss of beauty sleep. I can assure you that this is definitely not the case when using the Discovery Three.

As is becoming common knowledge, different short-wave bands are used for different times of the day, and it is possible generally to hear several stations, whether you are having your lunch, or whether you have "come home with the milk"!

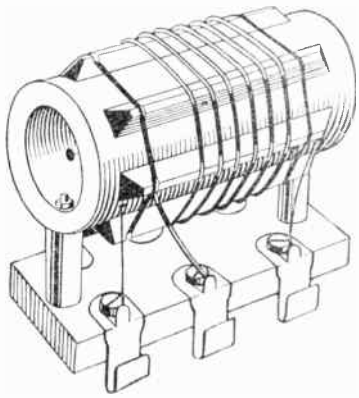
It is a common human failing that the moment one has achieved anything, or has become the possessor of anything out of the ordinary, the impulse is immediately to transmit this knowledge to the nearest person at hand.

Perhaps I am fortunate, inasmuch as by virtue of these columns I am able, or at least I am given the opportunity, of transmitting my enthusiasm to many thousands of you, and while a certain amount of modesty compels reticence, I really think that the following will put you in possession of something really new, entertaining, and capable of giving you a new enthusiasm.

The Discovery Three will put you in touch with many countries of which you might have heard but about which you have thought little, and it will surprise you to find that, whatever these other countries may think of you, the great majority of them take the trouble to make their announcements to you in your own language.

If you want to hear Moscow's point of view, tune in to Moscow. American baseball scores, or Amos and Andy? —tune in America! If you want to hear a running commentary on our test team in Australia, tune in Australia. South America, Honolulu, New Zealand, Japan—from pole to pole is your hunting ground.

If ever a prophecy came true, it is "And Nation shall speak unto Nation," and in giving you the Discovery Three I am giving you the

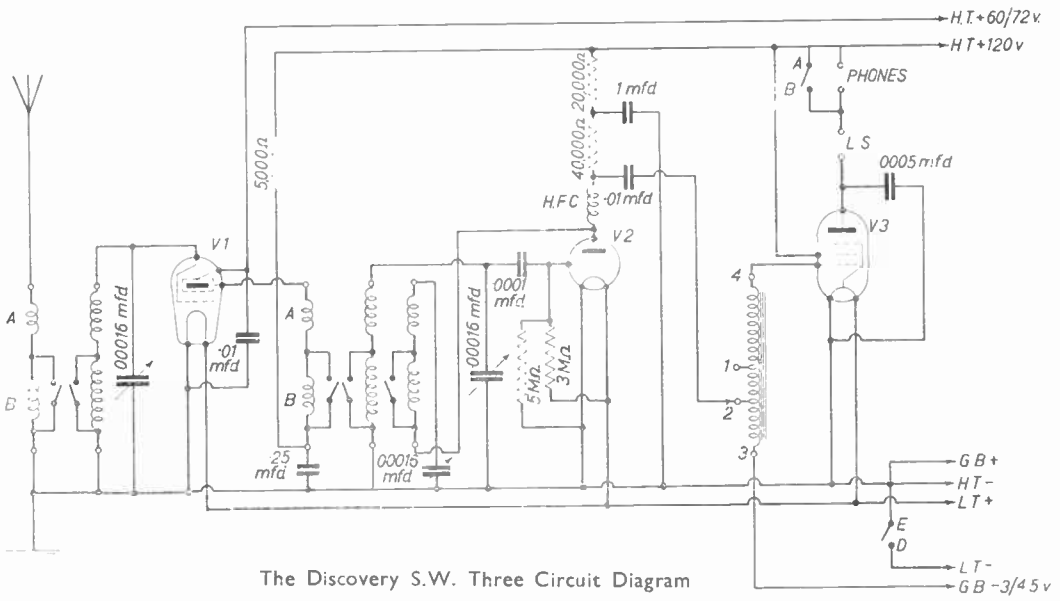


D

instrument with which you can hear.

Now, to get down to the job, we had better run through the fundamentals that have enabled me to get this ambition into practical form. First, I must remind you that I am in rather a unique position as a designer of receivers, and many of you will probably envy me in this respect. I can actually have any valve, component, cabinet, made or designed to fulfil my requirements if it is commercially practicable.

As in all radio receivers, the combination of components and valves is the fundamental basis. Look at the circuit diagram, those of you who understand it. Is there anything startling that makes you ponder? No. It is more or less a straight S.G. Three familiar to thousands of constructors, but—and what a big BUT!—any receiver built to a similar circuit using ordinary valves and components would be a sheer waste of time and money.



The Discovery S.W. Three Circuit Diagram

Coils, tuning condensers, drives, valves, and even valve-holders, contribute each in their due share towards the fulfilment of the design. Ceramic material, such as Frequentite, forms practically the entire insulating material in all H.F. circuits, and its value is obvious when you compare its losses in relation to those of the insulating materials normally used. The accompanying graph (Fig. 1) clearly tells its own story.

Realise then what this means. It means that, taking ordinary precautions in design, the inherent electrical loss in static and dynamic fields can be reduced to an almost negligible quantity, without relying on the use of excessive reaction for compensation. It has previously been recognised that, due to this enormous loss of energy and the colossal increase of H.F. resistance at these very high frequencies, any attempt to use H.F. amplification, other than by the superheterodyne method, was useless except as a stabilising circuit. From the moment the signal enters the Discovery Three it is carefully nursed and amplified without practically any loss due to insulating material.

The **COILS** are of a new type using metal chassis with supporting strips of Frequentite upon which the terminals for connection are mounted, and in addition provide the clips into which the coils are fitted. These coils are undoubtedly the last word in low loss components. The highest frequency band coil is wound with silver plated strip—silver plated because of its lower H.F. resistance, and the fact that ultra H.F. currents flow on the surface of a conductor; strip, because of its larger surface area and lower turn-to-turn self capacity.

On the other wavebands silver plating and strip were found to give no material advantage, so highly polished copper wire is used, covered with a special low loss enamel to prevent tarnish. Despite the negligible losses in the coil former, a ribbed formation is used, thus perfecting a remarkable piece of apparatus. By use of leaf contacts, switching from one coil to another can be effected, without dead end losses, although the coils are interchangeable.

By ganging two double coil units, each complete with its own switching, the waveband on *both* anode and aerial circuits can be changed by one control. Formo Products, Ltd., manufacture a special coupling sleeve for this purpose.

These coils are tuned by a new type of **SHORT-WAVE TUNING CONDENSER** which has die-cast stator and rotor, giving precision spacing, complete rigidity (so essential) and a perfect electrical bonding of vanes. Another desirable feature of this condenser is the fact that the rotor, and consequently its electrical connection, is entirely insulated by the base (also ceramic material) from the front bearing and drive. Although in my circuit the rotors and drives are both earthed, the fact that they are individually connected (the drives to true earth and the rotors to their respective h.f. circuit earth), makes a tremendous difference at these high frequencies. An absolutely quiet movement and freedom from hand capacity effects is the result.

If, after all our careful elimination of losses in the tuning circuits, we were to link up to an ordinary standard **H.F. VALVE**, I am afraid the majority of it would run to waste. I have sketched a tuning circuit (Fig. 2) and shown it connected to the base of such a valve. Remembering the H.F. losses at very high frequencies in normal bakelite material such as these bases are made of, a glance at the dotted lines which indicate where these losses would occur seems rather akin to "pulling the plug out of the hole."

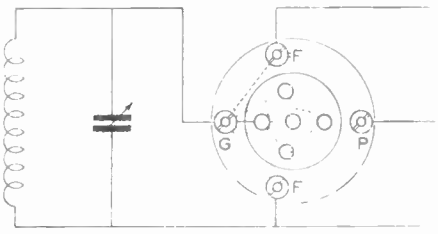
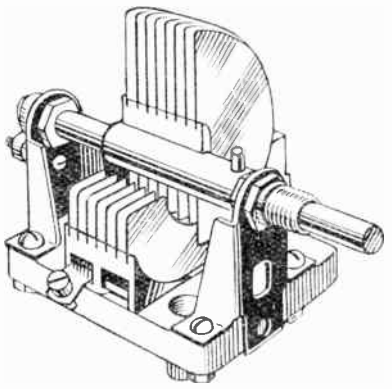


Fig. 2

Something obviously had to be done if full use of the previous advantages was to be maintained. Obvious as it is, its solving was not easy without calling in the valve engineers.

After many experiments, the Graham Farish **RING S.W.G. 2 VALVE** was evolved. And what a valve! First, it is mounted on a special base; secondly, its anode is entirely surrounded statically by the screen, thirdly, its grid is brought out at the *top* of the glass bulb. If that were all, it would be a distinct advantage, but it isn't—it has a ridiculously low internal grid anode self-capacity. Also, it has a guaranteed mutual conductance (or slope) of 1.35 m/v. If it were possible to use the maximum stage gain obtainable from this valve, an output as yet not even dreamed of on the ultra short waves would be achieved. We must not forget, however, that increase in sensitivity always means additional selectivity must be achieved, and so we have to sacrifice some sensitivity to make adequate separation of stations possible; but even so, I was able to get a really substantial amplification down to 12 metres. Something I had never done before.



Some detector losses are in evidence, but these are covered by reaction. The operation of the reaction control is not, however, at all critical due to the generous input signal. The reaction circuit is usual, except that even here I have gone to some pains to provide the best possible control. The special short-wave choke, although, like "Jane" in the well-known song, "nothing much to look at," still has a very important part to play. To the best of my knowledge this choke has for its inductance the lowest self-capacity, d.c. resistance, dielectric loss, than any other available to the constructor, irrespective of the price. Here, again, Frequentite is used as a former and the well-known advantages of wave form winding employed to still further reduce the self-capacity of each section. A similar condenser to that used for tuning forms the reaction control. Although the log law shape is not necessary, it certainly is an advantage, while the exceptionally low minimum capacity of this type of condenser gives us a margin to play with in case we are not too careful with our wiring. I have incorporated the dual ratio drive for this control, not because fine control is necessary on this set, but because I think it is an improvement. It certainly is a delight to handle, and to show you just where you are when using it I have designed a neat little revolving disc, operated by the drive. If you take a pleasure in these little mechanical refinements, as I do, then you will appreciate this.

The L.F. side of the set is orthodox, inasmuch as the detector is coupled to the output pentode through a parallel fed high primary inductance transformer. A pentode is used for the output valve, because it should be remembered that this set is intended for use with a loudspeaker.

A combined filament and phones-to-loudspeaker switch is fitted for use if desired. It will also be noticed that anode circuits are fully and adequately decoupled. This is essential to get really stable and smooth reception. It will also be obvious that separate tuning condensers are used for anode and aerial circuits. Practical difficulties in ganging circuits at such frequencies make this desirable, if not absolutely necessary, and it *is* so well worth while to ensure accurate tuning, especially since the two condensers are so very easy to keep in step.

From the illustrations which accompany this article you will see that our good friend Laurence has designed a somewhat original style of cabinet to house this receiver. The baseboard and panel are in one, whilst the remainder of the cabinet forms a lid which fits snugly over it, giving a neat housing with complete accessibility for examination and wiring. The cabinet is beautifully finished in grey leatherette and looks a really fine job when completed.

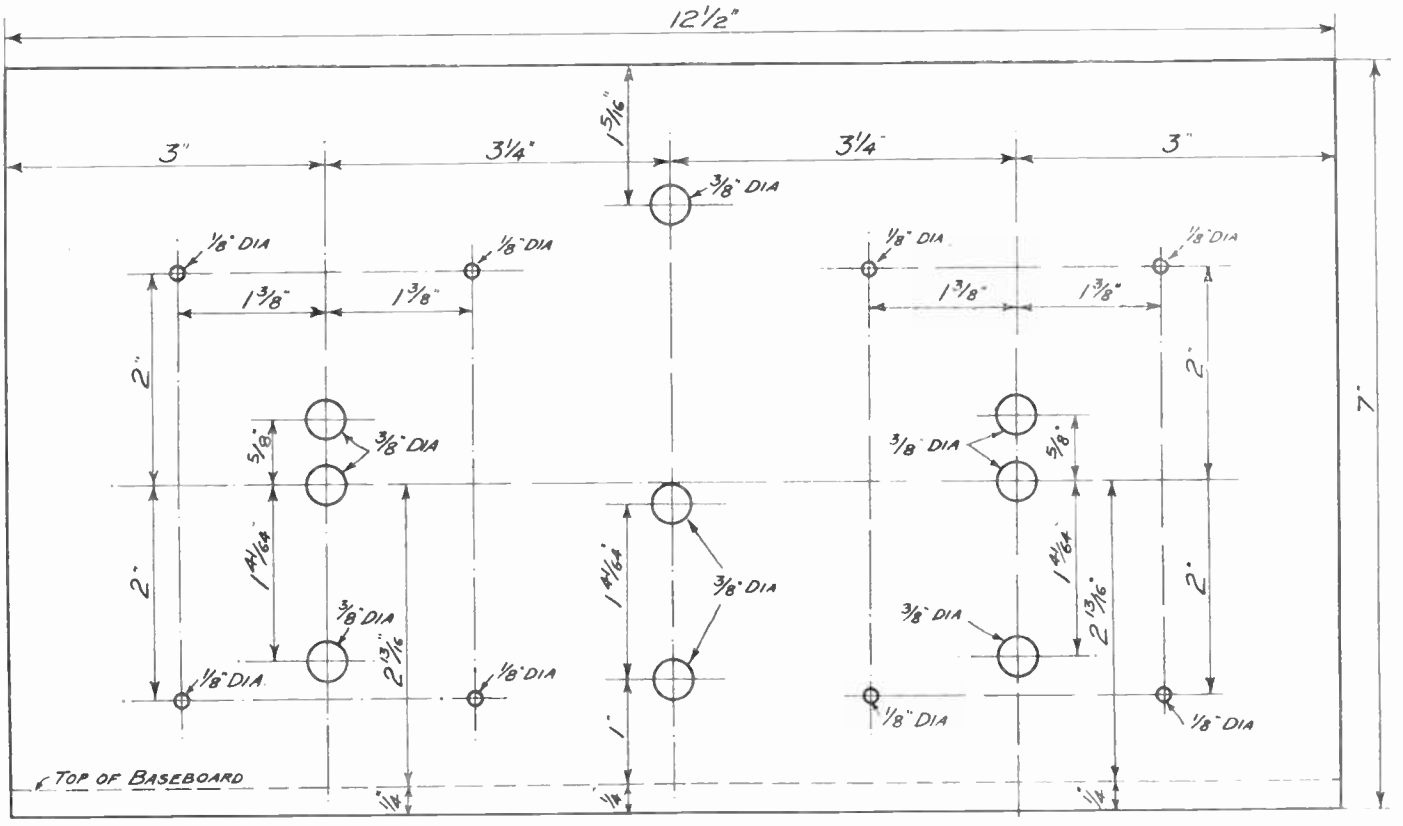
Well, that's that, and if you have not caught my enthusiasm for this receiver it is because I am primarily a radio set designer and not a journalist. Let me proceed to where I am more at home and describe how to construct it.

Before you commence screwing down any components, it is necessary to assemble the variable condensers and drives, since this job is more easily done outside the cabinet. The drives can then be screwed into place, using the panel holes to locate their positions. Note that the aerial tuning condenser is mounted sideways, in order to shorten the grid connection as much as possible.

DRILLING THE FRONT PANEL

Using the template included with the cabinet, or following the dimensioned instructions if you are making this yourself, the holes should be carefully marked out and, before being drilled, each escutcheon should be checked with the template forming part of its packing. By the way, this template also should be cut out to form a reflector for the dial light as without it the light behind the scale is not uniformly distributed. The holes can now be drilled through. If the *dial lights* are placed in

(*Continued on page 26*)



The Discovery S.W. Three Panel Layout

Step by Step Wiring

Eliminates all possibility of error

BY following the wiring table in conjunction with the easy stage wiring diagrams and blue print this can be carried out speedily—without error. Count and check all wires at the end of each stage. It may be necessary and advisable to glance occasionally at the photographs of the receivers to assist in the relative height of the wiring in order to be as nearly identical with the original receiver as possible.

Note.—Where Right or Left Hand is used it is assumed that the Front of the receiver is facing you.

STAGE 1.

1. Aerial slow-motion drive bracket to Reaction drive bracket.
2. Reaction drive bracket to Anode slow motion drive bracket.
3. Aerial slow motion drive bracket to ·01 mfd. fixed condenser.
4. ·01 mfd. condenser to front earth terminal Coil chassis.
5. Front Earth terminal coil chassis to Earth terminal Aerial tuning condenser.
6. Front Earth terminal coil Chassis to metal Screen terminal.
7. Metal Screen terminal to Aerial coil centre back terminal.
8. Aerial coil centre back terminal to Left hand back coil terminal.
9. Left hand back Aerial coil terminal to coil chassis back Earth terminal.
10. Coil chassis back Earth terminal to Earth terminal.
11. Aerial terminal to Aerial coil—Left hand front terminal.
12. Aerial coil centre front terminal to stator tuning condenser.
13. Stator tuning condenser to Grid cap for Valve (Flex wire).

STAGE 2.

14. Pair of twisted wires connecting dial lights together.
15. Left hand terminal A dial light to H.F. filament (Back terminal).
16. Right hand terminal A dial light to terminal E switch.
17. Terminal E switch to H.F. filament terminal front.
18. Anode terminal H.F. valveholder to left hand front terminal anode coil chassis.
19. Reaction condenser stator to right hand terminal anode coil chassis (front).
20. Front earth terminal coil chassis to front filament terminal of H.F. valveholder.
21. Front earth terminal coil chassis to filament Detector valve.
22. Front earth terminal coil chassis to rotor (earth) terminal of Reaction condenser.
23. Top H.F. Valve terminal to fixed condenser.

STAGE 3.

24. Terminal 5 meg. grid leak to Detector valve filament terminal.
25. 5 meg. grid leak to 3 meg. grid leak and to Grid terminal Detector valveholder.
26. 3 meg. grid leak terminal to Filament Detector valve.
27. Grid terminal Detector valve to Grid condenser terminal (Grid condenser held in wiring).
28. Grid condenser to stator, anode Tuning condenser.
29. Grid condenser to centre front terminal Anode coil.
30. Filament Detector valve to Earth terminal anode Tuning condenser.

STAGE 4.

31. Earth terminal metal Screen to back Earth terminal coil chassis.
32. Back Earth coil chassis to centre terminal back anode coil.
33. Centre back terminal anode coil to 1 mfd. condenser.
34. 1 mfd. Condenser to ·25 mfd. Condenser.
35. 1 mfd. Cond. to filament terminal Detector valve.
36. 1 mfd. Cond. to 40,000 Resistance.
37. 40,000 Resistance to H.F. Choke. (This is H.F. Choke with wire ends.)
38. H.F. Choke to Anode detector valve.
39. Anode Detector valve to right hand back terminal anode coil.
40. Terminal 2 Max transformer to ·01 mfd. condenser.
41. ·01 mfd. Condenser to 40,000 Ohmite (Lower end).

STAGE 5.

42/43. 20,000 Formomatt connected between aux. Grid pentode to 1 mfd. condenser.

44/45. 5,000 Formowatt connected between aux. Grid Pentode and ·25 mfd. condenser.

46. Filament Detector valve to filament Pentode.
47. Filament Pentode to 1 mfd. Condenser.
48/49. ·0005 mfd. Tubular condenser to filament Pentode and Anode Pentode.
50. Terminal 4 Max transformer to Grid Pentode valve.
51. Aux. Grid Pentode to Phone termina mount.
52. Pair of twisted wires from the Phone terminal mount to terminals A and B Switch.
53. Phone terminal mount to speaker terminal mount.
54. Speaker terminal mount to Anode pentode.
55. H.F. Valve rear filament terminal to filament Detector valve.
56. ·25 mfd. condenser to left hand back anode coil terminal.

STAGE 6.

Flexibles.

H.T. 60/72 volts to ·01 mfd. Condenser (Screening grid).

H.T. 120 volts to Aux. Grid Pentode.

H.T.— and **G.B.** + to ·25 mfd. Terminal.

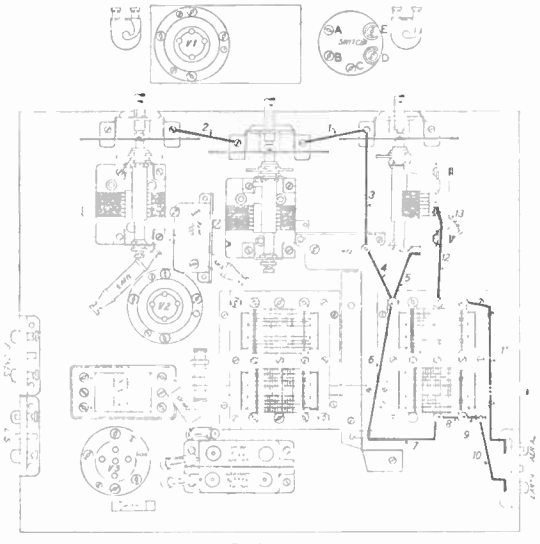
L.T. + to filament Pentode valve.

L.T.— to terminal D switch.

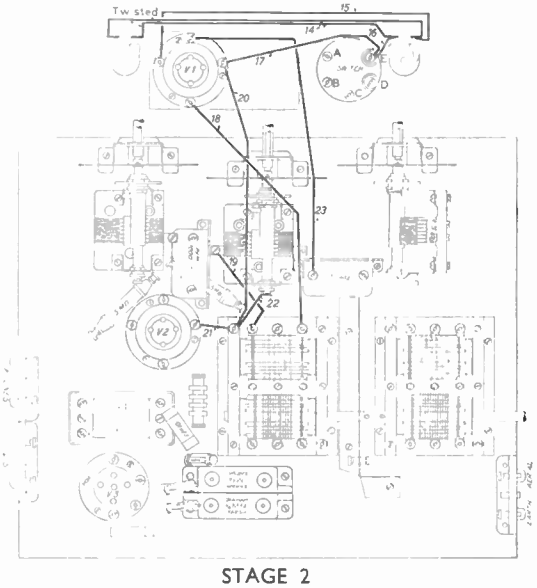
G.B.—3/4½ to terminal 3 Max transmer.

THE DISCOVERY THREE

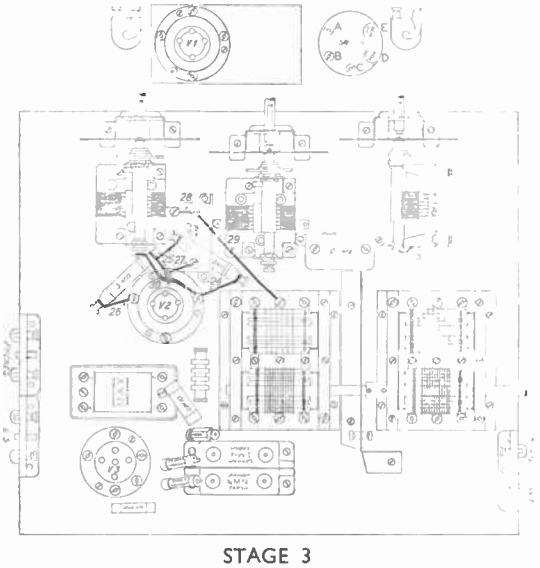
Stage by Stage Wiring Diagrams



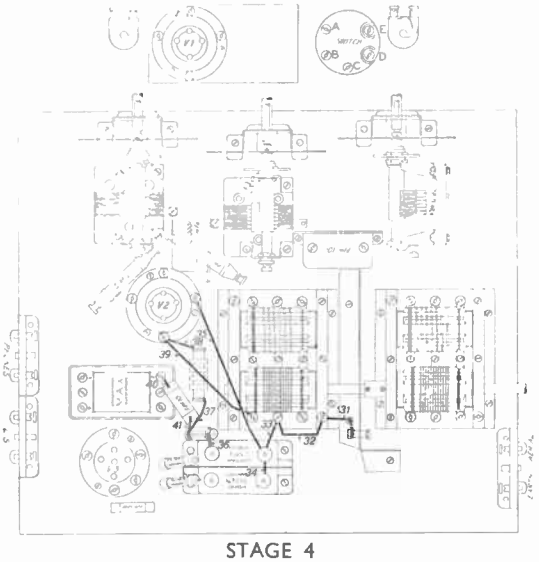
STAGE 1



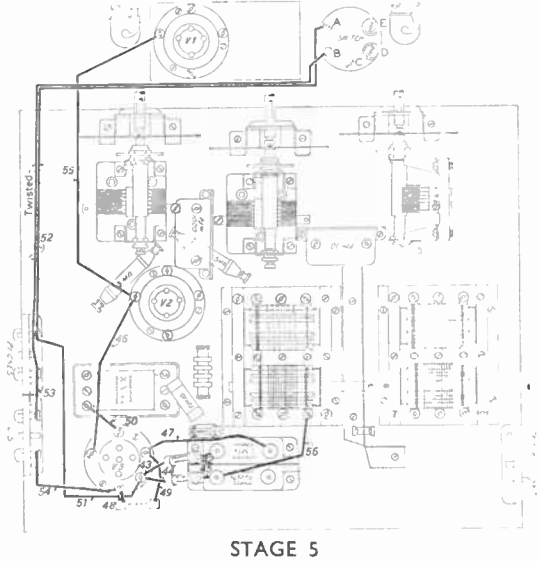
STAGE 2



STAGE 3



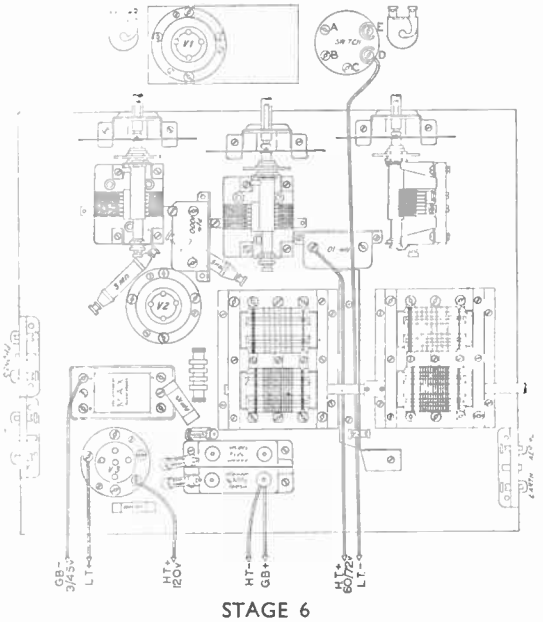
STAGE 4



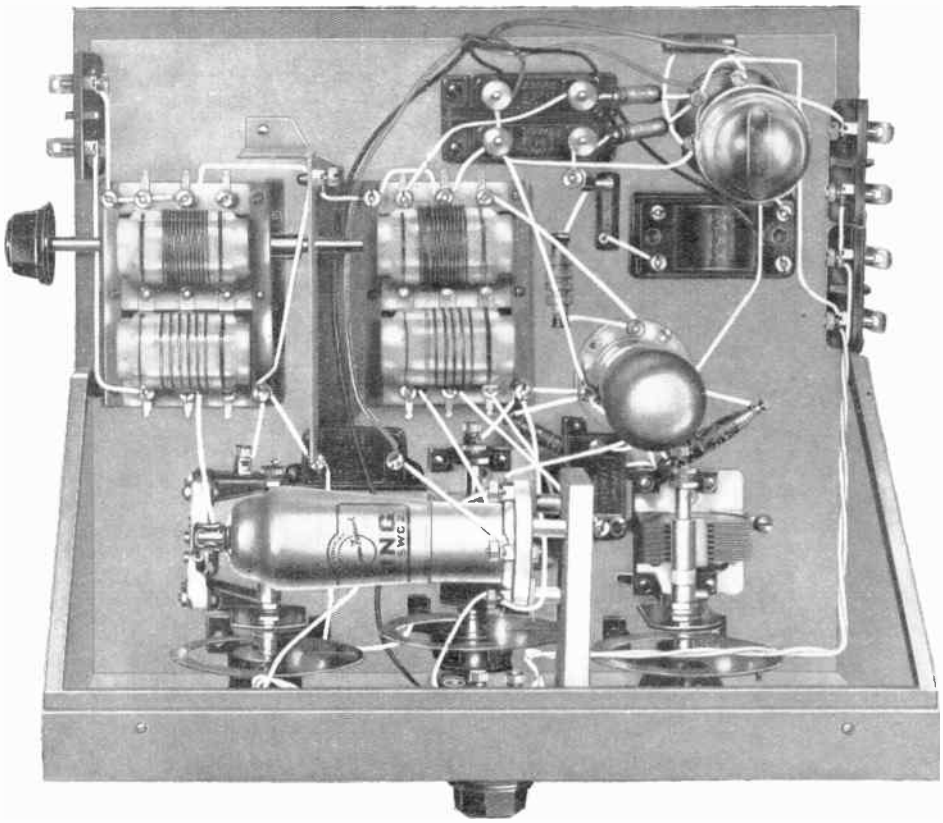
STAGE 5

IMPORTANT

CHECK ALL WIRING AFTER EACH STAGE



STAGE 6



Plan View of the Discovery S.W. Three Chassis

(*Continued from page 23*)

position before the drives are fitted, it will be found easier to get them well tight. Avoid over-screwing them, otherwise the bulb will be forced off the screwed portion of its base.

When fixing the drives in position, note that the drive supporting brackets are in the lowest position possible. The bracket fixing screws should be in the two lower tapped holes provided in the main assembly plate. The earth wires (Nos. 1 and 2) connecting the three brackets together, are best put in now under the heads of the fixing screws. Screw the ·01 condenser into position and connect the drive's earthing wire to it. The other components can now be proceeded with.

The screen should not be finally tightened down until you are sure it clears the wave-change switch shaft. Just a word concerning the connecting together of this shaft. If the anode coil chassis is screwed down first and the screen placed temporarily in position, the connecting sleeve should be mounted on the anode shaft and the aerial coil placed to it. Be careful to get the shaft into true line, otherwise when the coil stands are finally screwed down the switch movement will be rough and stiff.

Before fixing the H.F. valveholder bracket support to the panel mount the valveholder to it, and thus avoid straining it unduly when in position. This can then be fixed to the panel by means of the component bracket supplied. Here it should be noted that one of the screws fixing the escutcheon is also utilised for the bracket, and further do not use screws for the other hole, which will spoil the panel of the cabinet. The wiring can now be proceeded with, and the stage-by-stage charts should be used in conjunction with the large blueprint. The wires should be put on in their numerical order, as this will be found the easiest and most accessible way. The two grid leaks should be joined together with their connecting wire before being put into position, and the continuation of this wire should be left to connect to the grid of the detector valveholder. Use a good stout gauge of wire which will not flop about, otherwise you may experience some puzzling forms of "fading."

When mounting the Pop terminals let the patent clip project from the cabinet so that they are readily accessible when the top portion of the cabinet is in position.

The switch control spindle is a trifle long for the thickness of panel, and I suggest if possible that you cut about ⅛ in. from its length. This will enable the knobs to be mounted close to the panel.

A rather important point in connection with the dials is the type of bulb used. An ordinary flash lamp type has rather a high consumption, and if considerable use is made of the receiver—and surely such will be the case—the accumulator will have a rather unnecessarily extra load. The 2-volt .06-amp bulbs should be obtained, either from your dealer or Graham Farish, Ltd. The extra consumption will then be very small and, moreover, this type of bulb has a much longer life and is well worth the little extra cost.

One final remark before you commence wiring up. Do please study the photograph and blueprint, and follow my original as closely as possible. It nearly breaks my heart sometimes to see the way some of my sets have been wired. Bell wire and bits of string may create some things, but they are *not* the best of materials for building radio receivers.

Assume we have checked (and rechecked) systematically all wiring and are ready to try out. Put the valves into their respective sockets first. Connect up the L.T. and check the dial light bulbs by switching on, when both dials should light up. I know that this will give you a surprise, because the method of illumination is so entirely new and looks very fine, apart from its undoubted utility. Now switch off again if both circuits are in order. Connect H.T. and grid bias and we are ready, except for the aerial and earth.

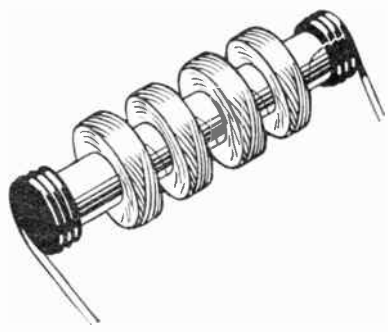
AERIAL

Practically any type of aerial will serve for this receiver. Generally speaking it is better to use a short outside aerial, even if if it is only a down lead of a few feet, rather than the normal indoor type. A picture-rail aerial is not very satisfactory on short waves owing to its very high self-capacity.

An apparent peculiarity of short wave receivers is the fact that they often perform equally well without an earth connection. This effect is usually accounted for by an earth having very doubtful efficiency. A long earth wire may be efficient on the broadcast band but on short waves it is of little use as it has a higher H.F. resistance than the internal self-capacity to earth of the receiver itself. A short earth lead direct, either to the water main or to a good earth outside, if available, will improve results.

It would be as well to connect the headphones first to enable you to get the "feel" of the tuning. Now plug in the coils B and C (12–25 metres and 21–50 metres), the lower waveband coils being to the front of the receiver. Make sure these coils are the correct way round. The coupling, or primary winding, is wound in a slot and should be to the left-hand side in both cases. Let us now try out the higher wavelength band first, since this has slightly broader tuning. Turn the wave-change switch in an anti-clockwise direction. Set both tuning condensers to 50° on the scale and advance reaction until the receiver is just oscillating. This is not audible, except as a slight rushing sound in the 'phones.

The aerial condenser can now be brought into tune with the anode condenser by

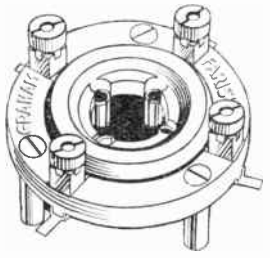


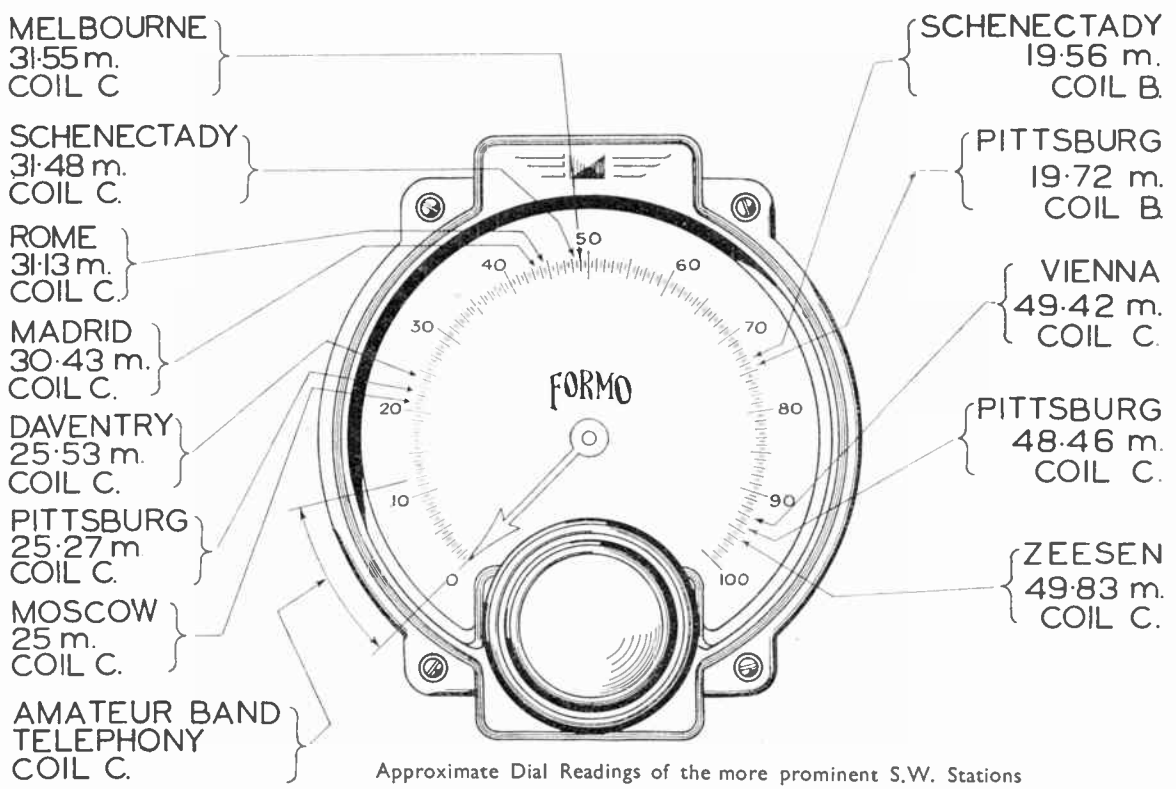
noting which way brings the detector into stronger oscillation. After noting this difference the two condensers can be rotated round the dial for a search. At first it will be found easier to keep the set in a near oscillating condition to find the stations. Since these oscillations do not reach the aerial, you need not fear that you are causing interference to other listeners. Later on, when you know the receiver, you can handle the set without this aid.

Connect a speaker with a suitable transformer (I have recommended the W.B. "Baby Stentorian"), and after a little manipulation it will be found that, except for the very weak stations, the speaker can be used almost entirely. Remember, when you are first handling the set, that fading is irregular and sometimes ceases suddenly, or, in other cases the strength of a station will build up enormously in a short space of time. This means that although you may have gone round the dial, a return often finds stations one has missed before. Also, by careful tuning, a faint signal can be built up to good loudspeaker strength. Have some patience at the start and you will be well rewarded.

While at these frequencies it would be very difficult to provide a tuning scale calibrated in metres, I have provided a sketch showing some of the positions where you should find the stations shown. Do not expect to hear a great deal of the Daventry Empire transmission. If you are near enough you will hear the "ground" wave, but the majority will be "skipped." Anyway, we can always hear those on broadcast wavebands.

In addition to the sketch above, I do not think it will be out of place to give you a short list of names of the main short-wave stations, together with their transmission times. I have put this under the headings of the different coils within whose range they come. It doesn't mean that because a name appears here you will get the station or that you will only get those stations which do appear. Reception is entirely dependent upon your own locality and upon the conditions under which the receiver is working. Write to me and let me know what you think of this set. I know it's good, but nevertheless—just how did you find it? Logs of stations received are welcome, except for the ordinary American and Continental broadcasting stations.





Approximate Dial Readings of the more prominent S.W. Stations

COIL B (12–25 Metres)

Metres	Call Sign	Station
25·23	FYA	Paris, Radio Coloniale (France). (Colonial Stn. N-S.) Daily 16.15 to 19.15, 20.00 to 23.00.
25·0	RW59	Moscow (U.S.S.R.). Relays No. 2 Station. Sundays 03.00 to 04.00, 11.00 to 12.00, 15.00 to 16.00.
24·83	CTICT	Lisbon (Portugal). Sundays 14.00 to 16.00, Thursdays 20.00 to 21.00.
19·82	GSF	Empire Broadcasting.
19·74	DJB	Zeesen (Germany). Daily 08·45 to 12·15.
19·72	W8XK	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) Daily 13·00 to 21·15.
19·68	FYA	Paris, Radio Coloniale (France). (Colonial Stn. E-W.) Daily 12.00 to 16.00, and other times.
19·66	GSI	Empire Broadcasting.
19·63	DJQ	Zeesen (Germany). Daily 04.30 to 06.00.
19·56	W2XAD	Schenectady, N.Y. (U.S.A.). Daily 19.30 to 20.30.
19·52	HAS3	Budapest (Hungary). Sunday 13.00 to 14.00.
16·89	DJE	Zeesen (Germany). Daily 13.00 to 16.30.
16·88	PHI	Huizen (Holland). Daily, except Tues, Wednesday, 13.30 to 15.30, Sunday 15.30 to 16.10, Saturday 15.30 to 16.30 also.
16.86	GSG	Empire Broadcasting.
13·97	GSH	Empire Broadcasting.
13·93	GSJ	Empire Broadcasting.
13·92	W8XK	Pittsburg (U.S.A.). Daily 12.00 to 14.00.

COIL C (21–50 Metres)

38·48	HBP	Radio Nations, Prangins (Switzerland). Saturday 22.15 to 23.15.
32·88	HAT4	Budapest (Hungary). Saturday 23.00 to 24.00.
31·58	PRF5	Rio de Janeiro (Brazil). Daily 22.30 to 23.10.
31·55	GSB	Empire Broadcasting.
31·54	VK3ME	Melbourne (Australia). Wednesday 10.00 to 11.30, Saturday 10.00 to 12.00.
31·48	W2XAF	Schenectady, N.Y. (U.S.A.). (Relays WGY.) Daily 23.30 to 04.00, Saturday 19.00 to 22.00.
31·45	DJN	Zeesen (Germany). Daily 08.45 to 12.50, 13.00 to 16.30, 22.15 to 03.30.
31·38	DJA	Zeesen (Germany). Daily 13.00 to 16.30, 22.15 to 02.00.
31·36	VUB	Bombay (India). Sunday 13.30 to 15.30, Wednesday, Thursday, Saturday 16.30 to 17.30, irregular Monday.

Metres	Call Sign	Station
31·28 ..	W3XAU ..	Philadelphia, Pa. (U.S.A.). (Relays WCAU.) Daily 17.00 to 24.00.
31·28 ..	VK2ME ..	Sydney (Australia). Sunday 06.00 to 08.00, 10.00 to 14.00, 14.30 to 16.30.
31·13 ..	2RO ..	Rome (Italy). Tues, Thursday, Saturday 00.45 to 02.00.
30·43 ..	EAQ ..	Madrid (Spain). Daily 22.15 to 00.30. Saturday 18.00 to 20.00 also.
25·6 ..	FYA ..	Paris, Radio Coloniale (France). (Colonial Station E-W.) Daily 00.00 to 03.00, 04.00 to 06.00.
25·57 ..	PHI	Eindhoven (Holland). Daily, except Tuesday, Wednesday, 13.00 to 15.30. Sunday, Saturday to 16.30.
25·53 ..	GSD ..	Empire Broadcasting.
25·49 ..	DJD ..	Zeesen (Germany). Daily 17.00 to 21.30.
25·45 ..	W1XAL ..	Boston, Mass. (U.S.A.). Daily 23.00 to 00.30.
25·42 ..	2RO	Rome (Italy). Monday, Wednesday, Friday, 23.00.
25·29 ..	GSE	Empire Broadcasting.
25·27 ..	W8XK ..	Pittsburg (U.S.A.). (Relays KDKA.) Daily 21.30 to 03.00.

COIL D (38–102 Metres)

50·0 ..	RW59 ..	Moscow (U.S.S.R.). (Relays No. 1 Station.) Daily 20.00 to 23.00.
49·83 ..	DJC ..	Zeesen (Germany). Daily 22.30 to 03.00, 17.00 to 21.30.
49·59 ..	GSA ..	Empire Broadcasting.
49·5 ..	W3XAU ..	Philadelphia, Pa. (U.S.A.). (Relays WCAU.) Daily 01.00 to 04.00.
49·42 ..	OER2 ..	Vienna Experimental. Daily 14.00 to 22·00.
49·3 ..	2RO	Rome (Italy). Monday, Wednesday, Friday, 23.00 to 00.30.
49·2 ..	ZTJ ..	Johannesburg (S. Africa). Daily, except Sunday, 04.30 to 05.30, 08.30 to 12.00, 14.00 to 20.00 (Saturday 21.45), Sunday 13.00 to 15.15, 17.30 to 20.00.
49·18 ..	W9XF ..	Chicago, Ill. (U.S.A.). Daily except Monday, Wednesday, Sunday, 21.00 to 07.00.
49·1 ..	GSL ..	Empire Broadcasting.
48·86 ..	W8XK ..	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) Daily 21.30 to 06.00.

THE DISCOVERY S.W. THREE—LIST OF COMPONENTS REQUIRED

			s.	d.
1	Graham Farish	Max transformer	4	6
3	Formo	Snail dual ratio drives @ each	3	0
2	Formo	Snail escutcheons @ each	3	6
3	Formo	Short wave ·00016 mfd. condensers .. @ each	3	6
1	Formo	Snail reaction indicator ..		6
1	Graham Farish	1 mfd. Mansbridge condenser	2	0
1	Graham Farish	·25 mfd. Mansbridge condenser	1	6
1	Graham Farish	·01 mfd. fixed mica condenser	1	6
1	Graham Farish	·0001 mfd. fixed mica condenser		6
1	Graham Farish	5 meg. Standard grid leak ..		10
1	Graham Farish	3 meg. Standard grid leak ..		10
1	Graham Farish	Short wave H.F. choke (10–100 m.)	2	0
1	Graham Farish	5 pin base-board valve-holder		8
2	Graham Farish	S.W. 4 pin base-board valve-holder .. @ each		9
1	Formo	5,000 ohm Formowatt resistor		10
1	Formo	20,000 ohm Formowatt resistor		10
1	Graham Farish	40,000 ohm Ohmite resistance	1	6
1	Graham Farish	·01 mfd. tubular condenser ..	1	3
1	Graham Farish	·0005 mfd. tubular condenser	1	0
3	Graham Farish	Pop terminal mounts @ each		6
2	Formo	2-way S.W. coil stands @ each	2	6
1	Formo	Metal connecting sleeve ..		6
1	Snap	Universal Turret switch ..	2	0
2	Formo	Type B (12–25m.) coils @ each	3	6
2	Formo	Type C (21–50m.) coils @ each	3	6
1	Graham Farish	Metal screen with terminal ..	1	6
1	Graham Farish	Component bracket		4

Accessories :

1 two-piece cabinet, covered grey leatherette. Specially designed for Contact Short wave receivers. Price 17s. 6d.
1 pair Brown Featherweight headphones.

VALVES :

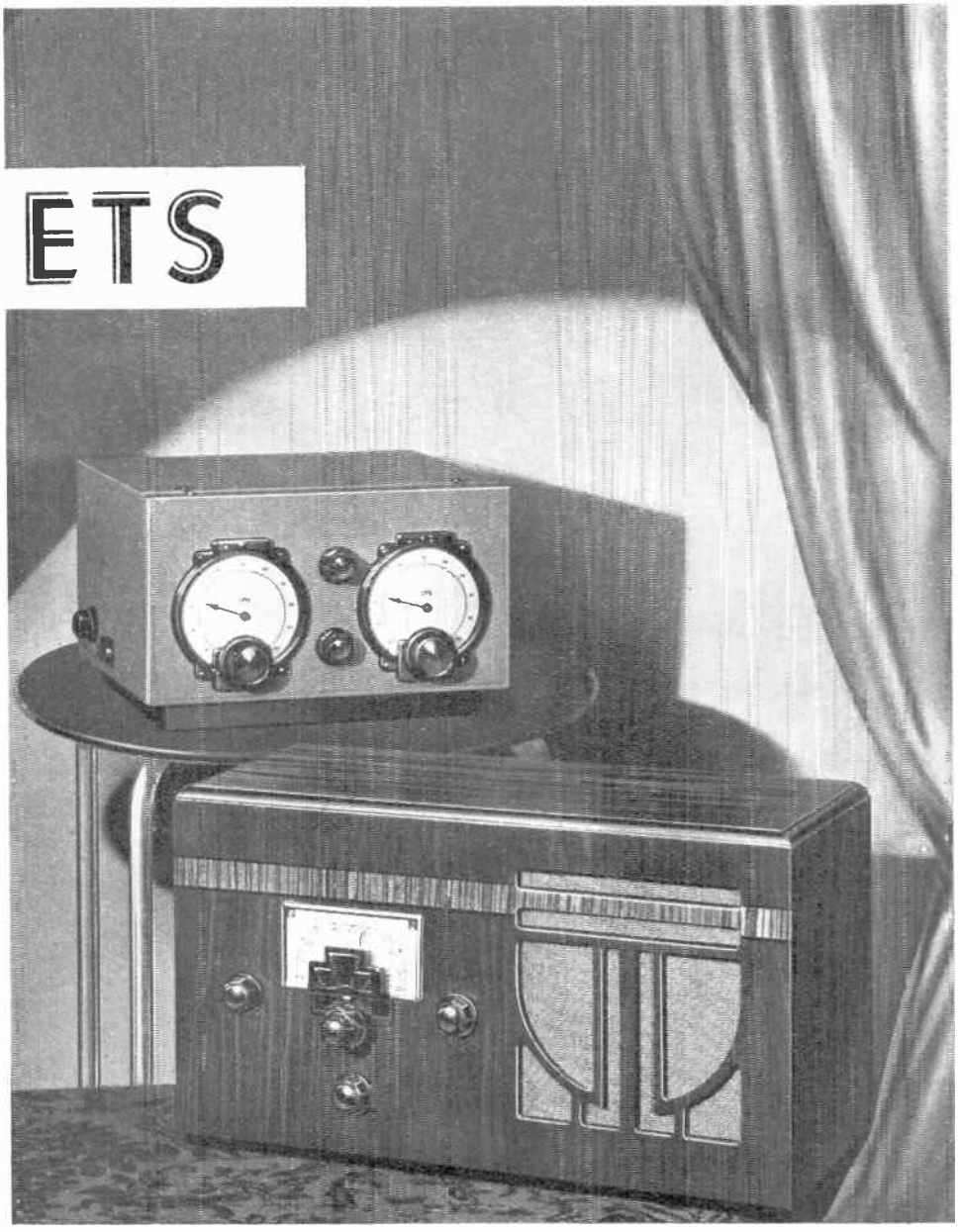
Graham Farish Ring short-wave high slope screened grid type SWG2 .. .. 13 6
Graham Farish Ring non-microphonic detector, type DX2 .. .. 5 6
Graham Farish Ring Medium power output pentode type PT2 .. .. 13 6

BATTERIES :

120v. H.T.
9v. G.B. Any good make
2v. 40aH accumulator

NOTE.—The coils quoted above cover the 12/50 metre range. This can be increased to 100 metres by the addition of two type D coils at 3s. 6d. each.

CABINETS



by

LAURENCE

Laurence—a name made famous by his exquisite radio cabinet designs, now achieves even greater fame with the two designs illustrated above. Give your receiver the housing it deserves—cabinets of whose great beauty you will never tire.

Two-piece cabinet, covered grey leatherette. Specially designed for Contact short wave receivers.
Internal measurements:—Width 12". Depth 10½". Height 6½".

17/6

Horizontal walnut table model cabinet designed for such famous circuits as The All-Electric and battery models Sensity Super, Stentorian 3, etc.
Internal measurements:—Width 19". Depth 8⅜". Height 10½".

25/-

MARKETED SOLELY BY:

GRAHAM FARISH LTD, BROMLEY, KENT

Graham Farish APPROVED

COMPONENT KITS

FOR ALL "CONTACT" CIRCUITS

THE DISCOVERY S.W. THREE

	s.	d.
1 G.F. Max transformer	4	6
3 Formo Snail dual ratio drives	9	0
2 Formo Snail escutcheons	7	0
3 Formo Short wave ·00016 mfd. condensers	10	6
1 Formo Snail reaction indicator	0	6
1 G.F. 1 mfd. Mansbridge condenser	2	0
1 G.F. ·25 " " "	1	6
1 G.F. ·0001 mfd. Fixed mica condenser	0	6
1 G.F. ·01 " " " "	1	6
1 G.F. 5 meg. Standard Grid leak	0	10
1 G.F. 3 " " " "	0	10
1 G.F. Short wave H.F. Choke (10–100m.)	2	0
1 G.F. 5 pin bakelite valveholder	0	8
2 G.F. Short wave 4 pin "	1	6
1 Formo 5,000 ohm Formowatt	0	10
1 Formo 20,000 " "	0	10
1 G.F. 40,000 ohm Ohmite	1	6
1 G.F. ·01 mfd. Tubular condenser	1	3
1 G.F. ·0005 mfd. " "	1	0
3 G.F. Pop terminal mounts	1	6
2 Formo 2-way S.W. Coil stands	5	0
1 Formo connecting sleeve	0	6
1 Snap Universal turret switch	2	0
2 Formo type B (12-25m.) coils	7	0
2 Formo type C (21-50m.) "	7	0
1 G.F. Metal screen with terminal	1	6
1 G.F. Component bracket	0	4
Kit "A" Cash	**72**	**6**

or 6/10 deposit and 11 monthly payments of 6/10.

Kit "B." As Kit "A," but including the set of specified and specially matched Graham Farish Ring valves .. Cash **£5 0 0**
or, 9/2 deposit and 11 monthly payments of 9/2.

THE QUEST S.W. TWO

	s.	d.
2 Formo Snail dual ratio drives	6	0
2 Formo Snail escutcheons	7	0
2 Formo ·00016 mfd. S.W. condensers	7	0
1 Formo S.W. Single coil stand	1	0
1 Formo type "B" S.W. Coil	3	6
1 Formo type "C" S.W. Coil	3	6
1 G.F. 4 pin S.W. Base-board valveholder	0	9
1 G.F. 5 pin valveholder	0	8
1 G.F. ·0001 mfd. Base-board Pre-set condenser	1	0
1 G.F. ·002 mfd. Fixed mica condenser	1	0
1 G.F. ·0001 mfd. " " "	0	6
1 G.F. ·01 Tubular condenser	1	3
1 G.F. ·0005 " "	1	0
1 G.F. 3 meg. Standard Grid leak	0	10
1 G.F. 5 " " " "	0	10
1 G.F. 40,000 Ohmite "	1	6
1 G.F. 1 mfd. Mansbridge	2	0
2 G.F. H.F. Chokes, S.W. (10–100m.)	4	0
1 Snap Universal turret switch	2	0
3 G.F. Pop terminal mounts	1	6
1 G.F. Component bracket	0	4
1 G.F. Max transformer	4	6
Kit "A" Cash	**50**	**0**

or 5/- deposit and 11 monthly payments of 5/-.

Kit "B." As Kit "A," but complete with specified Graham Farish Ring valves .. Cash **75 0**
or 7/1 deposit and 11 monthly payments of 7/1.

THE SENSITY SUPER (Battery Model)

	s.	d.
2 4 pin valveholders, Graham Farish	1	0
1 5 pin valveholder, Graham Farish	0	8
1 Dise H.F. Choke, Graham Farish	2	0
1 Max Transformer, Graham Farish	4	6
1 Formodensor Type "J," Formo Products	1	6
1 ·01 mfd. Mica condenser, Graham Farish	1	6
1 DU5 Twin-gang condenser, Formo Products	12	6
1 ·0002 mfd. Tubular condenser, Graham Farish	1	0
1 ·25 mfd. Tubular condenser, Graham Farish	1	6
1 ·1 mfd. Tubular Condenser, Graham Farish	1	6
1 1 meg. Ohmite Volume control, Graham Farish	2	9
2 Component brackets, Graham Farish	0	8
1 AH/G Twin coil unit. With switch, Formo Products	12	6
1 2 meg. Standard Grid leak, Graham Farish	0	10
1 ·0003 mfd. Differential condenser, Graham Farish	2	0
1 Vertical Ohmite holder, Graham Farish	0	6
1 40,000 ohm Ohmite, Graham Farish	1	6
2 Terminal Blocks, Graham Farish	1	0
Kit "A" Cash	**50**	**0**

or 5/- deposit and 11 monthly payments of 5/-.

Kit "B." As Kit "A," but including the set of specified Graham Farish Ring valves .. Cash **75 0**
or 7/1 deposit and 11 monthly payments of 7/1.

THE 1936 STENTORIAN THREE

	s.	d.
1 Formo ·0005 mfd. SU5 type condenser with mystic drive	6	6
1 G.F. ·0005 mfd. Differential reaction condenser	2	0
1 G.F. ·0003 mfd. Differential reaction condenser	2	0
2 G.F. Component brackets	0	8
1 Formo CA/G Coil unit	8	6
2 G.F. 4 pin valveholders	1	0
1 G.F. 5 pin valveholder	0	8
1 G.F. Dise H.F. Choke	2	0
1 G.F. ·0002 mfd. Mica condenser	0	6
1 G.F. Max transformer	4	6
2 G.F. ·006 mfd. Tubular condensers	2	0
4 Formowatt resistors :— 1—2 meg. 1—500,000 ohm 1—40,000 " 1—25,000 " at 10d. each	3	4
2 G.F. Pop terminal mounts	1	0
Kit "A" Cash only	**34**	**8**
Kit "B." As Kit "A," but complete with specified Graham Farish Ring valves .. Cash	**55**	**0**

or 5/5 deposit and 11 monthly payments of 5/5.

THE A.C. SENSITY SUPER

The Receiver

	s.	d.
2 G.F. Pop terminal mounts	1	0
1 Formo type "J" Formodensor	1	6
1 G.F. Dise H.F. Choke	2	0
2 G.F. 5 pin valveholders	1	4
1 G.F. 7 pin valveholder	1	3
1 G.F. Max transformer	4	6
1 Formo AH/G Coil unit	12	6
1 Formo DU5 condenser	12	6
1 G.F. ·0003 mfd. Differential	2	0
1 G.F. 1 megohm Ohmite V. Control	2	9
2 G.F. Component brackets	0	8
2 G.F. 1 mfd. Mansbridge condensers	4	0
3 G.F. Tubular condensers (·1 mfd.)	4	6
1 G.F. " condenser ·0005 mfd.	1	0
1 G.F. " " ·0001 "	1	0
1 G.F. 25 mfd. 25 v. Electrolytic	2	6
1 1,000 ohm Formowatt resistor	0	10
1 230 " " "	0	10
1 300 " " "	0	10
1 10,000 " " "	0	10
1 20,000 " " "	0	10
1 25,000 " " "	0	10
1 30,000 " " "	0	10
1 ½ meg. " " "	0	10
1 5,000 Ohmite resistance	1	6
1 40,000 " "	1	6
1 G.F. ·01 mfd. Tubular cond.	1	3

The Power Pack

1 G.F. Mains transformer type MT/250	25	0
1 G.F. 20H Smoothing choke type MC/20/40	11	6
1 G.F. 4 mfd. × 4 mfd. Electrolytic condenser	6	6
1 G.F. Bracket (condenser)	0	6
1 G.F. 4 pin valveholder	0	6
1 G.F. Pop terminal mount	0	6
Kit "A" Cash	**£5**	**10** **0**

or 10/1 deposit and 11 monthly payments of 10/1.

Kit "B." As Kit "A," but including the specified and carefully matched Graham Farish A.C. Ring valves .. Cash **£8 0 0**
or, 14/8 deposit and 11 monthly payments of 14/8.

NOTE.—The specified Laurence design cabinets can be supplied separately for cash, or on hire-purchase terms with any of the above Kits.

CASH PRICES

Laurence design Short wave cabinet, covered grey leatherette **17/6**

Laurence standard design walnut cabinet (suitable for A.C. or battery model Sensity Super, The Stentorian Three, etc.) **25/-**

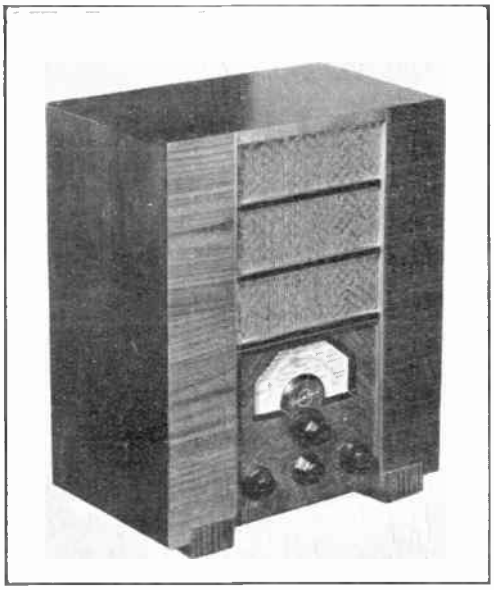
Ask your dealer or write direct for special hire-purchase quotations inclusive of Kit and cabinet.

IMPORTANT.—If your dealer cannot supply or cannot give you 100% service, write direct to the makers. Return delivery service guaranteed.

Any Kit or any specified components to the value of 50/- or more can be purchased from your usual dealer for cash or on Hire-purchase terms. In case of difficulty write direct to the makers.

GRAHAM FARISH LTD, BROMLEY, KENT

For those WHO CANNOT BUILD



The name Graham Farish, famous for many years amongst home constructors all over the world, is now to be found on a factory-built, ready-to-play, radio receiver. This superb instrument is recommended to those of our readers who do not choose to make their own

THIS being the first complete receiver available bearing the name of Graham Farish, it is naturally approached with more than usual interest—an interest which deepens as inspection proceeds.

We could not help being struck at the outset by the handsome and pleasing appearance of the cabinet. The chromium bars across the speaker opening lend a touch of modernity to the design, which avoids extremes in any direction, while the rich walnut finish compares well with sets offered at three times the price.

But it must be said at once that the outstanding attraction of the 333 is its performance, which for a set of this type is really excellent.

We have never believed in the extraordinary hobby of "station-counting." As an entertainment it has always seemed to have its drawbacks. How many stations the 333 will pull in on an 18-in. aerial over a barber's shop in Chorlton-cum-Hardy we really couldn't tell you. All we can say is we spent a very pleasant evening [no—in Kent!] tuning in programme after programme, and forgetting to count them in the enjoyment of listening to them. Tuning was commendably sharp. All the usual foreigners came rolling in with plenty of punch and a minimum of knob-twiddling. With this set the number of stations you get will depend mostly on your own energy in tuning them in, though of course the district you live in, and the sort of aerial-earth system you use, also govern the performance.

Quality of reproduction we found extraordinarily satisfying. The tone range is exceptionally even, and we could not pick out any particular feature, which is as it should be. As a result, both speech and music sound exceedingly natural, and this is the sort of reproduction to which one can listen indefinitely.

At every turn we noted little points which show forethought in the interests of the user. For instance, full instructions for use and maintenance of the set are printed on the back, where they can be easily referred to. Ample space is provided for good-sized batteries, though, incidentally, we found that the 333 is very moderate in its consumption. Even the aerial, earth, and pick-up terminals seem to have had their full share of thought. We found that these spring clips could be "hooked-up" quicker than it takes to write about them.

The general appearance inside the cabinet is quite up to first impressions. The 333 is obviously an engineering production throughout. There is a look of sturdiness and entire lack of "skimping" about the chassis and this is born out by the full-sized 8-in. moving coil speaker—enclosed in a dustproof bag.

The tuning scale is of sensible size. It is calibrated in metres and marked with a useful number of station names, both letters and figures being large and distinct, and in separate colours for long and medium waves. Instead of the usual pointer the tuning position is indicated by a slit of light which travels round the scale, a pleasing arrangement which avoids parallax.

The control knobs are normal in their

(*Continued on page 52*

Your old radio friends Scott and Whaley appear to be delighted with their Graham Farish 333 Set. They were amongst the first to handle this attractive new model

SPECIFICATION

MODEL.—Graham Farish 333.

TYPE.—Three-valve battery-operated table receiver with speaker and provision for pick-up.

CIRCUIT ARRANGEMENT.—Variably coupled aerial feeds a high-slope screened grid H.F. valve (Graham Farish Ring valve, Type SX2). This is coupled by tuned transformer to triode grid detector (Graham Farish Ring valve Type DX2), which feeds pentode output valve (Graham Farish Ring valve, Type PT2) through resistance-coupled transformer. Reaction is applied to the second tuned circuit, and automatic bias to the pentode grid.

SPEAKER.—8-in. permanent magnet moving coil.

BATTERY CONSUMPTION (as tested).—H.T., 8–9 m/a. L.T., ·56 amp.

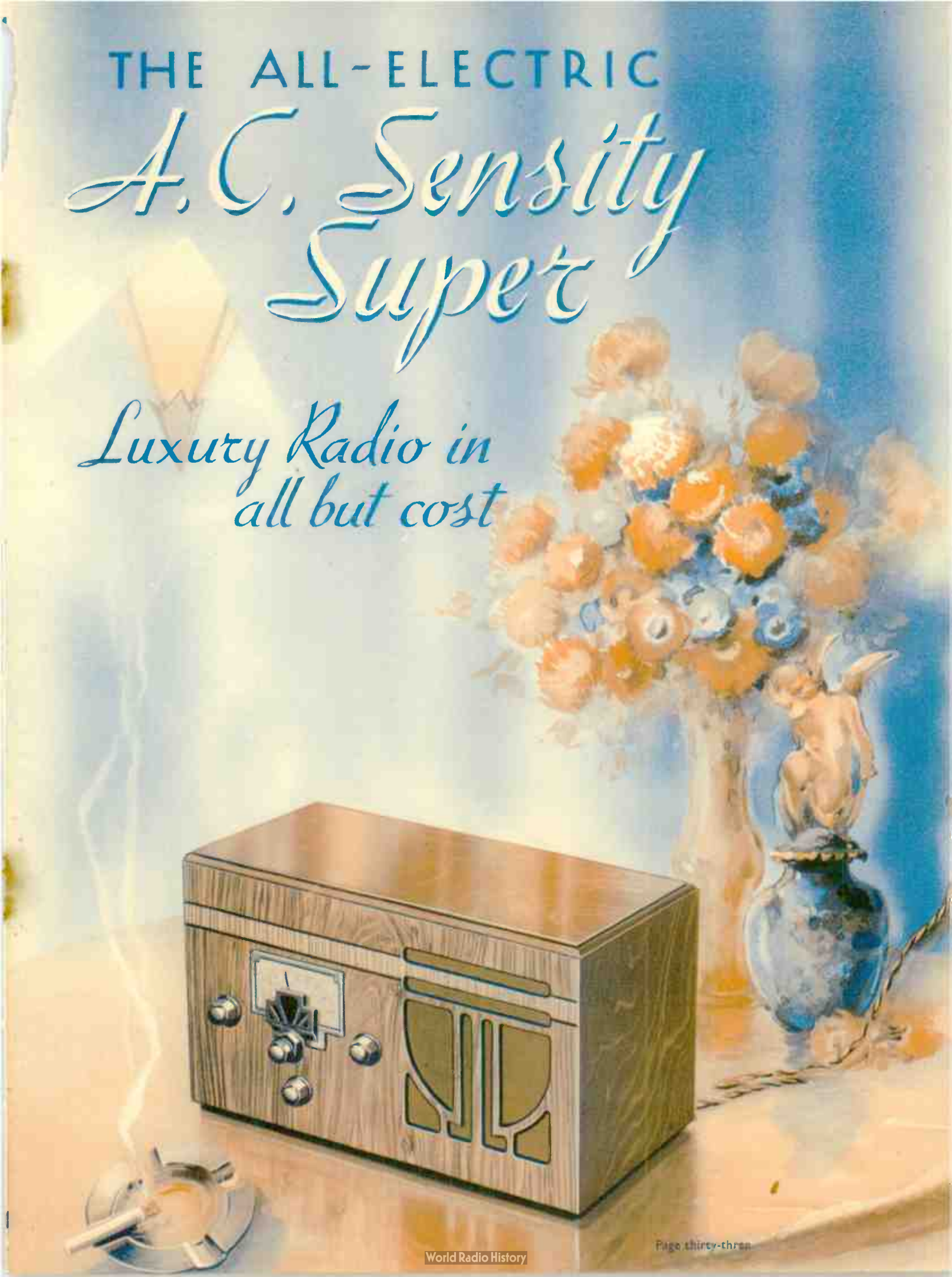
PRICE (without batteries).—£6 10s.

MAKERS.—Graham Farish, Ltd., Bromley, Kent.

THE ALL-ELECTRIC

A.C. Sensity Super

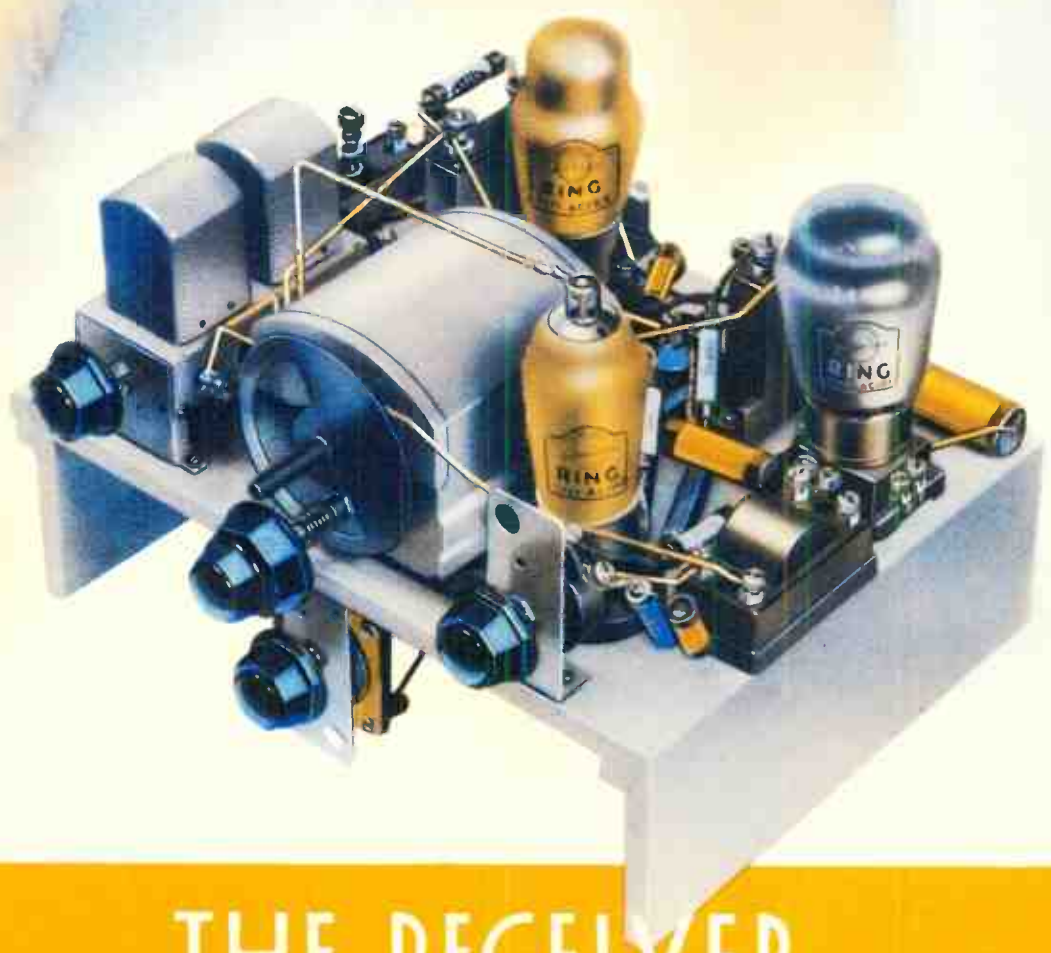
Luxury Radio in all but cost



HARNESS *the* MAINS

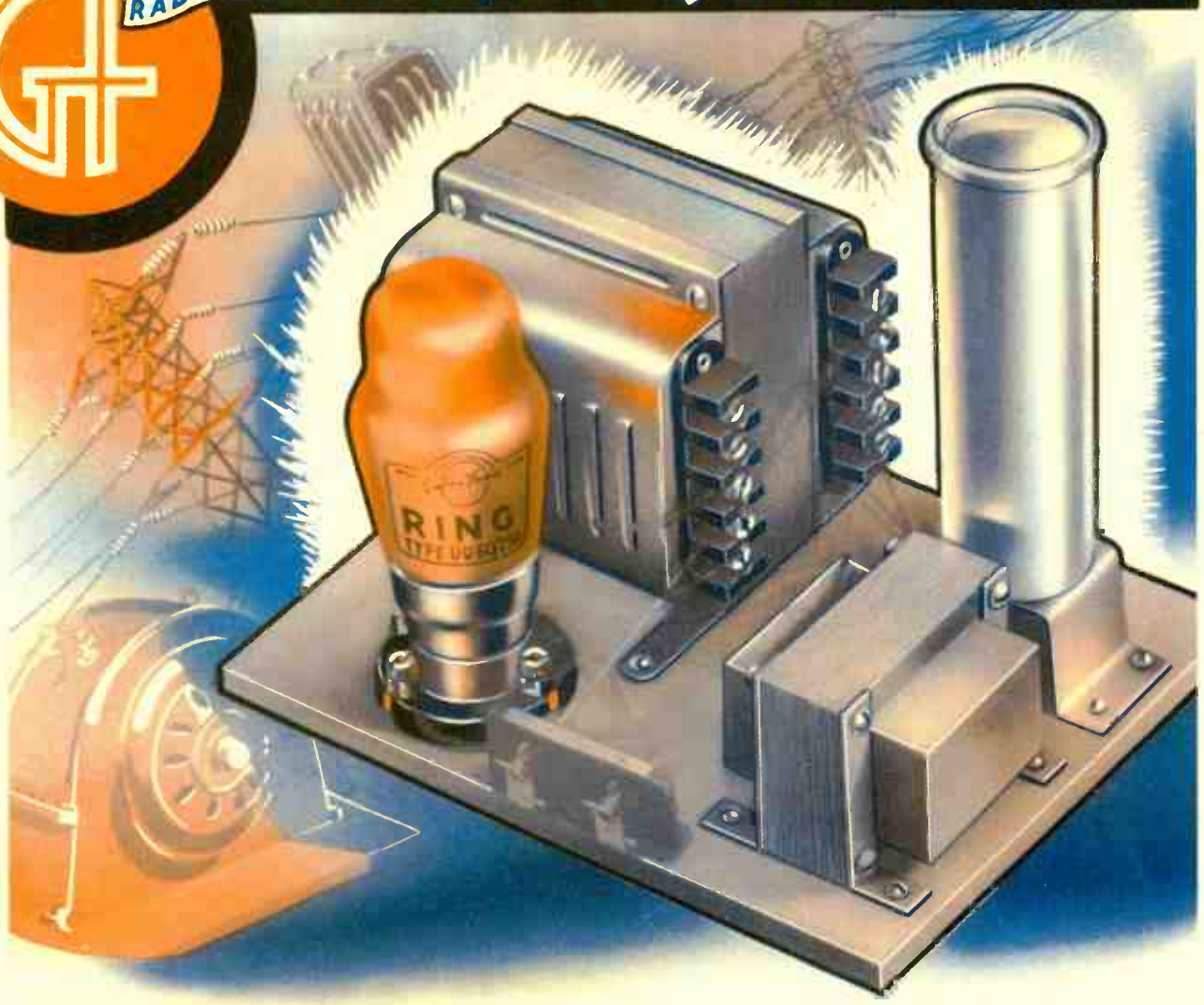
THE POWER PACK

for your ENTERTAINMENT



THE RECEIVER

GF RADIO MAINS EQUIPMENT



RELIABILITY—the keynote of all good radio material—is the outstanding feature of this new range of Graham Farish all-mains equipment for the constructor.

Just as easily—just as safely—can you feed power to your radio from the mains as from dry batteries. But first make sure that your mains equipment is reliable—build from the Graham Farish range and you build with safety.

GRAHAM FARISH MAINS TRANSFORMER TYPE MT/250.—Power transformer for A.C. Mains of 200/250v. Output 250+250v. at 50 m/a., 4v. 1 amp, 4v. 3 amp. Ventilated all-steel case, safety terminal blocks, universal mounting. Designed to supply 2, 3 or 4 A.C. Valves through full wave rectifier. Price **25/-**

GRAHAM FARISH ELECTROLYTIC CONDENSER.—A reservoir and smoothing condenser of the dry electrolytic type. Capacity 4+4 mfds. Negative electrode can. Working voltage 450v. Surge 525v. Price **6/6**

GRAHAM FARISH MAINS CHOKE TYPE MC20/50.—A gapped smoothing choke giving a constant inductance of 20H up to its rated load of 50 m/a. D.C. resistance of 350 ohms, all-steel case, fitted with flexible leads for easy connection. Price **11/6**

GRAHAM FARISH RING RECTIFIER VALVE.—Type UU60/250. A full-wave rectifier of the indirectly heated type. The slow heating of the cathode avoids excessive low load voltage rise. Filament input 4v. 1.25 amp. Maximum anode input 300+300v. R.M.S. Maximum D.C. output 75 m a. Price **12/6**

Issued by GRAHAM FARISH LTD. BROMLEY, KENT

3,000 MILLIWATTS OUTPUT!

HERE is the all-electric version of the Sensity Super, the most popular receiver yet designed for the home constructor. The designer has so arranged the circuit that the conversion of the battery model for A.C. mains can be accomplished with the minimum outlay.

WHAT do these headlines convey to *you?* Do you regard it as a miracle that this amazing power can be bottled up inside a three-valve receiver which you can build with your own two hands, without the slightest knowledge of radio or electrical technicalities? Despite the dozens of all-electric designs which I hold to my credit, I still cannot help feeling the urge to create more and more circuits—to bring greater and greater numbers of listeners to the shrine of that modern colossus—the electric grid system. Here indeed is a miracle which from day to day is changing the lives of literally millions of people. Never can I describe the feeling of awe when, during an air trip which took me over best part of the British Isles, I saw in true perspective these giant tentacles of steel and copper wending their seemingly endless journeys from huge power stations and sub-stations to every city, town, village and hamlet, across hills and through valleys—each cable the advance guard of new comforts, new services, which only the great power of electricity can give.

To the many millions of you who have taken advantage in your own homes of this service, the all-electric A.C. Sensity Super circuit is dedicated.

But do not sympathise too freely with your less fortunate neighbours. For those who "swear by" gas cooking, candle lighting, and paraffin oil heating, we designed and described in the last issue of these columns the Sensity Super battery operated receiver—a design which completely and thoroughly altered the ideas of all battery set users, and set a new standard of perfection in the performance of the conventional screened grid Pentode receiver.

The all-electric A.C. Sensity Super described now in these columns is created from this same circuit. It remains unchanged in principle, and only varies in detail by reason of the power which feeds it. You may well ask: Why, if the battery circuit is all that your readers claim for it, should you devote so much time, care and space to the design and description of an all-mains model? Since the theorists always insist that there is a reason for everything (although their theories cannot always be substantiated) and since you may ask the reason for the A.C. Sensity Super, here it is. Nobody can deny that a battery operated receiver has certain limitations and certain disadvantages. Its disadvantages are, in effect, governed by its limitations. First and foremost, perhaps, its chief disadvantage is its inconvenience. There are accumulators to be regularly charged—high tension batteries to be replaced. It is, further, impossible to maintain a battery receiver in a constant state of efficiency, due to the steady deterioration of the H.T. battery.

Its limitations are just as obvious. Although even a poorly designed battery receiver will give ample volume from local stations for the ordinary sitting room, there are many occasions when an ample output is badly needed. This can usually only be obtained by using a very large output valve and constantly replacing H.T. batteries.

In regard to all these points, the all-electric receiver scores, and scores heavily. With the power mains at your disposal a steady flow of the necessary driving force can be fed to your valves, and maintained without any attention. The mains voltage can be reduced or built up within reasonable limits, and generally used in a way which is entirely impossible for H.T. batteries.

There are a number of people who shake their heads a little when the question of building a mains receiver is discussed. Whether this is due to lack of confidence in their own ability, or in the instructions to be followed, is never quite clear to me, but what I do assure you is that anybody can construct the A.C. Sensity Super.

It's so simple—certainly as easy as the battery version.

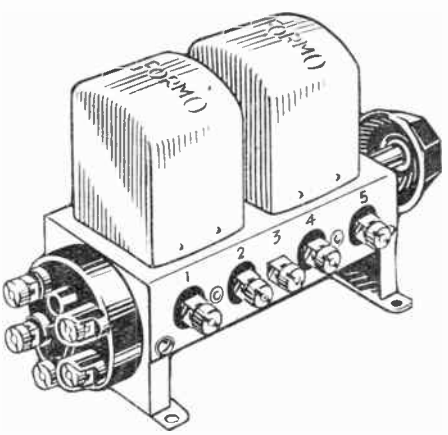
It would probably be useless for me to go on to describe the many virtues and capabilities of this set. You, with your British conservatism, would probably be doubtful as to my ability to maintain the truth. Nevertheless, even as the Battery Sensity Super seemed too good to be true, so is this A.C. version a truly new standard of receiver performance. Naturally enough, in redesigning the receiver for mains use, alterations had to be incorporated, but the same advantages have not only been maintained, but in some details improved.

We have the same Mono Control for switching on the receiver, changing wave bands, and transferring from radio to gramophone. We have the same tuning controls, the same layout, cabinet, and other controls. Then in addition we have *increased* sensitivity, increased output (3 watts), less pentode distortion and greater simplicity of operation.

In order to give complete adaptability for the construction we have maintained the chassis for the receiver, and provided an independent Power Pack. This Power Pack produces the H.T. and Heater current for the receiver valves and dial light, while the mains connection is taken through fuses and leads housed in the main receiver chassis. When housed in the Laurence Cabinet specified for it, the set will give a glorious account of itself, impressing the hearer with the majesty of its output.

As I have said before, the pedigree of this set is already famous, and there is not the slightest doubt that the A.C. version will add still more fame to its breed. If you as a constructor have never built a mains receiver for any cause whatsoever, then make a start with the Sensity Super. You just cannot go wrong, and the pleasure of standing back and listening to the admiration of your friends or family will, I know, be sufficient compensation apart from the everyday utility it will provide.

"Everyday utility" brings up immediately the two rather important points in connection with all household goods (and what is radio after all?) in daily use, viz.—cost, and still more important, reliability. Well, the cost can be divided into two: the initial cost and maintenance.

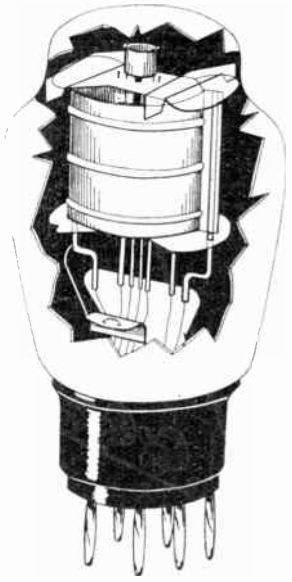


The initial cost is much below that of any commercial receiver of equal performance and quality class. The same can be said of its maintenance cost, because for its performance it only uses three highly efficient valves, and the utmost advantage is extracted from these valves in the circuit and design. The current consumed is approximately 25 watts—or 1 40th of a unit. Just realise what this means at 1½d. per unit. The set will run for 26 hours, or roughly a week's use, for the magnificent sum of one penny. If that's not economical enough for you, then you don't deserve radio.

If you understand circuit diagrams you will see that no vital factor has been omitted, either for the sake of cost or simplicity. Automatic bias, fully decoupled, is provided independently for the H.F. and Output valves, and in addition for the Detector valve for use when a Pick-up is connected. The Anodes are also fully decoupled to avoid L.F. instability. The aerial is entirely insulated from the receiver by means of a condenser which is also adjustable, enabling ganging to be simply carried out, irrespective of the type of aerial employed.

To those of you who have not made the acquaintance of the battery Sensity Super, I would like to give a glimpse of how the receiver manages to give such a remarkable performance.

Iron-cored ganged coils of the type introduced and perfected by Formo Products, Ltd., are used. All improvements in circuit design and component manufacture would be of little use if the efficiency of the coils lagged behind the requirements demanded by the ever-increasing chaos of overcrowded wavebands. A designer is, to an extent, limited to the materials available, but a large proportion of the praise which I think this receiver deserves, is due to the manufacturers of these coils. The efficiency hidden beneath those small screening cans, combined with the flexibility of the switching control, gives the designer a pleasure and thrill to build with.



What does this flexibility of switching control mean to the designer? It means that he can easily dispense with all the worries associated with the layout of H.F. switching, which is and always has been, a bugbear in radio design, especially when exceedingly high H.F. stage gain is attempted. The Formo coils have solved this in no uncertain manner. The coil windings are identical with those used for the battery version and match up with the AC/HG H.F. valve perfectly.

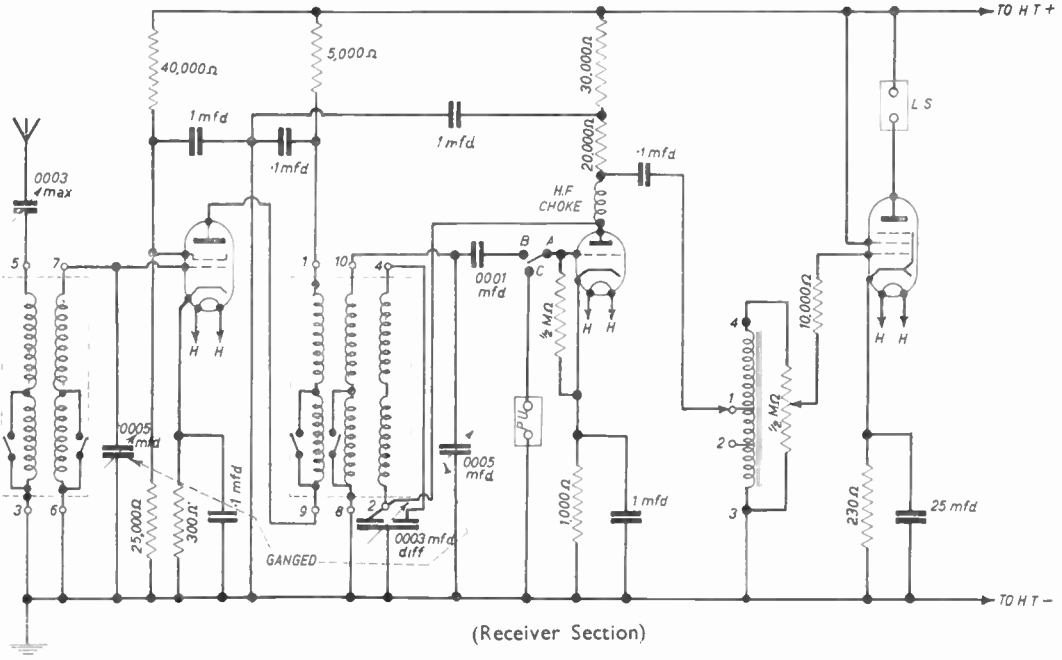
The aerial coil has a small primary winding, and the coupling is practically entirely inductive. This, combined with the aerial Formodensor, facilitates ganging enormously, and is a point which should not be under-estimated. One of the undoubted advantages a constructor has over the person who buys a ready-made set is the fact that he can himself gang the tuning circuits to suit his particular requirements, and not have to rely on the compromise usually adopted by some set manufacturers. The importance of this ganging operation has been emphasised many times in connection with Contact receivers, and again I would like to say that it plays a very important part in the efficiency and selectivity of a receiver.

The aerial and anode coils are wound in the form of full transformers, with both primary and secondary switching. The AC/HG H.F. valve is a type which I am fond of using, owing to its very high efficiency when correctly used. With suitable components a really extraordinary high stage gain is possible, even to the point of instability, due to the valve's own self-capacity, small as it is. The maximum gain, however, is not required, and since some must be sacrificed in order to obtain selectivity we still have plenty in hand.

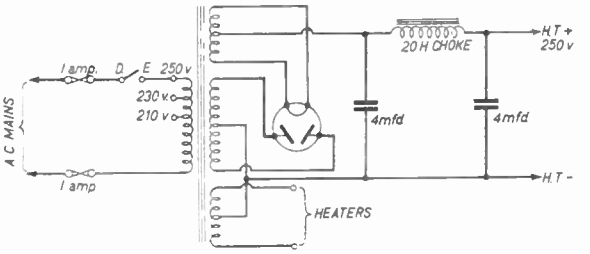
Since the coils are of the full transformer type, one is able to dispense with the usual H.F. anode choke, and here again an increase of about 7 per cent. is obtained over the other method, apart from the economy in the number of components required. These coils used in the A.C. Sensity Super must represent the highest possible practical efficiency obtainable from two tuned circuits, and remember that it does not matter what kind of aerial you use, the receiver is ready to be matched to it.

With regard to the detector circuit, the use of a differential reaction condenser is a point worth noticing, inasmuch as the

THE A.C. SENSITY SUPER CIRCUIT DIAGRAM



(Receiver Section)



(The Power Pack)

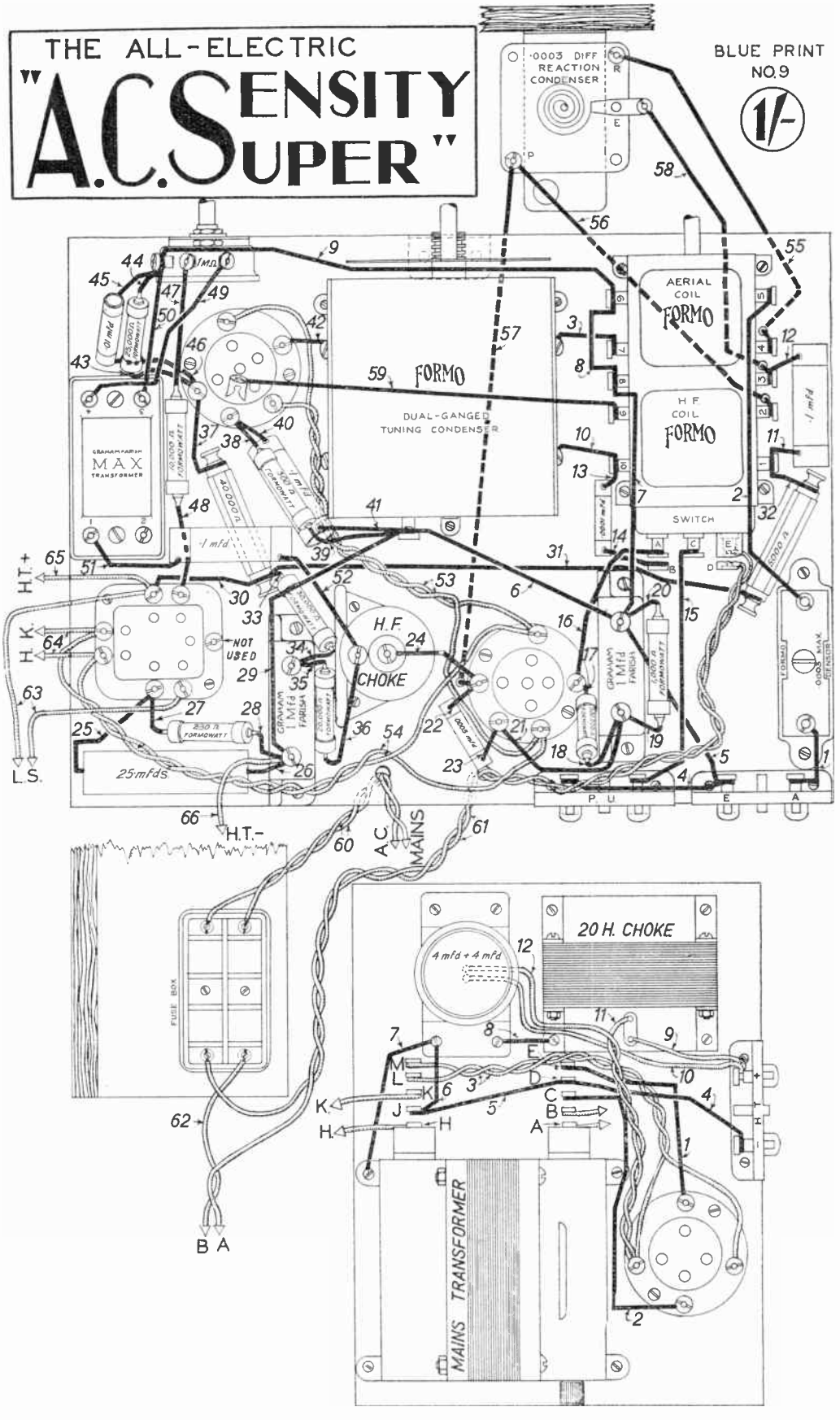
reaction spindle is directly connected to the earth side of the receiver. This gives a very fine control over reaction and, at the same time, avoids the slightest trace of hand-capacity. The grid circuit of the detector valve is interrupted by the throw-over switch incorporated in the coil, and which performs the function of changing the grid from radio to pick-up. As you can well imagine, in a grid circuit of a detector valve it is necessary to have the finest quality low-capacity switches obtainable, and the Snap Switch incorporated in the coil is a very fine example of this type of component. The switch is instantaneous in action, and thus avoids an open grid circuit.

As previously mentioned, the anode circuit of the detector valve is fully decoupled, and is coupled to a high inductance auto-transformer by the parallel-feed method. This gives practically straight line amplification, and the transformer is a really remarkable component inasmuch as it has a primary inductance of 75 henries with a ridiculously low self-capacity, and, irrespective of the fact that it only costs 4s. 6d., the output is extraordinarily good and is comparable only with the most expensive type of transformer.

Used normally, the Max transformer would, in conjunction with and due to the pentode output valve, tend to over-accentuate the higher frequencies. It is quite normal practice to put a fixed condenser either in series with or without a fixed resistance across the anode and cathode of the output valve to counteract this tendency, but this only provides a top cut-off which, when reaction is applied, is further reduced to the detriment of the quality of reproduction.

What is done in this receiver is this. The reproduction of the higher frequencies remains constant whether used for the strong local or the weak foreign transmission, and an L.F. volume control, which operates across the secondary of the transformer, reduces slightly the reproduction of the higher frequencies. We, therefore, have a very happy combination of controls which both have the same effect on quality and yet are operated independently. This is how they are used. On strong local signals the volume control is used to reduce

(Continued on page 42)



The ALL-ELECTRIC A.C. SENSITY SUPER RECEIVER & POWER PACK WIRING DIAGRAM

A full-size Blueprint is available from the Editor. Price 1/-

Step by Step Wiring

Eliminates all possibility of error

BY following the wiring table in conjunction with the easy stage wiring diagrams and blue print this can be carried out speedily —without error. Count and check all wires at the end of each stage. It may be necessary and advisable to glance occasionally at the photographs of the receivers to assist in the relative height of the wiring in order to be as nearly identical with the original receiver as possible.

Note.—Where "Left Hand" or "Right Hand" connections are referred to, it is assumed that the chassis is viewed from the Front.

STAGE 1.

1. Aerial terminal to Formodensor (·0003 mfd. max).
2. Formodensor to terminal 5 Coil.
3. Terminal 7 Coil to ganged condenser front section.
4. Earth terminal to P.U. terminal.
5. Earth terminal to 1 mfd. condenser.
6. 1 mfd. condenser to earth terminal on Ganged condenser.
7. 1 mfd. condenser to terminal 8 Coil.
8. Terminal 8 Coil to terminal 6 Coil.
9. Terminal 6 Coil to right hand terminal Volume control, looking from front of set. (This wire passes between Ganged condenser and Driving disc.)
10. Terminal 10 Coil to Ganged condenser back section.

11/12. Connect ·1 mfd. condenser between terminals 3 and 1 on Coil.

13/14. Connect ·0001 mfd. condenser between Coil terminal 10 and terminal B on Turret switch.

15. P.U. terminal to terminal C on Turret switch.
16. Terminal A on Turret switch to Grid terminal of Detector valveholder.

STAGE 2.

17/18. Connect ½ meg. Formowatt resister between Grid terminal of the Detector valveholder and 1 mfd. condenser.

19/20. Connect 1000 ohm Formowatt across 1 mfd. condenser.

21. 1 mfd. condenser to cathode terminal of Detector valveholder.

22/23. Connect ·0005 mfd. condenser between cathode terminal of Detector Valveholder and anode terminal of same.

24. Anode terminal of Detector valveholder to H.F. Choke.

25/26. Connect 25 mfds. condenser between cathode terminal of Pentode Valveholder and 1 mfd. condenser.

27/28. Connect 230 ohm Formowatt between cathode terminal of Pentode valveholder and 1 mfd. condenser.

29. 1 mfd. condenser to earth terminal of Ganged condenser.
30. Aux. Grid terminal of Pentode valveholder to 40,000 Ohmite.
31. 40,000 Ohmite to 5,000 Ohmite.
32. 5,000 Ohmite to Coil terminal 1.

STAGE 3.

33/34. Connect 30,000 Formowatt between 40,000 Ohmite and 1 mfd. condenser.

35/36. Connect 20,000 Formowatt between 1 mfd. condenser and H.F. Choke.

37. 40,000 Ohmite to Aux. grid terminal of H.F. valveholder.

38/39. Connect 300 ohm Formowatt between cathode terminal of H.F. valveholder and earth terminal of Ganged condenser.

40/41. Connect ·1 mfd. condenser between cathode terminal of H.F. valveholder and earth terminal of Ganged condenser.

42. Grid terminal of H.F. valveholder to Ganged condenser front section.

43/44. Connect 25,000 Formowatt beween Aux. Grid terminal of H.F. valveholder and right hand terminal of Volume control.

45/46. Connect ·01 mfd. condenser between Aux. Grid terminal of H.F. valveholder and right hand terminal of Volume control.

47/48. Connect 10,000 Formowatt between middle terminal of Volume control and Grid terminal of Pentode valveholder.

49. Left hand terminal of Volume control to terminal 4 Max transformer.
50. Right hand terminal of Volume control to terminal 3 Max transformer.

STAGE 4.

51/52. Connect ·1 mfd. condenser between Max terminal 1 and H.F. Choke.

53. Connect a pair of twisted rubber covered flex leads between Heater terminals of H.F. valveholder and Heater terminals of Detector valveholder.
54. Connect a pair of twisted rubber covered flex leads between Heater terminals of Detector valveholder and Heater terminals of Pentode valveholder.
55. Terminal 4 Coil to upper terminal of Reaction condenser.
56. Terminal 2 Coil to lower terminal of Reaction condenser.
57. Lower terminal of Reaction condenser to anode terminal of Detector valveholder.
58. Terminal 3 Coil to middle terminal of Reaction condenser.
59. Connect a flexible lead (about 8½ in. long) to Coil terminal 9. (This goes to anode terminal at top of H.F. valve.)

FLEXIBLE LEADS.

STAGE 5.

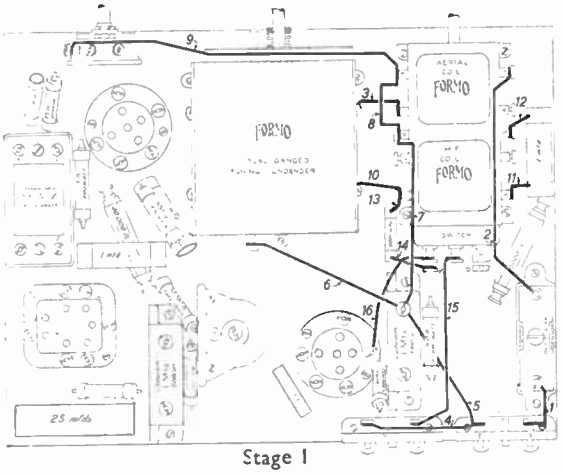
60. Attach a mains plug to a length of twin flex; pass this through the hole at rear of base-board; (existing holes require enlarging); tie a knot underneath, leaving about 7 in., which is connected to front end of fuse box.
61. Tie a knot 6 in. from end of 2 ft. length of twin flex; connect to terminals D and E on Turret switch; pass through hole at rear of base-board; connect one wire to rear end of fuse box; remaining wire goes to Transformer Terminal "A" in Power Pack.
62. Connect a single piece of flex, about 12 in. long, to rear end of fuse box; other end goes to Transformer terminal "B" in Power Pack.
63. Connect about 18 in. of twin rubber covered flex to Anode and Aux. Grid terminals of Pentode valveholder; other end goes to Loud-speaker.
64. Connect about 12 in. of twin rubber covered flex to Heater terminals of Pentode valveholder; other end goes to Transformer terminals H. and K. in Power Pack.
65. Connect about 12 in. of single rubber covered flex to Aux. Grid terminal of Pentode valveholder; other end goes to H.T. positive terminal in Power Pack.
66. Connect about 12 in. of single rubber covered flex to terminal of 1 mfd. cond.; other end goes to H.T. — terminal on Power Pack.

THE A.C. SENSITY SUPER POWER PACK.

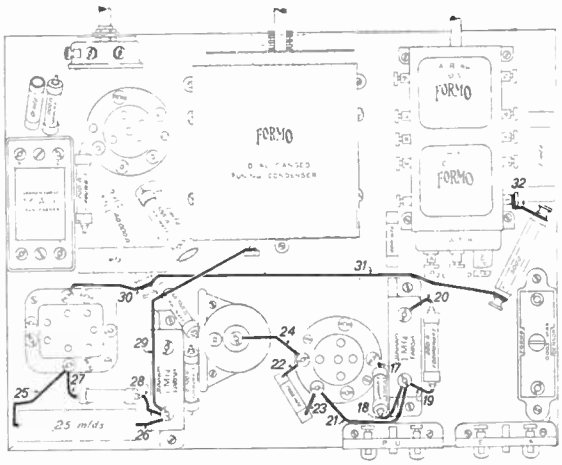
STAGE 6.

1. Anode terminal of Valveholder to terminal E transformer.
2. Remaining Anode terminal of Valveholder to terminal C transformer.
3. Pair of rubber covered flex leads to valveholder heater terminals, and to transformer terminals L. and M.
4. H.T.— terminal to transformer terminal D.
5. Terminal D transformer to terminal J transformer.
6. Transformer terminal J to smoothing condenser bracket.
7. Condenser bracket to fixing lug of transformer.
8. Condenser bracket to Choke lug.
9. Choke to H.T.+ terminal.
10. Condenser to H.T.+ terminal.
11. Choke to Valveholder heater terminal.
12. Condenser to valveholder heater terminal.

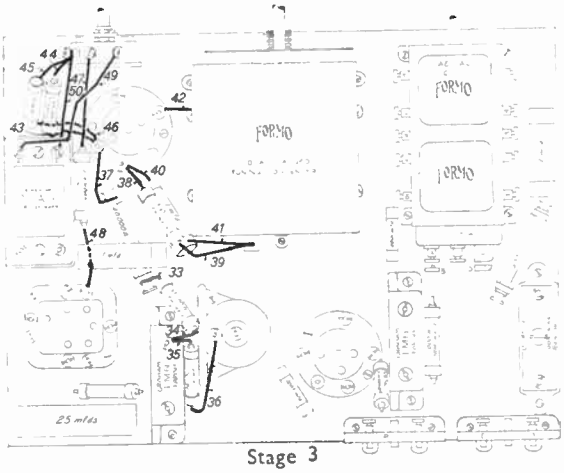
THE ALL-ELECTRIC A.C. SENSITY SUPER



Stage 1

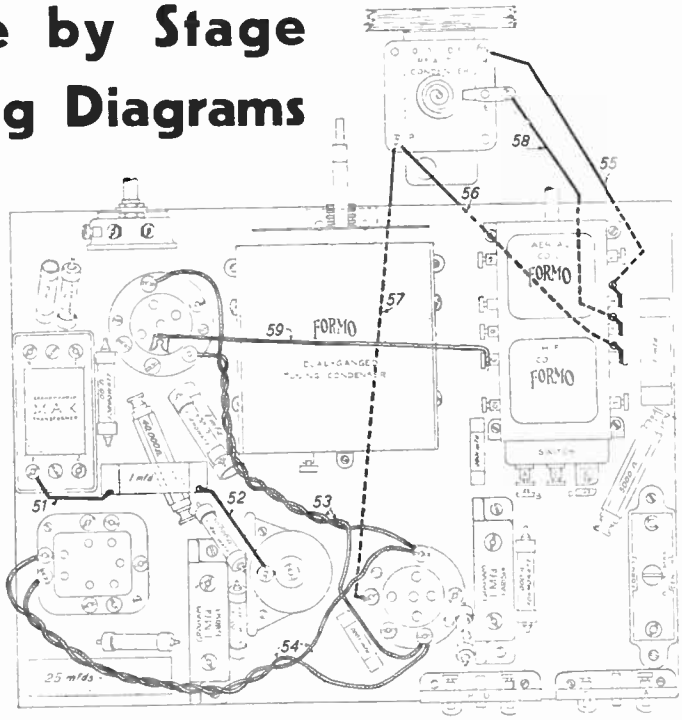


Stage 2

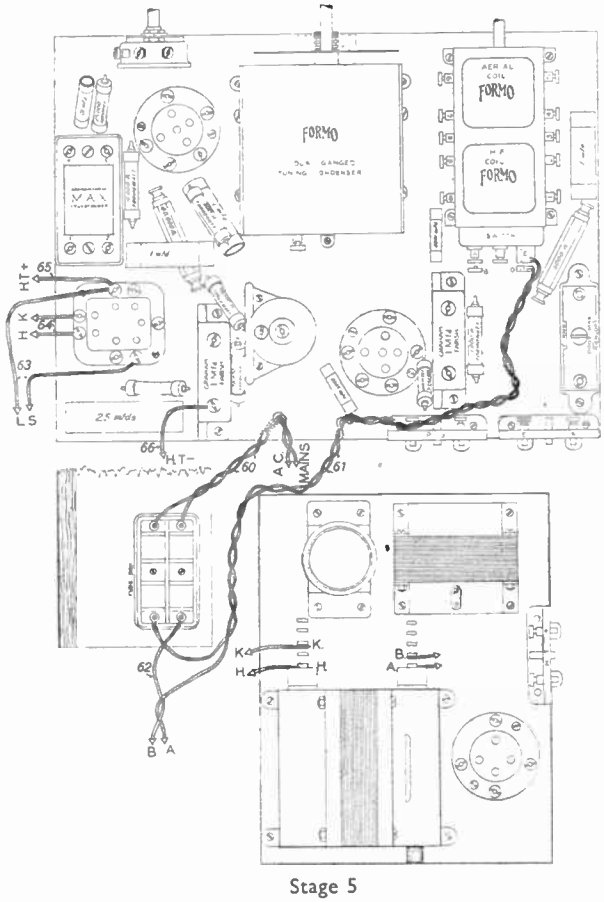


Stage 3

Stage by Stage Wiring Diagrams



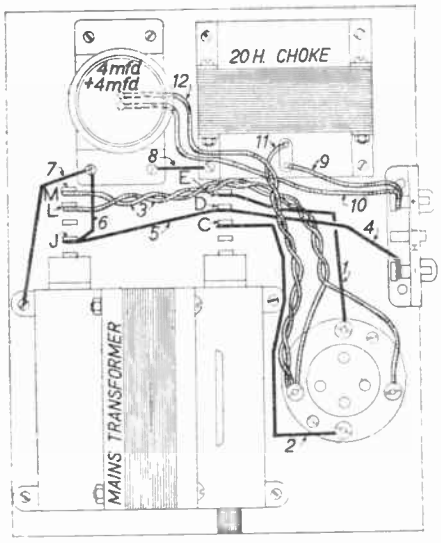
Stage 4



Stage 5

IMPORTANT

CHECK ALL WIRING AFTER EACH STAGE



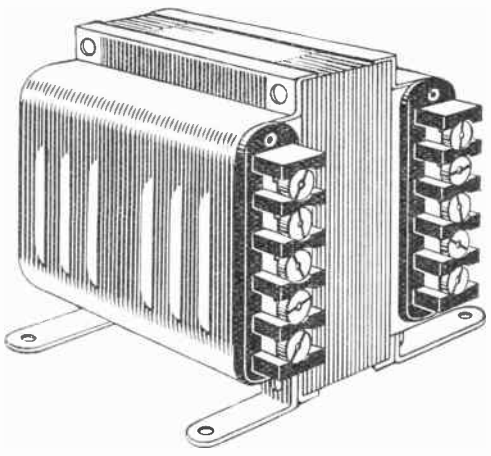
Stage 6

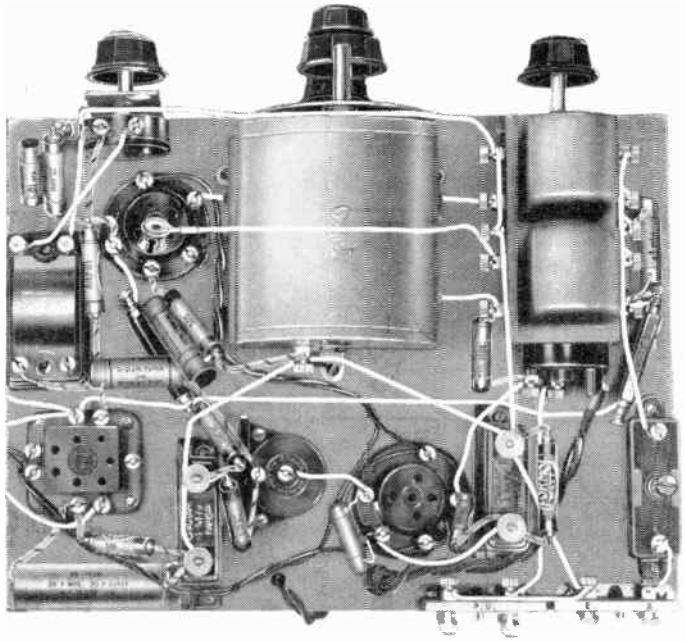
(*Continued from page* 39)
volume. This control counteracts the characteristic of the pentode and forms a correction factor. Now when you receive a weak signal, or a foreign station, requiring reaction, the volume control is fully on, and the reaction applied forms in this case the correction factor. Thus we are able to obtain exactly the same uniform amplification on either local or foreign stations. You will notice quite easily the exceptional clarity of foreign reception and the absence of top cut-off, or "woolly" effect, so inseparable from the use of reaction on the ordinary receiver.

Reference to the article on Records and Radio appearing in the second issue of this magazine (or to the leaflet issued by Graham Farish, Ltd., "The Pick-up and its Uses") will give some hints on tone control which are very readily adaptable to this circuit, and simple experiments can be carried out by those who so desire to adjust this portion of the receiver to individual requirements.

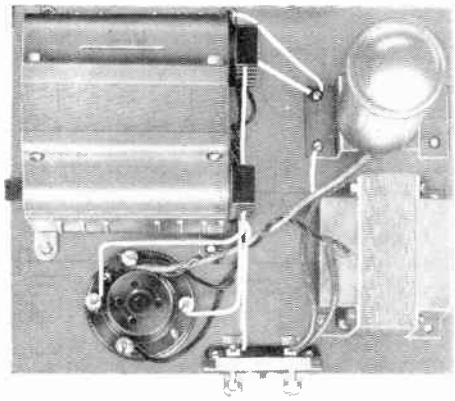
Now a word about the output valve. The new Ring output valve which is made under the Harries patents, is in itself a remarkable achievement. It is well known that, owing to the so-called "knee" which is formed in the curve of an output pentode valve, on strong signals this "knee" tends to limit the distortionless reproduction obtainable, and if it were possible to accentuate this "knee" and make it almost a right angle, this would mean that far greater output for the same input and under identical working conditions could be obtained. The ordinary pentode does certainly tend, when handling large signals, to give a certain harshness in its tone, and for this reason there are many people who ignore the greater sensitivity of the pentode and still favour the lower efficiency triode. With this new Ring output valve the one argument in favour of the triode has now disappeared, and for comparatively small anode voltages and currents this valve will, for quite a small input, give an enormous amplification and power in its output circuit.

The valve itself is extraordinarily rigid in its construction, and is illustrated in this article in order that you can see this for yourself. The mica bridge work is a triumph of valve engineering and design, and the enormous anode can clearly be distinguished. At first sight it would appear that this anode is rather widely spaced from the control grid and cathode. This spacing, however, has, owing to the work of Mr. Harries, been found to have a very great bearing on the characteristic of the valve and forms part of the patent under which the valve is manufactured. Another important feature of this valve is the fact that the cathode is insulated from the Heater by a new application of the material which goes under the name of "Alundum." This matter has a very high insulation resistance and practically negligible temperature coefficient. This has a very vital effect on the life of the valve, and also its consistency and reliability. Whole pages could be written on the technicalities of this new valve, but since we are primarily concerned in a brief description of the "Whys and Wherefores" of this receiver, I will endeavour to keep to the point, and refer only to those details which have a direct bearing on it, and which are readily understandable.





The Receiver



The Power Pack

As previously mentioned, the receiver includes a volume control across the secondary of the transformer. In this receiver the natural desire was to make it suitable for both radio and gramophone work, and as such it was desirable that the same volume control should function on both. It is, therefore, essential that the control should follow the detector valve.

It should be remembered that we do not require a volume control on the pick-up itself. Since the majority of pick-up manufacturers give their characteristics with a resistance across them in the form of a volume control, the resistance should be incorporated across the pick-up input, e.g., the Graham Farish Pick-up should have a value of 50,000 ohms across its terminals in order to maintain the correct characteristics. This, of course, can be varied at will, but a higher value should not be used.

We found that the Graham Farish pick-up, when used with the A.C. Sensity Super, forms an ideal combination. Its maximum output is certainly a little more than the output valve can handle, i.e., up to 3 watts, but at the same time the reserve is useful, since in the event of the receiver being required for use in a medium sized hall or room for dancing purposes, it will have adequate volume to deal with such cases.

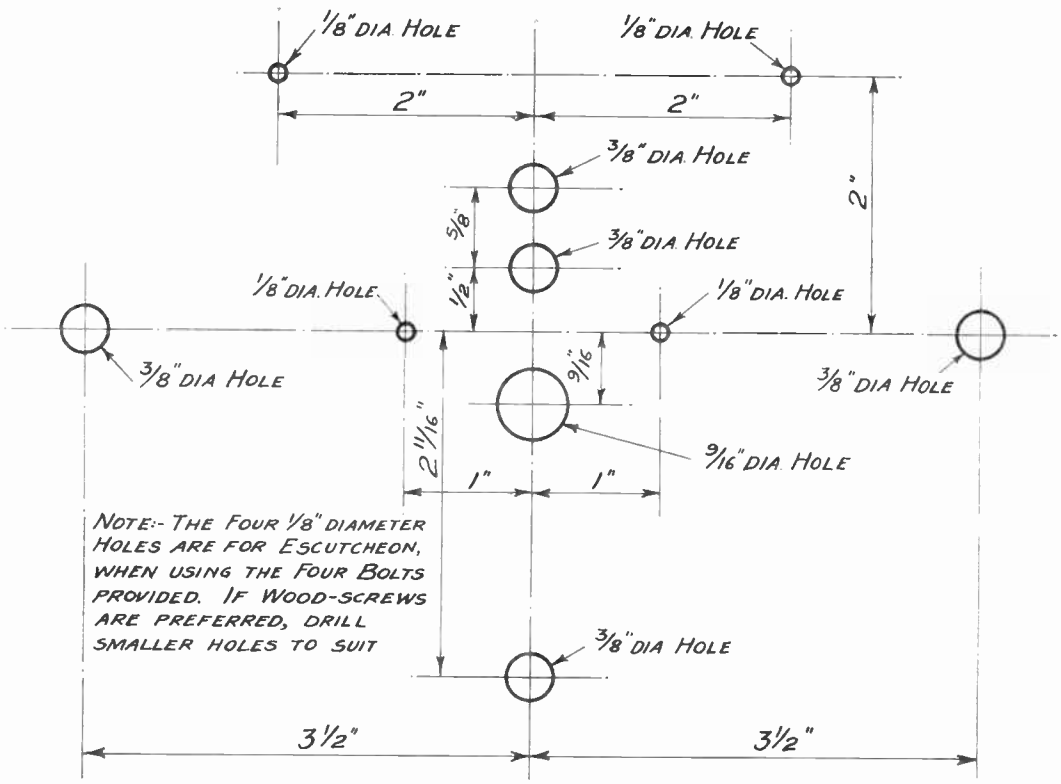
I have particularly recommended the Baby Stentorian speaker, not because I think that it is impossible to get a better speaker, but because to my mind it fully fulfils the requirements of the domestic receiver. The manufacturers themselves make larger and better speakers which possibly will deal more adequately with the full output that this receiver will give. Remembering however, that it only requires about $\frac{3}{4}$ watt at the most to give reasonable volume in a normal size room, the small speaker will deal with this quite well, and at the same time it is much more economical in its original cost.

If a bigger speaker is fitted it should be remembered that the cabinet is designed for the baby type, and care should be taken with regard to the speaker chosen if it is intended that a "Laurence" cabinet shall be used.

Now for the Power Pack. This has been reduced to the simplest possible construc-

tion, bearing in mind the requirements of the receiver. Graham Farish, Limited, have recently introduced a number of mains components which I have taken advantage of in the construction of this power pack. The mains transformer is perhaps rather large for the work it has to do, but if this be a fault it is an excellent one inasmuch as the main essentials of a transformer are that it should be free from breakdown, whether due to inadequate gauge wire used on its windings, or lack of core section, all of which cause overheating. It should be mentioned that a transformer working in good condition should not run at a higher temperature than a little above that of the room in which the receiver is operating.

For economy of space, and in order to get maximum possible smoothing, a split electrolytic condenser is used giving capacities of 4 mfds. on each side of the smoothing choke. This arrangement gives absolutely silent supply, so that no trace of hum is audible in the speaker.



The dimensioned panel drilling diagram

To avoid as far as possible the exposure of bare terminals carrying high potentials, the choke connections are finished to wire ends which are of ample length for all requirements. It is a well-known fact that, if either a metal rectifier or a directly-heated cathode rectifying valve is used, the voltage at the receiver reaches its peak value long before the valve Heaters are well heated, and thus all condensers and H.T. circuits in the receiver are subjected to a no-load voltage of over 300 v. if some precautions are not taken. Thermal delay switches have been used with success, but a far better scheme is that employed here. The rectifying valve has an indirectly heated cathode of the same type as that employed by the receiver valves, so that the emission of the valves rises in unison. Thus the load is correctly adjusted to the rising voltage. This avoids the danger of break-down due to surge currents and no-load voltages and gives the set added reliability.

It will be noticed that the mains leads supplying the power pack run through the receiver before being connected to the mains transformer. This is due to the fact that the switching is incorporated in the coil unit under the mono control system, and in addition the mains fuses are fitted on the underside of the receiver chassis, which gives ready accessibility in case of requirements.

Now a word concerning the actual construction. If you have purchased the specified Laurence cabinet you will also have the base-board provided with it. If not, it will be necessary for you to construct the chassis from the details given in the sketch shown on page 11. A piece of $\frac{3}{8}$ in. plywood should be obtained which is sufficiently large to cut into three pieces to the dimensions shown, the base-board being $11\frac{1}{8}$ in. by $8\frac{1}{4}$ in., and the two side pieces $8\frac{1}{4}$ in. by $2\frac{3}{4}$ in. You will note that one side is set back slightly from the edge of the base-board (about $\frac{3}{8}$ in.) to permit it to fit closely against the side of the cabinet, thus avoiding the blocking piece in the corner of the cabinet. If the Laurence cabinet is not used, however, you can be guided by the requirements of the cabinet which you propose to use.

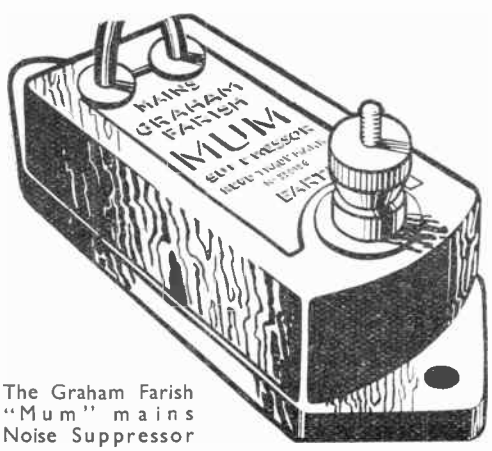
You will note that certain wires are allowed to pass through the base-board, the holes for which should be drilled in suitable positions either from the blue-print or during the course of wiring. We do strongly advise you, although the photographs and wiring diagram included in this article are of adequate size, to obtain the blue-prints, price 1s., since this facilitates construction considerably. It is full-sized and can be used for marking out the panel and base-board by transferring the holes through the blue-print to the base-board itself.

Remember when screwing down the components to the base-board that the controls must coincide exactly with your panel drilling, otherwise it may be necessary for you to shift the components after wiring, or alternatively, alter the holes in the front of the cabinet, either procedure being most irritating and tending, through impatience, to spoil the finished look of the job. A little care taken in this respect will save you a great deal of trouble later on.

Just one or two notes concerning the individual components when assembling.

Ganged Condenser. This component should be handled carefully, since it is very accurately matched before despatch and rough handling can and will upset this. Before fitting be careful to see that if the cover is not in position the moving vanes are fully in, since this is the most fragile portion of the condenser. The two front fixing tabs are normally turned inwards when packed. It is necessary to pull out the two front ones, which will be found to turn on their rivets. No. 4 × $\frac{3}{8}$ in. screws are suitable for fixing this component to the base-board.

Ganged Coil. When fixing this unit avoid pressure or strain on the screening can



The Graham Farish "Mum" mains Noise Suppressor

when holding it. Whilst they are fixed to the chassis of the coil, it is possible by force to disturb the fixing, and if they are forced out of position it may be possible to damage either the coil itself or its internal connections. The same type wood screws should be used as are specified for the condenser.

Volume Control.—See that this is well and tightly fixed to its component bracket, since it will be most irritating after having fitted the chassis into the cabinet to find that owing to constant use the volume control works loose when moved to the extreme end of its travel.

Reaction Differential Condenser.—The above remarks apply also to the reaction differential condenser. It should be noted with regard to this condenser that the insulating washers are not intended for insulating purposes but only packing washers.

The fuses are for the protection of the receiver as much as anything else and if, when you first switch on a fuse blows, then it is no good replacing it without having first ascertained the cause.

It is regretted that in the wiring and circuit diagrams the illumination of the dial light has been omitted. If it is desired to have these, and in any case it is well worth while, the two terminals connecting the dial light should be connected to the two Heater terminals of the H.F. valve. This valve is the only one whose Heater terminals have only one wire connected to them and leads can be made with flexible twisted wire quite conveniently. The type of 6 V bulb normally utilised for mains dial lights should be fitted, since these have a considerably longer life than the ordinary flash lamp bulb, and although not giving quite the same brilliance as the latter, it will be sufficient and cause far less inconvenience.

Before finally closing this article I feel that a few words on the subject of suppression of "mains noise" might not be out of place.

It is just possible that if your A.C. Sensity Super is to be used in close proximity to a factory or power station, or even a shop where electrical equipment is used, you may experience a form of noisy reproduction which is particularly annoying.

The media by which interference can reach the radio receiver can be divided roughly into three classes :—

1. The mains wiring acting as a direct carrier of interference through the mains connections to the set.

2. The mains wiring acting as a radiating aerial for the transmission of interference.

3. Radiated external interference picked up by the aerial and earth.

None of these cases indicate any fault in your receiver, and if you happen to be using your receiver in a district which is some distance from any commercial or industrial electrical equipment, it is more than likely that no interference will be experienced. To those of you, however, who will require some form of mains noise suppressor unit, I cannot do better than recommend the unit manufactured by Messrs. Graham Farish, Ltd., which, appropriately enough, is known as the Mum Mains Noise Suppressor. The cost (2s.) is trivial, and although it is not possible to guarantee complete elimination in every case, there is no doubt that the Mum has proved itself to be one of the most successful suppressor units in a very great variety of cases.

THE COMPONENTS REQUIRED FOR THE ALL ELECTRIC A.C. SENSITY SUPER

The Receiver.	s.	d.
2 G.F. Pop terminal mounts	1	0
1 Formo type J (·0003 mfd.) Formodensor	1	6
1 G.F. Disc H.F. Choke	2	0
2 G.F. 5 pin valveholders	1	4
1 G.F. 7 pin valveholder	1	3
1 G.F. Max transformer	4	6
1 Formo AH/G Twin coil unit	12	6
1 Formo DU5 condenser	12	6
1 G.F. ·0003 mfd. Differential condenser	2	0
1 G.F. 1 meg Ohmite V. Control	2	9
2 G.F. Component brackets	0	8
2 G.F. 1 mfd. Mansbridge condensers	4	0
3 G.F. ·1 mfd. Tubular condensers	4	6
1 G.F. ·01 mfd. Tubular condenser	1	3
1 G.F. ·0005 mfd. Tubular condenser	1	0
1 G.F. ·0001 mfd. Tubular condenser	1	0
1 G.F. 25 mfd. 25 v. Electrolytic condenser	2	6
1 Formowatt resistor 1,000 ohm	0	10
1 Formowatt resistor 230 ,,	0	10
1 Formowatt resistor 10,000 ,,	0	10
1 Formowatt resistor 300 ,,	0	10
1 Formowatt resistor 20,000 ,,	0	10
1 Formowatt resistor 25,000 ,,	0	10
1 Formowatt resistor 30,000 ,,	0	10
1 Formowatt resistor ½ meg.	0	10
1 G.F. Ohmite resistance 5,000 ohms	1	6
1 G.F. Ohmite resistance 40,000 ,,	1	6
1 Belling Lee Twin Safety Fuse No. 1033	2	6
The Power Pack.		
1 G.F. Mains transformer Type MT/250	25	0
1 G.F. 20H Smoothing choke, Type MC/20/40	11	6
1 G.F. Bracket (condenser)	0	6
1 G.F. 4 mfd. ×4 mfd. Electrolytic condenser	6	6
1 G.F. 4 pin Valveholder	0	6
1 G.F. Pop terminal mount	0	6
The Valves.		
Graham Farish A.C. Ring Valves.		
1 AC/HG Screened Grid 5 pin	17	6
1 AC/DX Detector 5 ,,	13	6
1 AC/PT Pentode 7 ,,	18	6
1 UU/60/250 Rectifier 4 ,,	12	6
Recommended Accessories.		
1 W.B. Baby Stentorian speaker	23	6
1 Laurence standard type walnut cabinet	25	0

"What the Eye Does Not See"

The progress of radio design in the past few years has been so regular and consistent that its breakneck speed has become accepted as commonplace—and is, indeed, hardly noticed by any but the technical enthusiast. Yet it is only necessary to compare the appearance and performance of, say, a three year-old set side by side with the Discovery Three or the Sensity Super to realise that of all the scientific research now being carried out that in radio is the most popular and the most prolific in surprises.

The differences in both internal and external appearances of the modern set are plain to the eye of the merest novice, except in one particular, that of the permanent magnet moving-coil speaker. Yet, strangely enough, this apparently little-altered component has in the past two years developed and improved to a prodigious extent.

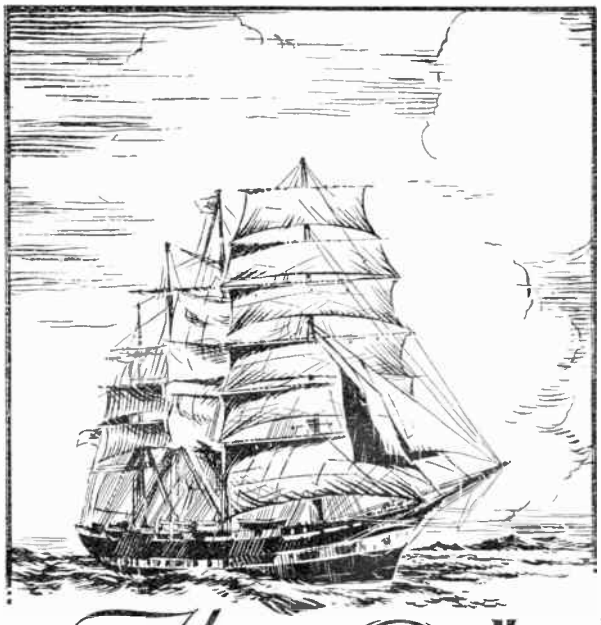
Vastly different in efficiency though they are, all magnet steels look much alike to the uninitiated; and the beauties of a new method of speech coil assembly are not apparent to the eye, even of the expert.

It is generally known that sensitivity and ready response to all frequencies depend very largely on the strength of the permanent magnet in the speaker.

The public is now, we believe, aware that size alone counts for very little, the important thing to know being the "coercive force" of the material used. Chrome steel, for instance, has a much lower coercive force than cobalt steel, and nearly three times the weight of this material is necessary to provide a strength equal to that of a "cobalt" magnet. Cobalt, in its turn, is now giving way to a new type of alloy embodying aluminium and nickel. The new materials are at present no cheaper to use than chrome or cobalt steels, but are more compact, and apparently have the advantage of retaining their magnetic properties unimpaired over a longer period of years.

Outstanding among new magnetic materials is that developed by the Whiteley Electrical and Radio Co., Ltd., and incorporated in their "W.B. Stentorian" speakers. This, besides the advantages of compactness and long life, has this additional and most important feature—it gives enormous strength at a cost little over half that of other alloys, and makes possible at a moderate price a loudspeaker so amazingly sensitive as to set an entirely new standard in performance.

In addition to providing this greater sensitivity, the extra "field strength" enables a larger "air gap" to be used. Thus it is, for the first time, possible to use the "Whiteley" speech coil in a domestic speaker. Previously confined to public address models (which, of course, can and do use very large air gaps) this speech coil brings a vast improvement in "attack" and bass response. It enables the bass resonance to be placed much lower in the musical scale and thus provides a fuller *natural* bass free from any artificial "boom."



The QUEST S.W.2

A SHORT WAVE TWO-VALVER FOR WORLD-WIDE RECEPTION

MANY years ago the ear telephone was invented to make audible the variation of minute electrical currents. The earphone, unchanged in its fundamentals, remains to-day one of the most widely used instruments. This is no doubt due to two reasons, firstly its sensitivity and secondly its privacy.

It is these two reasons which make thousands of experimenters and constructors stick so faithfully to their earphones for short wave use, and it is to those that this receiver will find its greatest appeal.

The amazing penetration of short waves over great distances is well known, and the fact that even a single reacting valve can be used to pick up signals transmitted thousands of miles away is ever an astounding achievement. You will note that I have mentioned that the valve is reacting, and this is essential where no H.F. amplification is used.

Many "stunt" circuits are used, and have been tried, but the simplest and most popular up to the moment has been the ordinary triode, generally coupled with a single stage of amplification. The triode with capacity coupled reaction is simple to understand, and can always be relied upon to function, even under the most adverse circumstances. It operates, after a style, over a wide range of conditions, and one can pretty well always guarantee some kind of result.

I might have used a similar circuit for this receiver, employing the new short wave components, except that there is also a new short wave valve produced by Graham Farish Limited. This valve, which is called the S.W.G.2, provides the ideal detector for this type of receiver. It has certain characteristics, due to its unique design and construction, of which one can readily take advantage. The fact that the grid of the valve is far removed from the base and insulated by the glass bulb means that the only loss across the tuning inductance is that of the grid condenser, and internal electrodes of the valve itself. By using H.F. currents collecting in the screening grid and feeding them back in the ordinary capacity method, we are able to gain many advantages over the triode valve.

In the first place, the screened grid valve has a much higher scope and higher amplification factor than the triode. Secondly, owing to its low internal capacity, the reaction control has less effect on the tuning—a very important point in short wave reception where desired signals are sometimes sharply tuned. Thirdly, practically no reaction effects are passed to the L.F. stage, which means that the output side is almost entirely free from H.F. currents, making the receiver stable in operation. The reaction control is extraordinarily smooth.

An aerial series condenser is used so that it may be adjusted to avoid "blind spots." This term is used to describe variations of the tuning scale in which either it is impossible to tune a signal, or where the reaction suddenly requires to be increased out of all proportion to that which is used over the rest of the scale. This is due to the aerial-earth system and can be prevented by adjustment of the aerial series condenser. "Blind spots" usually only occur where the aerial is of very high capacity or of long length, or alternatively where a long high resistance earth is used.

A short wave H.F. choke is used in the H.T. lead to the screening grid to avoid H.F. currents passing through the H.T. battery, and another in the anode of the valve itself, which performs a similar function. From here the rectified current is taken through a condenser, the detector valve being parallel fed and coupled to the output valve by means of an auto transformer. Since quality of output is not our first consideration the 1–5 ratio on the Max transformer is utilised, although owing to the very high impedance of the detector valve there is little gain by using the low primary inductance coupling. This, however, can be varied at will to suit the individual, and this connection from the coupling condenser to the transformer can be fixed to terminal No. 1 if so desired. The transformer is connected to a pentode output valve chosen on account of its high sensitivity, and the phones are directly in its anode.

A slight improvement can be effected by using a pentode output choke having a ratio of 2·5 or 3–1—this being dependent upon the resistance of the phones. It is not, however, necessary and accordingly need not be fitted, there being ample sensitivity for all general purposes without this.

Care should be taken to see that the phones are connected the right way round since they carry the anode current to the pentode valve. Incorrect connection will result in de-magnetisation of the phones, and as they are normally clearly marked, attention should be paid to this point.

Now with regard to the construction. The drives and condensers should be assembled together before they are fitted to the cabinet, as this job is much more easily done before they are in position. If the dimensioned sketch for drilling the front of the cabinet is followed, then this will provide a location for the drives. The marking out of the front of the cabinet ready for drilling should also be checked from the templates which form part of the packing of the escutcheons. It is assumed that you are using the cabinet specified, and it will be noticed that there is plenty of spare space which can be utilised for the L.T. battery and the grid bias battery. This means that only two external leads are required for the H.T. and since in many cases this battery will be borrowed from the broadcast receiver, the arrangement appears most convenient.

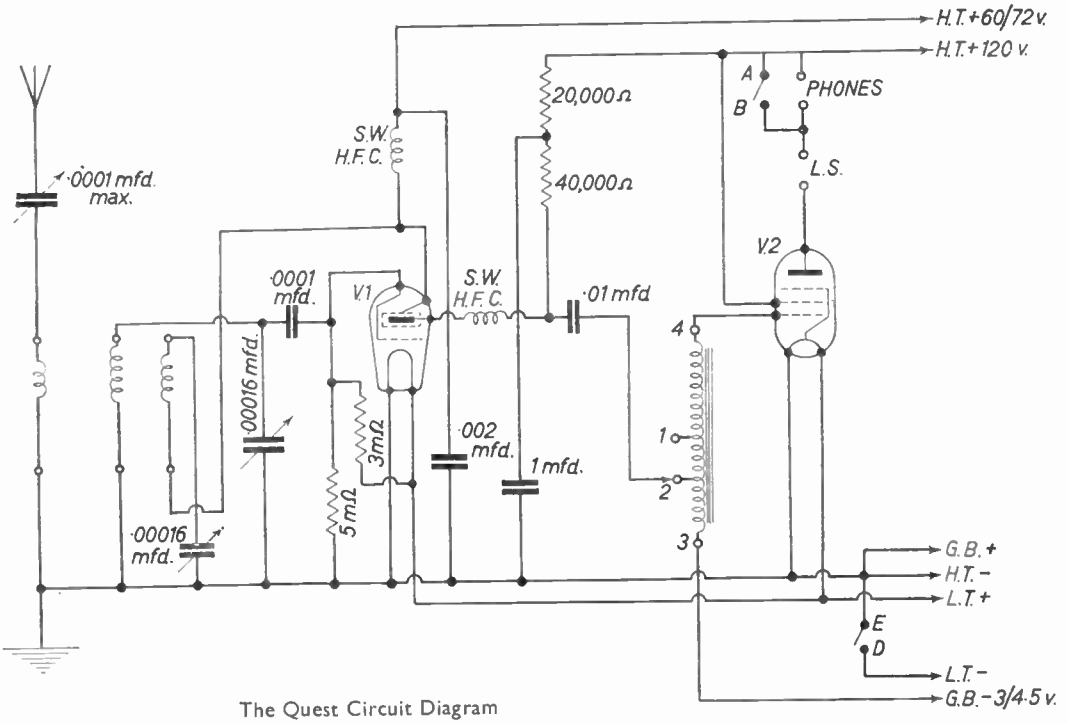
Regarding the drilling operation, it should be noted that the hole for the switch should either be slightly countersunk on the inside of the cabinet, or better still, if you are able, slightly counter-bore on the front of the panel sufficiently to clear the fixing nut. Either of these methods must be used as the spindle bush is barely long enough for the panel, and if you do not get

more than one thread of the nut biting, it will probably strip when you tighten up.

To revert back to the drives and condensers, these can now be mounted in position. Note that the fixing bracket for the drive is mounted as low as it will go. This means that the two 4 BA screws which fix the bracket to the main assembly are screwed into the two lowest holes on the main supporting plate.

The detector valveholder should be screwed to its bracket before this is mounted in the cabinet, since it is as well to avoid undue strain on the bracket when it is in position. You can now proceed to mount the components, and if you follow this sequence you will find it the easiest way.

1. The two drives and condensers. In mounting connect up, at the same time, the wires under the screws which earth the two drives as shown in the wiring diagram.



The Quest Circuit Diagram

2. Lampholders for dial lighting. Note that the templates on the cartons containing the escutcheon should be cut out and mounted behind the scale to form a reflector which spreads the light evenly. Also note that 2v .06 amp. low consumption bulbs should be fitted and not the ordinary flash-lamp type, otherwise an unnecessary drain is put on the low-tension battery. If any difficulty is experienced in obtaining these from your dealer, they are readily obtainable from Graham Farish, Limited, at 6d. post free.

3. Mount switch on the front panel, with the filament terminals to the aerial side of the receiver.

4. Coil stand to base-board. Provided that this is mounted longways it does not matter which way round since the terminals are universally spaced.

5. Grid condenser.

6. Valve bracket. This wooden mounting is secured to the base-board by means of a component bracket. The component bracket should be screwed to the wooden base first and then the whole of the assembly screwed to the base-board.

7. Aerial condenser.

8. One mfd. Mansbridge condenser.

9. Max. transformer—take care to mount this as shown.

10. Output valveholder.

11. Screen condenser.

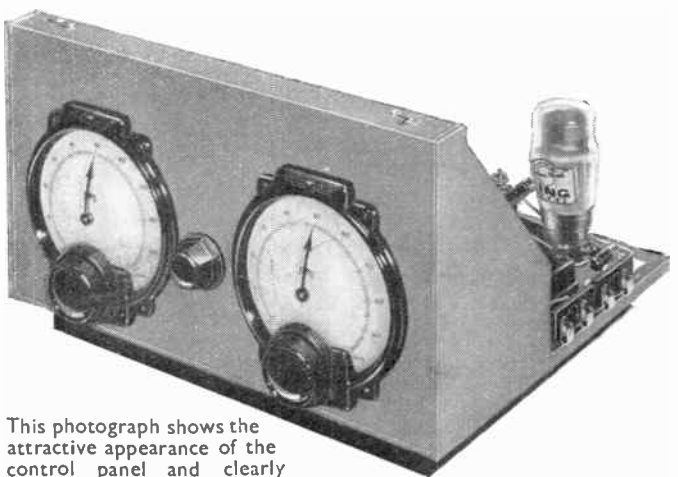
12. 13. 14. Pop terminal mounts.

By referring to the diagram the wiring is simple, but we suggest that you wire the switch first, then the coil and condensers. Next the H.F. valve and dial lamp filaments, then carrying on with the balance of the set. You will note that various components such as resistors, H.F. chokes, etc., are mounted in the wiring. These should be kept as close to the terminals as possible to ensure complete rigidity.

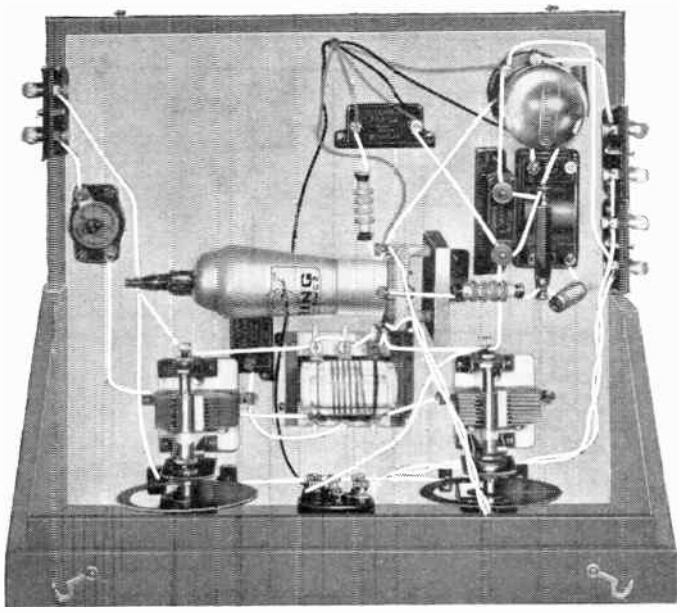
Upon completion of the receiver, and assuming that the valves are in their respective holders, we should like to say a word about the aerial. Remember that generally speaking the length of an aerial should depend upon the wavelength it is desired to receive. In other words, it is not necessary to use as long an aerial as one would have for broadcast reception. This does not mean to say that you are to cut your aerial in half. No doubt you would strongly object to this, but what you should use is an aerial that is not trailing around tree branches, gutters, drainpipes, etc. So far as the length of aerial is concerned, this can be varied by use of the series aerial condenser, but the losses and high capacity of an aerial are far more difficult.

A further point is that an aerial which is in close proximity to earth (and on a wet night the side of a house, tree branch, or gutter, can be regarded virtually as an earthed object), and which is not taut, will swing to and fro between earthed objects, giving a variation in its characteristics. This will cause fading which you will probably put down to the station, but which is actually due to the manner in which the aerial is rigged. There is nothing to beat a good taut aerial running direct from the lead-in up to a horizontal wire of short length. On short waves it can generally be considered that the vertical portion is of more use than the horizontal.

Now with regard to the earth. It is a strange peculiarity of short-wave sets that very often they function equally well, and in some cases better, without an earth connection at all. This is really not a peculiarity of the receiver, but is only proof that your earth is not efficient. It may perform reasonably well on broadcast wavelengths, but on the ultra short-wave bands it is of such high H.F. resistance and capacity that it might just as well not exist at all, since the natural capacity of the set itself to earth provides a much easier path for the H.F. currents than the earth wire. If you are able, get a good stout gauge of wire and earth it within a few feet, either to the outside earth, using a good quality earthing component such as the Graham Farish Filt, or direct to a rising water main. A rising water main is the pipe which brings



This photograph shows the attractive appearance of the control panel and clearly indicates how the baseboard forms the base of the cabinet



Plan view of the Quest Chassis

water into the house, and if the earth wire is taken as near as possible to the point where it comes out of the ground, this will be quite efficient.

If you find it possible to follow these ideals then so much the better, but at the worst if you aim at getting as near as possible to them you will have at least achieved some measure of success. The whole point is that it is just as important to look after your aerial equipment for short-wave listening as it is to study the losses in the receiver.

Now that we have our aerial and earth attached, the question of connecting up the batteries is quite simple. The valves being of the two-volt type, an accumulator of two-volt and approximately 30 A.H. should be used. A small block accumulator will work the receiver quite well, provided it is regularly and adequately charged. In the case of the H.T. connections, here we have a slight variation from the usual, inasmuch as the screen voltage is considerably below that normally used. Between 35 and 48 volts, when the battery is new, is the best voltage to give smooth reaction, coupled with good rectification.

Now for the coils to be plugged in first. If you take my advice you will use the higher waveband, i.e., coil D to start off with, since, although when you are accustomed to it you will not find tuning difficult, it requires half an hour or so to get the "feel" of the receiver, and it is easier to do this on the higher wavelength coil.

When changing the coils always take the precaution of either removing the H.T. positive or the negative plug from the battery. Not that you would do any damage, but "it is better to be safe than sorry."

To you who have handled a short wave detector and L.F. receiver before there is one thing which might possibly strike you in connection with the use of reaction on the Quest Two. Normally a tremendous build up in signal strength is obtained with most types of detector and L.F. receivers. Bearing in mind that reaction is to compensate for losses in the circuit by reducing them to zero the moment the valve goes into oscillation, it is not difficult to understand why this set should be rather different. The losses have been reduced to an absolute minimum, both in the case of the coils and the valves themselves, and consequently you will not get the same apparent increase in signal strength by the application of reaction as you have probably been accustomed to. Nevertheless, although signal strength will be the same, the reaction is not so critical as under normal circumstances. In point of actual fact, on some of the strong short wave stations, such as Moscow, Zeesen, etc., reaction can be reduced considerably and the reception still be good.

In the operation of reaction also will come the question of "blind spots," which has been previously mentioned, and it will be found that, assuming we are tuning from 0–100 on the aerial tuning condenser, reaction will progress in the same way.

If you find a "blind spot" you will find that it suddenly becomes necessary to increase reaction up to almost the limit of the scale to obtain signals, and then, after passing out of the blind spot, again reduce reaction to the normal position.

Since this is highly unsatisfactory in operation, close attention should be paid to the adjustment of the aerial series condenser. Generally speaking, it is most convenient to work reaction on the threshold of oscillation, and since the reaction control on this receiver is so smooth that it is not, without a little practice, readily audible, it would be well to note the relative positions of reaction and aerial tuning condenser in the first try out and, as near as possible, endeavour to remember them.

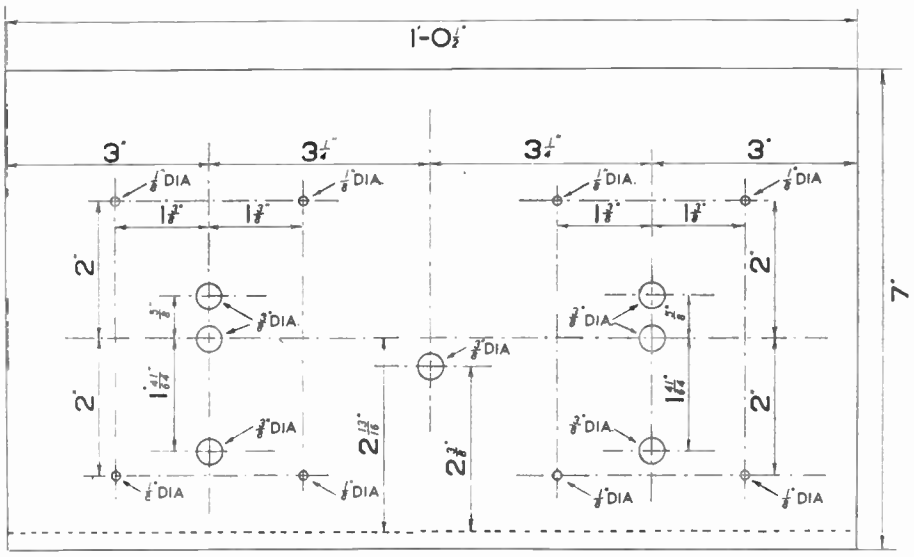
Reference to the dial shown with the stations marked thereon in the article on the Discovery Three will give you approximate indications of some of the main stations you will be able to receive. The varying effect of different aerials will probably alter this slightly, as well as the way you carry out the wiring, but it will at least serve as a slight indication and guide.

Remember that whichever way you plug in the coil you cannot do any harm, but if you remember that the aerial coupling is wound in the slot and this should always be towards the aerial side of the receiver then you can readily ascertain the correct position. The effect of plugging in wrongly is only that the aerial coupling will be increased, whilst the reaction will be decreased.

When using coil B and operating it on the lower half of the tuning condenser, you may find that reaction becomes unduly fierce. If this is the case it is due entirely to the adjustment of the aerial series condenser or, alternatively, to your aerial-earth system, but if you follow the previous directions in connection with this condenser the trouble can easily be avoided.

In many cases signals will be strong enough to connect to a loudspeaker, and if you can arrange this then there are terminals provided for it, together with a switch.

We shall be glad to have reports from you on the results obtained. Please state clearly the locality in which you are using the receiver. Its comparison with the



Drilling Template for Panel—Quest Two

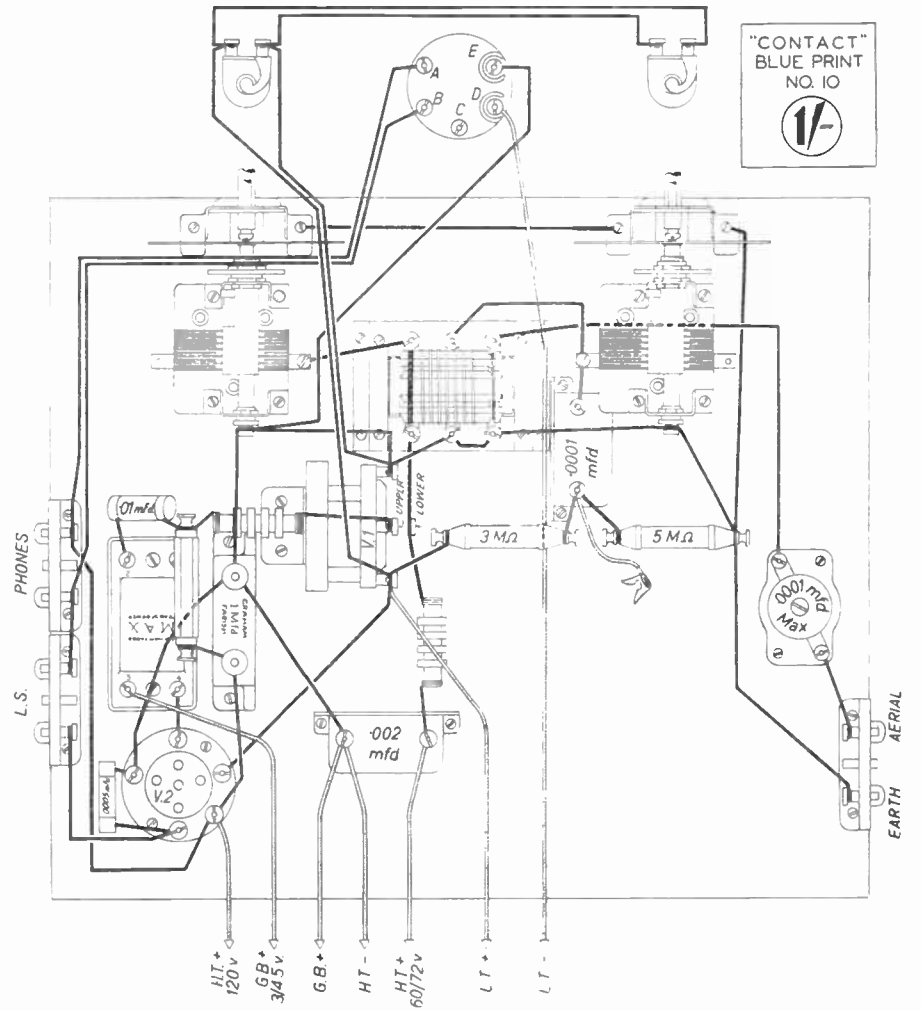
results obtained from other S.W. receivers and the logs of stations received would be welcomed. We know you will receive the main Continental and American stations and American amateurs, so quite frankly we are not so interested in reports on these stations, but we shall really welcome notes on reception of stations other than those mentioned, especially on the 12/25 metre band in use during daylight.

You will no doubt have read the constructional details of the Discovery Three, and if you have constructed the Quest receiver it is possible that the Discovery Three is of further interest to you, but for some reason or other you preferred to deal with the more simple receiver first.

This is possibly as it should be, but we would like to point out that in designing the Quest Two we have taken particular care to avoid using components which could not ultimately be used in the construction of the Discovery. With the exception of a Fixed condenser, a Short-wave H.F. Choke and the single coil stand, all the components used in the Quest, and even the cabinet, are used in the Discovery. It is more than likely that when you wish to go a step further and build the Discovery Three there will be many of your friends who, having heard this very snappy little two-valver will want to relieve you of it in its entirety, but if this is not the case you can, with the minimum of trouble and expense, easily convert it to the Discovery Three.

In the latter case there is just one small point which must be watched when building the three-valver into the cabinet which has previously housed the Quest. The hole which is used for the switch in the Quest becomes the hole for the reaction indicator in the Discovery. It means that your reaction control in the Discovery will be slightly lower than that in the original model, thus avoiding the hole which now exists in your cabinet showing outside the reaction indicator. It is a simple matter to lower the reaction control by means of the adjustable bracket on the reaction drive.

THE QUEST SHORT WAVE 2



THE QUEST S.W. TWO WIRING DIAGRAM

Full Size Blue Prints are available from the Editor. Price 1/-

QUEST TWO COMPONENTS

			s.	d.
2 Formo Products	Snail dual ratio drives ..	@	3	0
2 Formo ..	Snail escutcheons	@	3	6
2 Formo ..	·00016 mfd. S.W. Condensers	@	3	6
1 Formo ..	S.W. Single coil stand		1	0
1 Formo ..	Type B Short wave coil		3	6
1 Formo ..	Type C Short wave coil		3	6
1 Graham Farish	S.W. 4 pin Base-board valveholder		0	9
1 Graham Farish	5 pin bakelite valveholder		0	8
1 Graham Farish	·0001 mfd. Base-board Pre-set cond.		1	0
1 Graham Farish	·0001 ,, Fixed mica condenser ..		0	6
1 Graham Farish	·002 ,, ,, ,, ,, ..		1	0
1 Graham Farish	·01 ,, Tubular condenser ..		1	3
1 Graham Farish	·0005 ,, ,, ,, ..		1	0
1 Graham Farish	3 meg. Standard grid leak		0	10
1 Graham Farish	5 ,, ,, ,, ,, ...		0	10
1 Graham Farish	40,000 Ohmite resistance		1	6
1 Graham Farish	1 mfd. Mansbridge condenser ..		2	0

			s.	d.
2 Graham Farish	Short wave H.F. chokes (10–100 m.)	@	2	0
1 Graham Farish	Universal Turret switch ..		2	0
3 Graham Farish	Pop terminal mounts ..	@	0	6
1 Graham Farish	Component bracket		0	4
1 Graham Farish	Max transformer		4	6

Recommended Accessories :

Valves

Graham Farish Ring Short-wave High-slope S.G., valve type SWG2 .. .. 13 6

Graham Farish Ring Output Pentode valve type PT2 13 6

Cabinet

Two-piece covered grey leatherette. Specially designed for this receiver. .. .. Price 17 6

Phones

One pair Brown " Featherweight " head-phones.

A Guide to 1936 RADIO PRICES

THE FORMO RANGE

FORMO VARIABLE CONDENSERS AND DRIVES.

2-Gang ·0005+·0005 mfd. Condenser Type DL5, with Trimmer on back section, but without dust cover or drive	9/-
2-Gang ·0005+·0005 mfd. Condenser Type DU5a, as DL5, but complete with Mystic Drive and Escutcheon. Trimmers are provided on both sections	11 -
2-Gang ·0005+·0005 mfd. Condenser Type DU5, as above, but complete with dust cover	12 6
Dust Cover only	1/6
Single Unit Slow Motion Condenser Type SU5, with floodlit Mystic Drive, ·0005 mfd.	6/6
Short-wave Variable Condenser Die-cast Rotor and Stator mounted on ceramic base —·00016 mfd. max. capacity	3 6
Snail dual ratio Drive and Escutcheon. 8-1 and 64-1 ratios. 270° dial movement	6/6

FORMO SENSITY IRON-CORED COILS.

Aerial Coil, Type T1 (without reaction)	5/-
„ „ Type A1 (with reaction)	5 -
H.F. Coil, Type PP1	5/-
Universal Coil, Type U1, full transformer windings and reaction	5 -

FORMO SINGLE SENSITY COIL UNITS.

Type CU, Universal Coil with wave-change Switch	6/6
CU/G, as CU, but with auxiliary switching for filaments and radiogram	8/6
CA, Aerial Coil with reaction	6/6
CA/G as Type CA, but complete with auxiliary switching for filaments and radiogram	8/6
CT, Aerial Coil without reaction	6/6
CT/G, as Type CT, but complete with auxiliary switching for filaments and radiogram	8/6
CP Anode Coil with full transformer winding	6/6
CP/G as Type CP, but complete with auxiliary filament and radiogram switching	8/6

FORMO SENSITY GANGED COIL UNITS.

Type AH Matched Aerial and Anode Coils, both with full transformer winding. Wave-change switching incorporated	10/6
AH/G, exactly as Type AH, but with auxiliary filament and radiogram switch	12/6
Type BP is a Band-pass Ganged Unit matched for band pass circuit preceding the 1st valve	10 6
BP/G, as Type BP above, but complete with filament and radiogram switch	12/6

FORMO SHORT WAVE COILS.

Type B .. 12–25 metres	3/6
„ C .. 21–50 „	3/6
„ D .. 38–102 „	3/6

SHORT WAVE COIL STANDS.

2-Way Stand with wave-change switching	2 6
The above can be supplied fitted with auxiliary filament and "Phones to Speaker" switch at an extra charge of 2 -	
Single Short Wave Stand	1 -

FORMODENSORS.

Ref.	Max. to Min.	
F	·0001—·000005 mfd.	1 6
J	·0003—·000025 „	1 6
G	·001 —·0002 „	1/6
H	·002 —·001 „	2 3

FORMO OIL IMMERSION CONDENSERS.

·1 mfd.	1 6
·2 „	1/6
·25 „	1/6
·5 „	1/9
1 „	2/-
2 „	3/-

FORMOWATT (1 WATT) RESISTORS.

100 ohms.	10d.
150 „	10d.
200 „	10d.
250 „	10d.
300 „	10d.
350 „	10d.
400 „	10d.
450 „	10d.
500 „	10d.
550 „	10d.
600 „	10d.
650 „	10d.
700 „	10d.
750 „	10d.
800 „	10d.
850 „	10d.
1,000 „	10d.
1,500 „	10d.
2,000 „	10d.
2,500 „	10d.
3,000 „	10d.
4,000 „	10d.
5,000 „	10d.
6,000 „	10d.
7,000 „	10d.
8,000 „	10d.
10,000 „	10d.
15,000 „	10d.
20,000 „	10d.
25,000 „	10d.
30,000 „	10d.
35,000 „	10d.
40,000 „	10d.
50,000 „	10d.
60,000 „	10d.
70,000 „	10d.
80,000 „	10d.
100,000 „	10d.
150,000 „	10d.
200,000 „	10d.
250,000 „	10d.
300,000 „	10d.
500,000 „	10d.
1 meg.	10d.
2 „	10d.
3 „	10d.

THE GRAHAM FARISH RANGE

GRAHAM FARISH VALVE HOLDERS.

4-pin	6d.
5 „	8d.
7 „	1/3
9 „	2/3

GRAHAM FARISH SHORT WAVE VALVE HOLDERS.

Base-board Mounting Type.

4-pin	9d.
5 „	1/-

Chassis Mounting Type.

4-pin	9d.
5 „	1/-
7 „	1/3

GRAHAM FARISH 1½ WATT OHMITE RESISTANCES.

50 ohms.	1 6
100 „	1 6
150 „	1 6
200 „	1/6
250 „	1 6
300 „	1 6
350 „	1 6
400 „	1/6
450 „	1/6
500 „	1 6
550 „	1 6
600 „	1/6
650 „	1/6
700 „	1 6
750 „	1/6
800 „	1 6
850 „	1/6
1,000 „	1/6
1,500 „	1 6
2,000 „	1 6
2,500 „	1 6
3,000 „	1/6
4,000 „	1/6
5,000 „	1/6
6,000 „	1/6
7,000 „	1/6
8,000 „	1/6
10,000 „	1/6
15,000 „	1/6
20,000 „	1/6
25,000 „	1/6
30,000 „	1 6
35,000 „	1/6
40,000 „	1/6
50,000 „	1/6
60,000 „	1/6
70,000 „	1/6
80,000 „	1 6
100,000 „	1/6
150,000 „	1/6
200,000 „	1/6
250,000 „	1/6
300,000 „	1/6
500,000 „	1/6
1 meg.	1/6
1·5 „	1/6
2 „	1/6
3 „	1/6
4 „	1 6
5 „	1 6

GRAHAM FARISH 3-WATT HEAVY DUTY OHMITE RESISTANCES.

(All sizes up to 100,000 ohms) 2 3 each

GRAHAM FARISH RESISTANCE HOLDERS.

Horizontal type	6d.
Vertical type	6d.
Universal type	6d.
H.D. Ohmite type	6d.

The Listeners REFERENCE TO THE FINEST RANGE OF COMPONENTS EVER PRODUCED

GRAHAM FARISH LITLOS REACTION CONDENSERS.

·00005 mfd.	2/–
·0001 ,,	2/–
·00015 ,,	2/–
·0002 ,,	2/–
·00025 ,,	2/–
·0003 ,,	2/–
·00035 ,,	2/–
·0005 ,,	2/–
·00075 ,,	3/6
·001 ,,	4/6

GRAHAM FARISH LITLOS DIFFERENTIAL REACTION CONDENSERS.

·00005 mfd.	2/–
·0001 ,,	2/–
·00015 ,,	2/–
·0002 ,,	2/–
·00025 ,,	2/–
·0003 ,,	2/–
·00035 ,,	2/–
·0005 ,,	2/–

GRAHAM FARISH LITLOS LOG MID LINE CONDENSERS.

·00005 mfd.	2/–
·0001 ,,	2/–
·00015 ,,	2/–
·0002 ,,	2/–
·00025 ,,	2/–
·0003 ,,	2/–
·00035 ,,	2/–
·0005 ,,	2/–
·00075 ,,	3/6
·001 ,,	4/6

GRAHAM FARISH TUBULAR CONDENSERS.

·00005 mfd.	1/–
·0001 ,,	1/–
·0002 ,,	1/–
·0003 ,,	1/–
·0005 ,,	1/–
·001 ,,	1/–
·002 ,,	1/–
·003 ,,	1/–
·004 ,,	1/–
·005 ,,	1/–
·006 ,,	1/–
·01 ,,	1/3
·02 ,,	1/6
·05 ,,	1/6
·1 ,,	1/6
·2 ,,	1/6
·25 ,,	1/6

GRAHAM FARISH MANSBRIDGE TYPE CONDENSERS.

·25 mfd.	1/6
·5 ,,	1/9
1 ,,	2/–
2 ,,	3/–
4 ,,	5/6

GRAHAM FARISH STANDARD TYPE GRID LEAKS.

¼ meg.	10d.
½ ,,	10d.
1 ,,	10d.
2 ,,	10d.
3 ,,	10d.
4 ,,	10d.
5 ,,	10d.

GRAHAM FARISH KONE KAP GRID LEAKS.

¼ meg.	9d.
½ ,,	9d.
1 ,,	9d.
2 ,,	9d.
3 ,,	9d.
4 ,,	9d.
5 ,,	9d.

GRAHAM FARISH FIXED MICA CONDENSERS

·00005 mfd.	6d.
·0001 ,,	6d.
·0002 ,,	6d.
·0003 ,,	1/–
·0004 ,,	1/–
·0005 ,,	1/–
·001 ,,	1/–
·002 ,,	1/–
·003 ,,	1/–
·004 ,,	1/–
·005 ,,	1/6
·006 ,,	1/6
·01 ,,	1/6

GRAHAM FARISH H.F. CHOKES.

Disc H.F. Choke	2/–
H.M.S. Single Screen	2/6
L.M.S. Twin Screen	4/6
Short Wave (10–100 m.) H.F. Choke	2/–

GRAHAM FARISH TRANSFORMERS.

Pip L.F. General Purpose 1–3	6/6
Pip L.F. General Purpose 1–5	6/6
Max Parallel Feed	4/6
Quip Q.P.P. 1–8	10/6
Mains Transformer, Type MT/250	25/–

GRAHAM FARISH MAINS CHOKE

Constant Inductance. 350 ohms D.C. resistance. 20H 50 m/a. Type Number, MC 20/50 .. 11/6

GRAHAM FARISH ELECTROLYTIC CONDENSERS.

4+4 mfd. 450 v. working. 525 v. Surge (mounting bracket, 6d. extra)	6/6
25 mfd. 25 v. D.C. working, 30 v. Surge, with wire ends	2/6

SNAP SWITCHES.

2-point	10d.
3 ,,	1/–

GRAHAM FARISH OHMITE VOLUME CONTROLS.

All sizes from 5,000 ohms to 1 megohm .. 2/9

GRAHAM FARISH PICK-UPS.

Compensated Model without Volume Control	14/6
Compensated Model with 50,000 ohm built-in Volume Control	18/6

GRAHAM FARISH.

Mum Mains Noise Suppressor Unit	2/–
Filt Percolative Earth	2/6
,, ,, ,, refill	1/6
Gard Automatic Lightning Arrester	2/–
Audion R.C.C. Unit	4/6
Slot Aerial Filter	2/–
Booster Unit	7/6
Component Brackets	4d.
Pop 2-Way Terminal Mounts	6d.
Base-board pre-set Condensers—	
·00005 mfd.	1/–
·0001 ,,	1/–

GRAHAM FARISH UNIVERSAL TURRET SWITCH.

A Rotary Switch suitable for a variety of purposes, i.e., wave-change switch, combined filament and radiogram switch, etc. With knob .. 2/–

GRAHAM FARISH RING 2-VOLT BATTERY VALVES.

Type	Purpose	
DX2	Non-micro Detector	5/6
LF2	L.F. Amplifier	5/6
LP2	Small Power	7/–
MP2	Medium Power	12/–
XP2	Super Power	12/–
PT2	Medium Power Pentode	13/6
PP2	Super Power Pentode	13/6
QP2	Q.P.P. Valve	22/6
SG2	Screened Grid	12/6
SX2	High Slope S.G.	12/6
VS2	Var. mu. S.G.	12/6
VP2	Var. mu. Pentode	13/6
SWG2	Short-wave High Slope Screened Grid	13/6
HP2	H.F. Pentode	13/6

GRAHAM FARISH RING 4-VOLT MAINS VALVES (A.C.).

Type	Purpose	
AC/DX	Detector	13/6
AC/LP	Small Power	14/–
AC/PT	Output Pentode	18/6
AC/PP	High Slope Out. Pen.	18/6
AC/SG	Screened Grid	17/6
AC/HG	High Gain S.G.	17/6
AC/VG	Var. mu. S.G.	17/6
AC/VS	Var. mu. High Gain S.G.	17/6
AC/HP	H.F. Pentode	17/6
AC/VP	Var. mu H.F. Pentode	17/6
UU/60/250	Full Wave Rectifier (I.H.C.)	12/6
UU/120/350	Full Wave Rectifier (I.H.C.)	15/–

GRAHAM FARISH LAURENCE CABINETS.

Horizontal Model Walnut finish, with base-board	25/–
Short Wave Cabinet covered Grey Leatherette	17/6

FREE LITERATURE SERVICE

THE following explanatory literature is now available from the manufacturers concerned. Please write for the folders you require and enclose 1½d. stamp and your name and address, when the Editor will be pleased to send you any or all of the folders detailed below:—

- Graham Farish Component list.
- Formo Component list.
- Graham Farish Ring Valve Guide.
- Graham Farish Ring Comparative Table.
- Formo Sensity Coil Folder.
- Graham Farish Pick-up Folder.
- Sensity Super (battery model) Broadsheet.
- Graham Farish Battery Receiver Folder.
- Mum Mains Noise Suppressor Folder.

"CONTACT" QUERY COUPON

The actual designers of "Contact" Receivers are prepared to answer all queries from readers in connection with the operation or construction of these sets solely on condition that only the specified component parts are used.

Readers are requested to write clearly and to state as concisely as possible the exact nature of their requirements.

Queries must have this coupon attached, together with a Postal Order for 1/- and should be addressed to :

"CONTACT" DESIGNERS,
153 MASONS HILL,
BROMLEY - - KENT

The Editor will also be pleased to have readers' opinions on this, the third issue of "Contact," and any suggestions for articles or receivers which they wish to have dealt with in the next issue.

CERAMICS IN RADIO

(Continued from page 16)

(500–1,500 kc.), and vitally important on short waves (5,000 kc. and upwards).

The method of production of these materials is interesting; and a visit to the vast factory where they are made is very impressive. Monstrous devices of weird shape, stalagmites of huge porcelain insulators, and great metal spheres hang from the roof. With everyone safe behind steel gates, the engineers in control produce long ribbons of lightning, which give rise to a fierce tearing sound and light up the huge building eerily.

The ceramic pieces which are built into your components are made in a long glass roofed building fitted with rows of automatic hopper-fed presses. The atmosphere of scrupulous cleanliness and whiteness reminds one of a food factory, an effect heightened by the white powder everywhere. This powder is supplied to the pressing rooms after many careful processes, including analysing, grinding, weighing and mixing. In these machines the parts are now formed under enormous pressure by intricate steel dies. These brittle, raw cakes are now packed into special earthenware pots called "saggars," and loaded on trucks for firing in the "tunnel kiln."

If the laboratory is a devil's cathedral, then this tunnel kiln must be Hell's tube railway. It surely is slower and hotter than any railway on earth! The trucks, loaded with parts for firing, pass into a brick tunnel, heated to an intense white heat by producer gas, and though the tunnel is 320 feet long, a truck takes several days to crawl through to the other end. This firing process goes on day and night without ceasing, and the heat never dies down from one year's end to the other.

When cool, the trucks are unloaded and the ceramic parts, now hard and permanent, are examined. They eventually find their way into the components, coils, tuning condensers, valve holders, chokes, even valves now, which you buy at such moderate prices in the radio shop.

All *you* need to do is to see that in buying your short-wave components you get 100 per cent. ceramic insulation.

EASY PAYMENTS FOR HOME CONSTRUCTORS

A New and Novel Scheme to Help you Rebuild or Build Anew

THERE is a very old and very true saying amongst bankers and industrialists that "credit makes the wheels go round." This is undeniably true in the case of motor cars, although the wheels of commerce were undoubtedly meant.

It has taken the average Englishman a considerable time to realise that purchasing out of income is not by any means a sign of poverty, nor anything to be ashamed of. In the United States, where anything from a battleship to a baby can be purchased on "terms," the man who pays cash is regarded either as a philanthropist or a fool. Whilst we do not entirely agree with this point of view, it is a fact that innumerable people do wait an unnecessarily long time for things they want, when a small regular monthly payment would enable them to satisfy those wants.

Even in England, however, the objection to gradual payment is fast becoming a thing of the past, and the banks and financial houses are doing their utmost to make these credit facilities available to all classes and to all members of the community.

Perhaps one can ascribe the Englishman's early dislike to this system of payment to his attitude towards his commitments, for it is true of the English people that their hire-purchase transactions are considered to bind them as much by honour as by law. This very refreshing streak of honesty in our people makes the British Isles probably the safest place in the world for the investment of capital in hire-purchase business, and, what is more, reacts on the purchasers by making it more simple for the banks and manufacturers to give cheaper credit facilities.

One of the most interesting recruits in the radio hire-purchase field is undoubtedly the Graham Farish organisation. Hire-purchase business in the radio industry is not by any means new, as for many years past complete receivers and kits of parts have been available to the public on such terms. One great difficulty has been, however, that hire-purchase facilities could not be economically or reasonably granted on transactions involving a capital expenditure of less than £5. In short, the home constructor who wanted to construct a new receiver, or adapt an old one, had to spend at least £5 to obtain hire-purchase facilities, or else pay cash.

The Graham Farish organisation has found a very novel way out of this very unsatisfactory position, and the new hire-purchase facilities are now made available for the first time.

In an interesting interview with one of their accounts chiefs a few days ago I was given full details of this interesting system, and for the benefit of those of you who contemplate purchasing radio in any shape or form I am going to give a brief *résumé* of the scheme.

I will assume that you have made out a list of parts from these pages which will be either used for making a completely new receiver or remodelling an old one. The procedure from then on is simplicity itself. First call with your list on your local dealer, who will hand you a yellow agreement form to fill in and sign. One word of warning is necessary here. To avoid delay you should see that the signature is put in its proper place and is duly witnessed, either by the dealer or by one of his assistants, and that the few simple details asked for are supplied. The dealer will then send your agreement form through to the manufacturers, and within two to three days he will have word back that the goods can be released on payment of a deposit. From then on you are at liberty to remit your payments through the post, or alternatively payment can be made at any local branch of the Midland Bank Limited.

Nothing simpler can be imagined. Your purchase can be a complete kit, with or without valves, or an assorted collection of components, pick-ups, etc., and, provided your purchase reaches a total of not less than £2 10s., hire-purchase facilities are yours for the asking.

Should you live in a small out-of-the-way village where stocks cannot reasonably be held, or if your local dealer is the short-sighted type of individual who will not give you adequate service, then by all means write direct to the manufacturers, who, you will find, will handle your transaction with a courtesy and speed which will leave you a very satisfied purchaser and a very much stronger adherent to the policy of purchasing out of income.

FOR THOSE WHO CANNOT BUILD

(Continued from page 32)

layout, and are of a mottle walnut colour which harmonises very neatly with the sunk walnut control panel. At the top is the main tuning knob, with a trimmer knob mounted on it for fine adjustment. This is a very useful feature which enables the utmost performance to be had from the set.

Immediately under it is the combined wave-change and on-off switch. This takes the unusual form of a pendant knob, which is very neat and practical. To the right is the reaction control and to the left the volume adjustment, which acts by varying the degree of aerial coupling, and so can be used to improve selectivity when required. The circuit is a well-tried one, interpreted with the soundest practice, and containing all desirable refinements without any complications. There is no doubt that a set of this type has great attractions, apart from the question of economy. It cannot, of course, equal a multi-valve mains superhet either in range or selectivity, but on the other hand it has the great advantages that there are no troubles with background "mush," interference whistles, sideband splash, mains hum, or mains-born crackle. Nor is there the same necessity for "Spot on" tuning to avoid distortion.

Printed for the Proprietors, GRAHAM FARISH LTD., Masons Hill, Bromley, Kent, by W. H. SMITH & SON LTD., Stamford Street, London, S.E.1

It's COMPENSATED!

The Pick-up with a difference

For the first time in the history of electrical reproduction the idea of "compensating" or balancing out —the defects between "mike" and record finds expression in this superb component. Many superlatives have been used to describe Pick-ups manufactured hitherto, but until the principle of true compensation was applied to Pick-up design even approximate "realism in response" was not obtainable without complicated networks of correctors, etc., with their attendant reduction of output. The Graham Farish "Compensated" Pick-up dispenses with all such devices. It is new in its conception, a revelation in reproduction and, connected to the simplest amplifier, gives an incomparably closer rendering to the original recording than has ever been achieved before.

Built to a new principle the Graham Farish COMPENSATED Pick-up will reveal new and unsuspected beauties in your records, adding enormously to the pleasure they give you.

14/6
Boxed complete with Fitting instructions.

Incorporating Volume Control as illustrated **18/6**

GRAHAM FARISH LTD, BROMLEY, KENT