A FINE "FOUR" FOR £5!

Wireless Magazine

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TECHNICAL EDITOR: J.H. REYNER, B.Sc. (Hons) A.M.I.E.E.

VOL 8. No 43. AUGUST 1928

1/-

The CHUMMY FOUR

SOME "HOME" ADDITIONS TO A FAMOUS HOLIDAY PORTABLE

BLUE PRINTS of THIS MONTH'S SETS AT HALF PRICE

Volume VII
No. 43

Wireless Magazine

August, 1928
Price 1/-

"The Best Shillingsworth in Radio"

CONTENTS

JUST A COMMENT OR TWO BY THE EDITOR

I AM not inclined to the belief that we are nearing the end of the very best "portable" season we have yet had—a sentence which has, I fear, two meanings. Undoubtedly the best portables in the history of wireless have been introduced to the public during this summer (and we are proud to think that J. H. Reyner's Sunshine Five and our Constructional Staff's Chummy Four hold premier positions among them), but what I have in mind is that the season itself is not ending; *the vogue of the portable has arrived, and a brief summer season will not see the end of it.*

Perhaps the set of the winter will be a large portable—a transportable—that we can remove at a moment's notice from the cold drawing-room to our warm "den" or to the cheery living-room without trouble and without sacrificing quality.

As you look through our pages this month you will certainly escape any suggestion that the portable is waning as the days draw in. J. H. Reyner talks of experiences with his Sunshine Five in the North country; Capt. Round offers a helping hand to those who would like to design their own portable sets; we describe at length the Pilgrim Portable, a headphone set for the tourist; and we take the Chummy Four and make it a "home" set by adding a jack for phones or external loud-speaker, and by adapting it for external H.T. supply, etc.

Both J. H. Reyner and R. W. Hallows speak enthusiastically this month on summer-time reception.

In our "Gramo-Radio Section" Capt. H. T. Barnett writes upon a most absorbing subject—the angle and the weight of the pick-up. When you are using expensive records you need to see, not only from the point of view of quality of reproduction but from that of expense also, that the needle is used at the correct angle and that some counter-balance is used to take up the dead weight of the pick-up.

We have a small gramo-radio set, by the way, in this issue, The Glee-singer Three, comprising a detector and two resistance-coupled low-frequency stages. The Connoisseur's Six, another fine set in our pages this month, can also be used for gramo-radio work.

One of the most popular features of our issue will be the Five-pounder Four, carefully designed for economical building. In the blueprint of this set (available at half-price to everyone who sends us the Special Blueprint Coupon during its currency) you will find the shape and full size of every wire used in assembling the set, a system which many novices prefer.

Well, the great annual holiday is upon us, but how quickly it will pass! In my next issue I shall be talking about the programme for the winter.

B. E. J.

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Come on and Dance— TO LISSEN'S NEW PORTABLE GRAMOPHONE

LISSEN has entered the gramophone trade—with a determination to make good in it. The first productions are two portable gramophones in different price fields. These are LISSEN'S first contributions to the gramophone buying public. LISSEN has got to make good in gramophones right from the very beginning, and you can be sure, therefore, that there is fine value for money concentrated in the two portable models illustrated on this page.

TAKE A LISSENOLA PORTABLE WITH YOU ON YOUR HOLIDAYS

Do this year what you may never have done before—take a portable gramophone with you on your holidays, and be sure it is a new LISSENOLA portable. On the river, in the car, in your garden, use it indoors. You can take the LISSENOLA Portable Gramophone with you everywhere. The large model is better than many indoor table grands sold at double the price.

The LISSENOLA Portable will happily pass away many of your leisure hours, no matter where they may be spent. The range of tone reproduction is wider in the LISSENOLA than in many other portables sold at double the prices, because the horn in each LISSENOLA is longer than any portable horn except the most expensive kind. There is a fine sound-box fitted to each LISSENOLA model. The motor is strongly made and silent running. Fittings are bolted on — not merely screwed in. They, therefore, do not come loose. Heavily nickel-plated fittings throughout. Case is covered in black morocco grain leather cloth. Every LISSENOLA Portable is compact, easy to carry, light, handsomely finished. The lid of each machine carries eight 10-inch records. Each machine plays up to 12-inch records.

Should your music dealer be unable to give you prompt delivery, ORDER AT ONCE DIRECT FROM FACTORY. Kindly give dealer's name and address. State machine required. Remittance may be sent with order, or the machine will be sent by return C.O.D. merely on receipt of your order on a post card.

7 DAYS' APPROVAL

If you are not entirely satisfied with your LISSENOLA Portable Gramophone after trial, you can return it to the factory within 7 days of purchase, and your money will be willingly refunded in full.

LISSENOLA MODEL No. 1.
(Thorens motor)
12½" × 10½" × 6"
£2 : 2 : 0

LISSENOLA MODEL No. 4.
(Garrard motor)
14" × 11½" × 7½"
£3 : 7 : 6

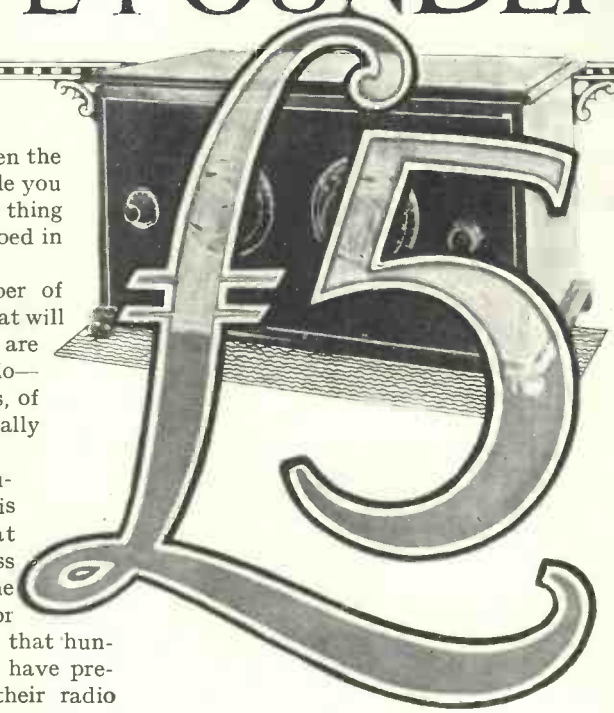
LISSENOLA GRAMOPHONE

THE LISSEN TRADITION FOR FINE QUALITY AND BIG VALUE FOR YOUR MONEY IS FULLY UPHELD IN THESE TWO NEW LISSENOLA PORTABLE GRAMOPHONES.

LISSEN LIMITED
FRIARS LANE, RICHMOND, SURREY.
Thomas N. Cole, Managing Director.

Twenty-odd stations in one evening is not at all a bad performance for a cheap four-valver, yet the point that struck J. Godchaux Abrahams most about the Five-pounder Four was its great selectivity. Many readers of the "Wireless Magazine" will find it a receiver that will meet their needs—especially if they are new to radio. Read all about it now!

The FIVE-POUNDER FOUR



NOW that you have seen the heading of this article you know the most important thing about the set to be described in in the following pages.

But there are a number of special features about it that will appeal to you even if you are not a beginner in radio—though it is for beginners, of course, that the set is specially intended.

Great though the popularity of the three-valver is amongst beginners—that was evident from the success of the Music Charmer in the WIRELESS MAGAZINE for April—we have no doubt that hundreds of amateurs would have preferred to have started their radio work with a four-valver, if only a simple enough design had been available.

Well, not only can this set be built for £5 (less coils, valves, batteries, and loud-speaker, of course), but the WIRELESS MAGAZINE Technical Staff definitely claim that it is the simplest design of a four-valve receiver yet attempted.

Actual Shape of Every Wire

This claim will be better appreciated when it is known that, although the set is connected with stiff wire, **the length and shape of each connection is indicated full size on the blueprint.**

Nowhere, we believe, has an attempt been made to do so much for the constructor as has been done in this case by the WIRELESS MAGAZINE Technical Staff.

MAKES USE OF GOOD QUALITY COMPONENTS

RECEIVES 24 STATIONS ON THE LOUD-SPEAKER

NO SOLDERED CONNECTIONS

COVERS BOTH WAVE-LENGTH RANGES

EACH OF THE 39 CONNECTING WIRES SHOWN FULL SIZE

ONLY TWO TUNING CONTROLS

DESIGNED AND BUILT BY THE "W.M." TECHNICAL STAFF

TESTED INDEPENDENTLY BY J. GODCHAUX ABRAHAMS

And now, in the leisure of summer days, is the time for the beginner to build this fine receiver which will be worth its cost many times over in the winter evenings when it brings entertainment to the hearth-side from all over Europe, and even further.

Question of Price

Before going into actual technical details of the Five-pounder Four, let us first look into the question of price a little closer. Money has been saved wherever possible, of course, but nowhere at the expense of electrical efficiency.

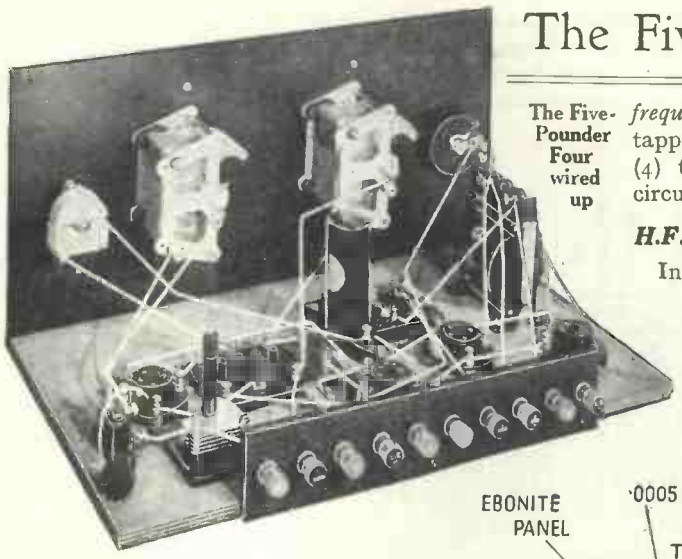
Here is an analysis of the cost of the original set:

Ebonite panel	8/-
2 .0005-microfarad variable condensers, with dials	15/-
2 dial indicators	-/2
.0001-microfarad reaction condenser	5/-
H.F. choke	5/6
Resistance-capacity coupling unit	4/-
Low-frequency transformer ...	15/-
Terminal strip	1/-
7-ohm panel rheostat	2/6
Single coil-holder	1/-
Neutralising condenser	5/-
4 valve-holders	5/-
6-pin coil base	1/6
.0003-microfarad fixed condenser	1/-
2-megohm grid leak with holder	1/6
10 terminals	5/-
Cabinet	16/11
Connecting wire	1/8
Screws	-/6
Total ... £4 15s. 3d.	

If this list is read in conjunction with the detailed specification on page 8 it will be seen that the components are of good quality and represent the best value for money.

Full Size and Shape of Each Connecting Wire Shown on Blueprint!

The Five-pounder Four (Continued)

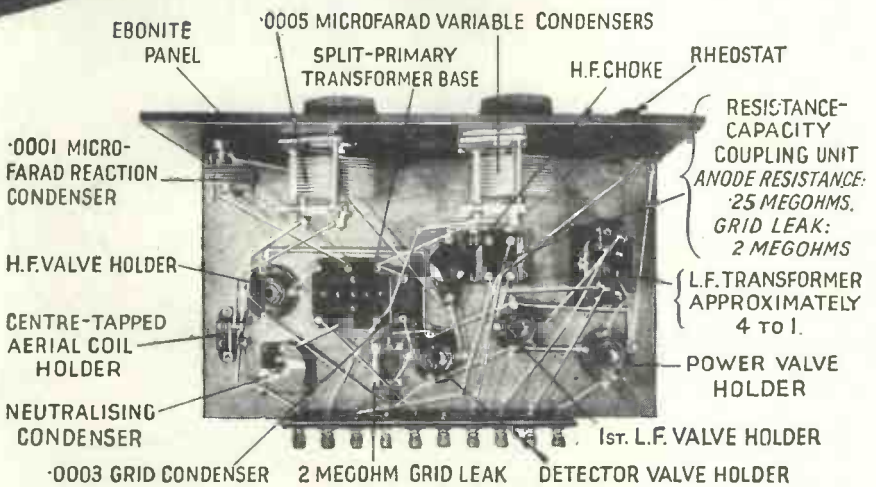


The Five-Pounder Four wired up

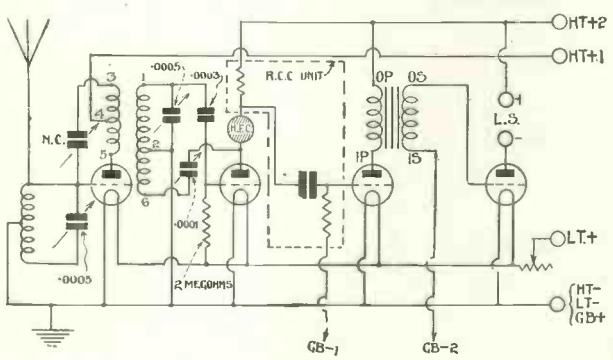
The prices given apply, of course, to the original WIRELESS MAGAZINE receiver and the manufacturers of the components used in that are mentioned first in the brackets in each case.

Complete Outfit

To convert the Five-pounder Four into a complete receiving installation it is necessary to add four valves (44/-), coils for both wavelength ranges (44/-), an accumulator (16/-), a high-tension battery (16/-), and a loud-speaker (30/-)—say £12 10s. for a complete outfit!



All the components for the Five-pounder Four are clearly indicated in this plan-view photograph



Combination of Valves Employed

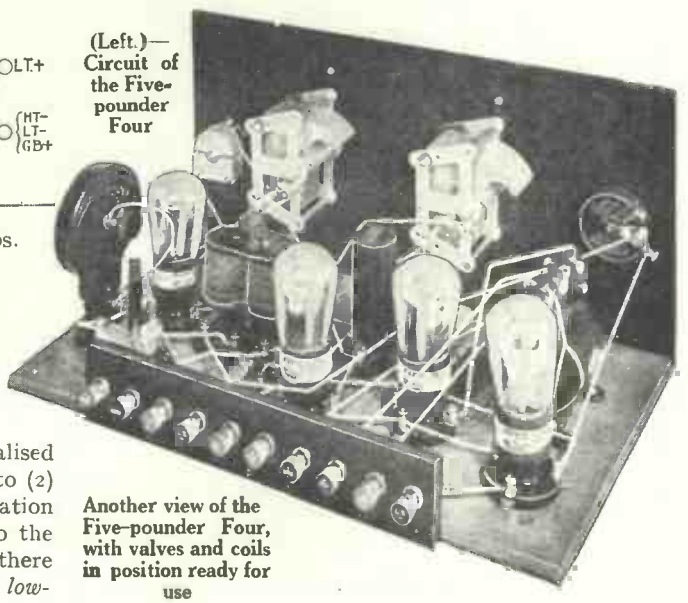
Even the non-technical beginner will be interested in the circuit of the Five-pounder Four, for it is representative of any straightforward modern receiver. The combination of valves employed is: (1) *High-frequency amplifier*, neutralised and coupled by six-pin split-primary transformer to (2) the *detector*, which makes use of leaky-grid rectification for sensitivity and simplicity; reaction is taken to the secondary of the high-frequency transformer and there is a resistance-capacity coupling to (3) the *first low-frequency amplifier*, provided with a separate grid-bias tapping, this being coupled by means of a transformer to (4) the *second low-frequency amplifier*, in the anode circuit of which is connected the loud-speaker.

H.F. Valve gives Greatly Increased Selectivity

In this arrangement the high-frequency amplifier with its tuned transformer circuit gives the set a high degree of selectivity. For this reason a four-valver is often of much greater utility near a local station than is a three-valver without a high-frequency amplifier—the last gives sensitivity and selectivity.

Moreoever, in this case still greater selectivity is obtained, without in any way complicating the controls, by utilising a tapped coil in the aerial-tuning circuit (see circuit diagram on left). The whole of this coil is tuned by a .0005-mfd. variable condenser.

(Left.)—Circuit of the Five-pounder Four



Another view of the Five-pounder Four, with valves and coils in position ready for use

Ideal for the Beginner in Radio Work

In the anode circuit of the first valve is the primary of the split-primary transformer, the centre tap of which is connected to the H.T.+1 terminal. The top end of the primary is connected back to the grid of the valve through a neutralising condenser, which gives the set stabilisation and greater range.

Capacity-controlled Reaction

To the primary is coupled the secondary of the transformer, which is tuned by another .0005-microfarad variable condenser. Reaction is obtained by means of a special winding coupled to the secondary and connected through a small variable condenser (which controls it) to the anode of the detector valve.

No efficiency is lost by not screening this split-primary transformer in a metal case—it is, in fact, more efficient than those that need screening. The windings are of the astatic type and, having only a negligible external field, no interaction with neighbouring components or pick-up from the local station is experienced.

Importance of the High-frequency Choke

Leaky-grid rectification of the detector valve is carried out by a .0003-microfarad fixed condenser and a 2-megohm grid leak. High-frequency currents are prevented from leaking through to the low-frequency portion of the receiver and so causing interference by the insertion in the anode circuit of the detector of a high-frequency choke.

The coupling between the detector and the first low-frequency amplifier is provided by a resistance-capacity unit; note that it has the following values, which should be specified when the complete unit is ordered: Anode resistance, .25 megohm (250,000 ohms) and grid leak, 2 megohms. It is important that these values should be adhered to.

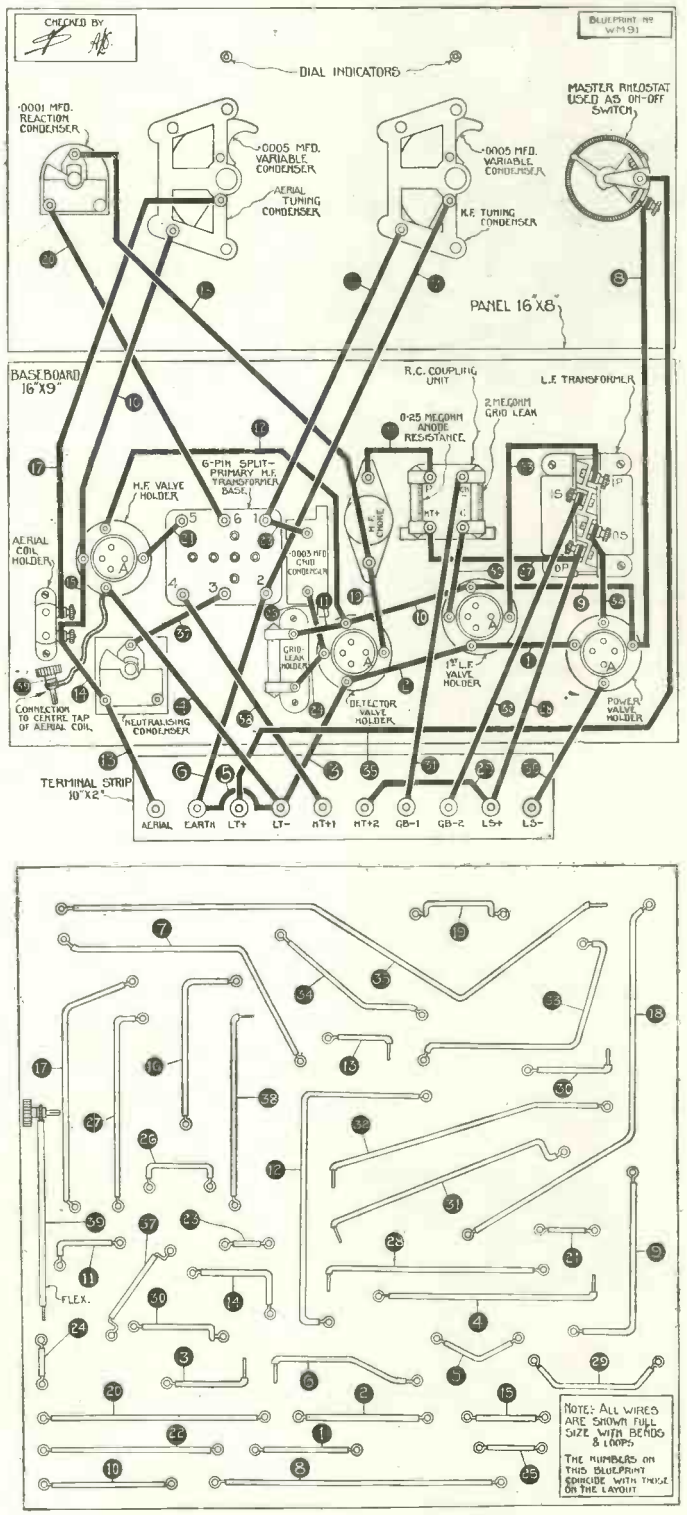
Separate Grid Bias for each Amplifying Valve

A low-frequency transformer with a ratio in the neighbourhood of 4 to 1 is used to couple the first low-frequency transformer to the last valve. Note that each amplifying valve is provided with a separate grid-bias tapping. A rheostat is utilised as an on-off switch to protect the valve filaments from too sudden changes in temperature.

Before beginning the construction of this set readers are advised to obtain a copy of the full-size blueprint that is available for half-price, that is, 9d. post free, up till the end of the month if the coupon to be found on page iii of the cover is used before that date.

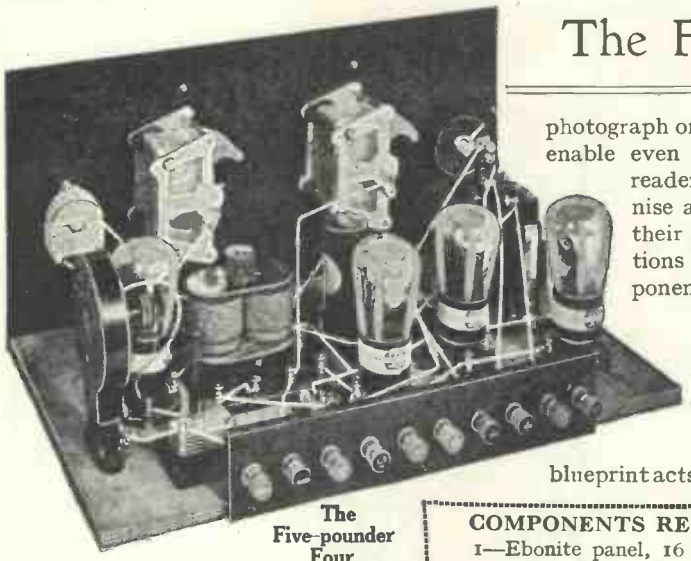
Where to send your Postal Order

Address your inquiry to Blueprint Department, WIRELESS MAGAZINE, 58/61 Fetter Lane, E.C.4, and ask for No. WM 91; your copy will be sent by return of post. It is not essential to buy a full-size blueprint in order to build this set if the full-size layouts of the connecting wires are not required;



This layout and wiring diagram of the Five-pounder Four can be obtained as a full-size blueprint (on which the actual size and shape of every wire is indicated) for half-price, that is 9d., post free, if the coupon on page iii of the cover is used by August 31. This blueprint, which is reproduced on good stout paper, actually measures 37 in. by 16 in.

The Five-pounder Four (*Continued*)



The Five-pounder Four

all the essential details are reproduced in these pages.

Before starting to do any part of the constructional work the reader is recommended to get together all the parts. Remember that if you intend to wire up from the full-size layout of connecting wires you must use components made by the manufacturers whose names are mentioned first in the list of components.

Unusual Layout

Looking from the back of the panel the components are laid out on the opposite way from standard practice. This was done after considerable experiment and discussion as it saved a number of awkward cross-over connections. Moreover, the layout of the set as it is being wired corresponds closely to the circuit diagram.

Constant reference to the full-size blueprint (or the reduced reproduction on page 7) and the plan-view photograph on page 6 will enable even the newest reader to recognise and place in their proper positions all the components, and they will not be enumerated in detail here.

The top part of the blueprint acts as a drilling template for the necessary panel holes, while the lower part can be utilised as a baseboard layout. If the blueprint is folded and stuck on the back of the panel and on the upper face of the baseboard there is no chance of going wrong.

As soon as all the components have been secured firmly into position, wiring up can be started, and here there is less danger of going wrong than there is in the buying of the components.

Uncoil one of the lengths of Glazite and bare an inch or so at each end, clamp one end of it firmly and then stretch it out taut. If it is pulled hard enough it will stretch slightly but, more important, it will also become more rigid and quite straight. It is important to stretch only the wire and not the insulated covering, as the latter will crack under tension.

Now with a pair of wire-cutting pliers cut off a piece of wire the same length as connection No. 1 on the blueprint, allowing enough to make a small "eyelet" at each end. Connect this wire in position, and put a line through No. 1 on the blueprint.

Carry on with wires Nos. 2, 3, 4, etc., marking them through on the blueprint as soon as they have been placed in position on the set. In the case of shaped leads bend the connecting wire exactly to the shape indicated on the blueprint and it will fit into position without further bending, although it may be necessary to give a slight twist to the "eyelet" at each end.

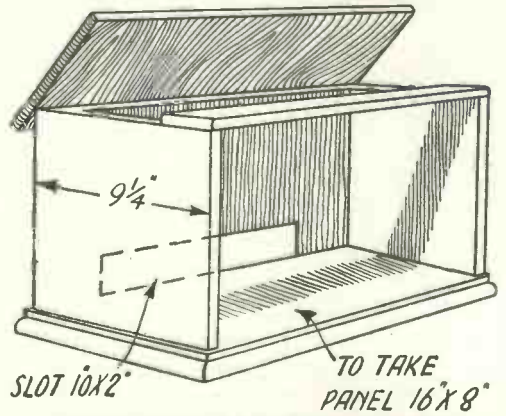
No Soldered Connections

Notice that there is no need to solder any connections, but all the terminals should be screwed down tightly with a pair of pliers. Connection No. 39 is a flexible lead.

COMPONENTS REQUIRED FOR THE FIVE-POUNDER FOUR

1—Ebonite panel, 16 in. by 8 in. (Resiston, Raymond, or Becol).
2—.0005-microfarad variable condensers with 4-in. dials (Raymond, Dubilier, or Igranic).
2—Dial indicators (Bulgin).
1—.0001-microfarad reaction condenser (Bulgin, Cyldon, Bébé or Igranic).
1—6-ohm panel rheostat (Lissen or Peerless).
1—Single coil-holder (Lissen or Magnum).
1—Neutralising condenser, 65 micro-microfarads (Bulgin or Peto-Scott).
4—Anti-microphonic valve holders (Ashley, Lotus, or W.B.).
1—6-pin coil base (Cason or Lewcos).
1—.0003-microfarad fixed condenser (Lissen, Graham-Farish, or Dubilier).
1—2-megohm grid leak with holder (Lissen, Graham-Farish, or Dubilier).
1—High-frequency choke (Lissen, Wearite, or Igranic).
1—Resistance-capacity coupling unit with .25-megohm anode resistance and 2-megohm grid leak (Lissen, Trix, or Dubilier).
1—Low-frequency transformer (Igranic type F, R.I. and Varley, or B.T.H.).
1—Ebonite terminal strip, 10 in. by 2 in. (Raymond, or local dealer).
10—Terminals, marked :—Aerial, Earth, L.T.+, L.T.—, H.T.+1, H.T.+2, G.B.—1, G.B.—2, L.S.+, L.S.— (Belling-Lee, type M).
2—Centre-tapped plug-in coils (Lewcos or Atlas, No. 60 and 150).
2—Six-pin split-primary high-frequency transformers (Lewcos types, BSP5 and BSP20).
1—Cabinet, with 9 in. baseboard.
2—10-ft. coils insulated wire (Glazite).
22—½-in. wood screws.
12—¾-in. wood screws.
Short length of flex.

(Only components made by the firm mentioned first in the brackets in each case can be utilised if proper use is to be made of the full-size blueprint.)



Details of cabinet for the Five-pounder Four

The Simplest Yet Attempted

The necessary coils for use in the Five-pounder Four are listed with the rest of the components. For the lower broadcast waveband use the No. 60 coil and the BSP5 transformer, while for the higher waveband use the No. 150 coil and the BSP20 transformer.

Not quite so easy is the choice of valves, but the following may be taken as an approximate guide. Two-, four-, or six-volt valves can be used, but they should conform to the following standards: The high-frequency amplifier should have an impedance of 20,000 to 30,000 ohms, while the detector should have an impedance in the neighbourhood of 60,000 to 80,000 ohms.

Any valve round about 10,000 to 15,000 ohms will do for the first low-frequency amplifier, while the last valve should be of the super-power type with an impedance of 6,000 ohms or less. Actually in our tests we used the following Six-Sixty two-volt valves: SS210HF, SS210RC, SS210LF, and SS215P.

As regards batteries connect these up as follows (remembering that red is positive and black is negative): To L.T.+ and L.T.— connect an accumulator of the same voltage as the valves to be used. To H.T.+1 apply about 80 to 90 volts and to H.T.+2 the full 120 volts of the battery. To G.B.—1 apply 3 to 6 volts negative, and to G.B.—2 apply 6 to 12 volts this depending upon the valve used.

Connect both G.B.+ and H.T.— to L.T.— (this, of course, saves two terminals). If two 60-volt high-tension batteries are used connect the negative end of one to the positive end of the other and regard the remaining negative and positive poles as those of one 120-volt battery.

To operate the set connect up the aerial, earth, and a loud-speaker. Now turn round the knob at the left-hand side of the panel; this switches on the valves and makes the receiver ready for action.

Next, move the small right-hand knob until a slight rustling or hissing sound (not a howl or whistle) is heard from the loud-speaker; this indicates that the set is on the verge of oscillation and in a very "live" condition for receiving signals.

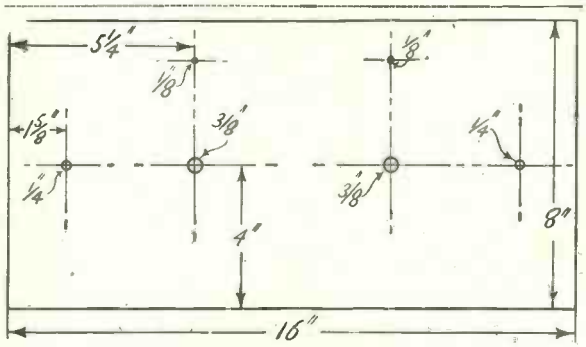
Now turn the two large dials slowly throughout their range, in such a way that the rustling or hissing sound is always heard from the loud-speaker, until a transmission is picked up.

When this occurs, readjust the reaction condenser (small right-hand knob) until the clearest results are obtained. If the quality is very bad readjust the grid-bias voltages; an increase in the amount of negative bias applied will in most cases effect a cure.

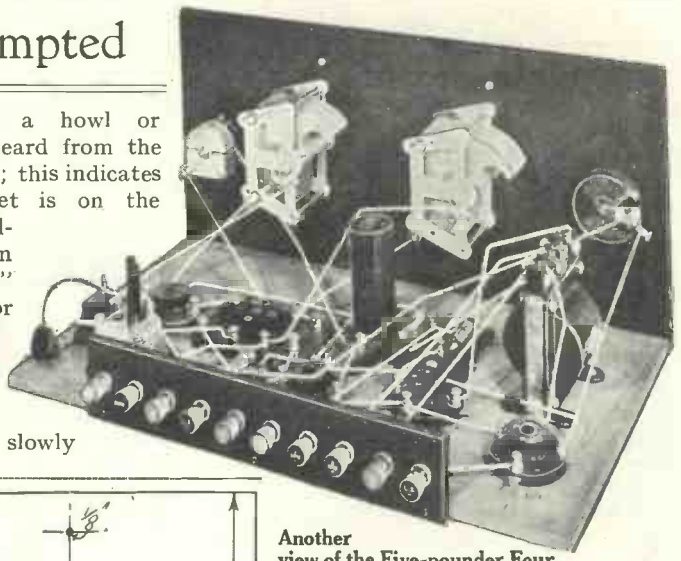
As soon as one station has been fairly well tuned-in try neutralising the high-frequency valve; this will make the set easier to manage.

Keep the station tuned-in and remove one of the filament connections from the holder of the high-frequency valve, say wire No. 1.

Do not remove the valve, but turn the vanes of the neutralising condenser on the baseboard until signals become quite inaudible; then the capacity of the valve has been completely neutralised. Replace wire No. 1 and carry on as explained previously. If this neutralisation is carried when the low-wave coils are being used it may be necessary to re-neutralise on the higher waveband.



Panel layout of the Five-pounder Four



Another view of the Five-pounder Four

Note the Dial Readings

When a station has been picked up, make a note of the dial readings—that of the left-hand condenser dial (which tunes the high-frequency transformer) is very critical, but will remain constant under all conditions. The reading of the right-hand dial (which tunes the aerial circuit) will vary with different aerials.

For quick searching note the difference in the readings for any particular station of the two dials, then keep this difference (approximately) throughout the entire range when turning the dials.

LOG OF FIVE-POUNDER FOUR

(TESTED JULY 1st—3rd, 1928, by J. GODCHAUX ABRAHAMS)

LONG WAVES (COIL NO. 200)

Wave-length metres	Station	Aerial Cond.	H.F. Cond.	Wave-length metres	Station	Aerial Cond.	H.F. Cond.
1,765	Radio Paris	155	122	1,250	Koenigswusterhausen	106	82
1,604	5XX	135	105	1,153	Kalundborg	100	80
1,450	Moscow (?)	116	90	1,100	Warsaw	94	72
1,380	Motala	112	84	1,060	Hilversum	86	64

MIDDLE BROADCASTING BAND (COIL NO. 60)

556	Budapest	180	178	428	Frankfurt	132	114
549	Milan Vigentino	176	164	*b* 422	Kattowitz	130	112
517	Vienna	172	158	380	Stuttgart	126	110
508	Brussels	168	152	*c* 375	Madrid EAJ7	124	105
491	5GB	164	150	*d* 368	Leipzig	120	100
a 485	Berlin	160	146	364	2LO London	115	98
470	Langenberg	148	128	345	Barcelona EAJ1	110	90
461	Oslo (faint)	142	126	337	Copenhagen	104	80

Gleiwitz, Breslau, Lille, and Cologne were also picked up, but with the use of a smaller coil.

a Only heard when 5GB closed down.
b Was somewhat spoilt by Frankfurt.
c Heard when Stuttgart had closed down.
d Only when 2LO was not transmitting.

(FURTHER COMMENTS WILL BE FOUND ON PAGE 73).

HALYARD'S Chat on the Month's Topics **Sketches by GLOSSOP**

Wireless Gramophonics

A LITTLE wireless knowledge is a—wait a minute—very useful thing sometimes, now isn't it?

I certainly thought so one afternoon recently, when I had what was to me a new, and rather novel, experience. My intentions that afternoon were to visit the annual sports of a school in which I have a live interest, in the shape of a boy. Rain, however, caused a postponement of the sports, so I turned in to the nearest cinema.

The music in this cinema that afternoon was provided by apparatus of a type now becoming rapidly familiar to wireless enthusiasts, namely, a gramophone with electrical pick-up followed by amplifiers, the amplified sound from the gramophone record being reproduced by loud-speakers.

During the performance the sounds from the loud-speakers gradually diminished in volume until they finally dwindled away altogether. I thought I recognised the symptoms, and I think you would have done so, too.

After the performance I went to have a look at the wireless gramophonic apparatus. A very troubled cinema operator was going over the wires to the two loud-speakers on the stage. I asked him what kind of an accumulator he was using to light the filaments of the valves.

"A six-volt accumulator," he replied.

"Do you mind letting me have a look at the valves with the accumulator turned on?" I asked.

He did so and, as I thought, the accumulator was run down. There was scarcely enough glow in the valves for the dullest of dull-emitters.

I suggested trying another accumulator. On our doing so, the volume of sound from the loud-speaker was splendid.

The operator was very puzzled to know how the accumulator had come to fail so badly in the middle of its week's work. If he had our knowledge of wireless he would know that

New and rather novel experience

accumulators do occasionally play strange tricks of this kind, wouldn't he?

◆ ◆ ◆

Titles for Talks

If there is anything in the old idea that your ears burn when somebody is talking about you I should think that certain of our programme builders and broadcast talkers must have had red-hot ears on many occasions during the past few weeks. Really it is astonishing how much has

If there is anything . . .

been and is being written and said about our broadcast talks.

Most of the criticism of our talks is of the destructive variety. Occasionally we do get a little criticism of the constructive type, as for example, a recent suggestion that, if only attractive titles were to be given to our broadcast talks, all would be well and we should find ourselves taking far greater interest in those talks.

I have been rather intrigued by this suggestion and I should be very interested to hear your opinion of it. Do you think that you would be much more tempted to listen to a talk on American motor cars say, if the title of the talk were given as "Rattling Good Things from the U.S.A."?

Again, would you be more likely to listen to a talk on Wordsworth if the talk were announced under the title "The Poet with the Big Output."?

◆ ◆ ◆

Sound Theory

I had just finished reading an interesting article on the acoustics of reception when George came in. Full of my newly-acquired knowledge, I fired this question at him:

"What is the best way to obtain tonal fidelity, George?"

"Gargle night and morning with salt and water," replied George.

Now if my technical adviser has one fault above all others, it is this evasion of my technical questions. Usually he evades my questions in order to gain time to think. On this occasion however, I was in no mood to be trifled with so I said:

"Don't be foolish, George. You know I am referring to tonal fidelity in wireless reception. To obtain such a desirable quantity, the proper position of the loud-speaker must be determined from a careful consideration of the acoustical properties of the reception room. A loud-speaker should never be put so that it points across the breadth of a

Sound theory

narrow room. It should point down the length of that room."

"So that everybody can see the point."

"Damping should be moderate over the whole room, George. Soft materials such as rugs, curtains, and upholstered furniture damp sound. Flat, hard surfaces reflect sound, which is bad."

"That's why a loud-speaker never works as well in a room full of bald-headed———"

"Be quiet, George, and please listen. Damping should be greatest at a point directly opposite to the loud-speaker. Hence a soft hanging of some kind, or a rug, placed on the wall facing the loud-speaker may improve the quality of reception."

"I know a wireless enthusiast who hung a large tapestry on the wall opposite his loud-speaker."

"Did it improve the tonal fidelity, George?"

"I'm not sure about that, but it certainly hid a nasty hole in the plaster."

◆ ◆ ◆

Taking More Risks

What kind of notice do you take of thunderstorms these days? Are you switching off your set when atmospherics become troublesome, or are you taking more risks than you used to do?

I do not know whether it is a case with me of familiarity breeding contempt, but just lately, I seem to have been risking a great deal more than previously with regard to thunderstorms.

Possibly this increased daring of mine started on the afternoon of Derby Day. I could not go to the Derby, but I did manage to snatch a few minutes from a busy day to listen-in to the great race. As soon as I switched on, the banging and crackling of a severe thunderstorm commenced. I was more than a little afraid of it, but when I heard the commentator tell us that Epsom was free from the thunderstorm that somebody or other had prophesied for the Derby this year, I made up my mind not to let my thunderstorm do me out of my reception of the Derby.

It was pretty bad though, really. The next day I read of a bad thunderstorm which had occurred the previous afternoon some fifty miles away. So I know now just what noise a thunderstorm fifty miles away can make in my wireless receiver, and,

Taking more risks

having that knowledge, I am taking more risks than before, perhaps.

◆ ◆ ◆

A Wireless Log

The last time I went on a shopping expedition to the city, my attention was drawn to a wireless writing-pad in a stationer's window. I wonder if you have ever seen such a thing?

At the top of the pad were the

A wireless log

words "London calling the British Isles" and a picture of Big Ben. The pages of the pad were of different lengths. On the bottom of each page was a heading—well—scarcely a heading at the bottom of a page, perhaps, but anyhow, there were printed words at the bottom of each page indicating what was to be written above.

By pushing my nose close to the window pane, I was able to count up the pages. There were five pages allotted to "Stations Heard," one to "Records of Renewals and Additions to Set," five to "General Notes," and one to "Press Cuttings."

Rather an optimistic person who designed that log, wasn't he? How would the proportion of five pages of "stations heard" to one page of "renewals and additions to set" suit your book?

Still, the idea of a wireless log like that seemed good to me and I really believe I should have bought that one I saw if the shop had not been closed.

◆ ◆ ◆

Stunts

Are you in favour of the re-introduction of "stunts" into our broadcast programmes with the idea of brightening things up a little?

You remember the broadcast "stunts" of a year or two ago, don't you? There was the stunt broadcast of a diver speaking from the bed of the river Thames. Another stunt, and a very jolly one, was the broadcasting of feeding time at the Zoo. Then there were several stunt broadcasts from aeroplanes.

I wonder what has happened to the stunt department of the B.B.C.? Why did it cease to stunt? Was it because the stunters ran out of ideas, or was it because the B.B.C. officials came to the conclusion that we were tired of stunts? Of course it might have been that somebody high up held the opinion that stunts were not good for us.

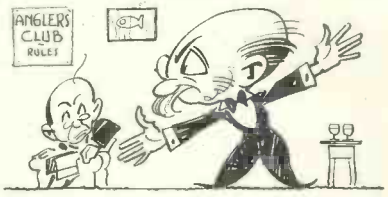
Anyhow, there is no stunt department at the moment, and the question is whether we want its revival or not. What is your opinion?

If we were to ask for the re-introduction of stunts, it would be rather an idea for each one of us to suggest a jolly good broadcast stunt. Here is my suggestion—the roar of Niagara Falls, promised to us some time back but never broadcast to us, as far as I remember. What is your stunt suggestion?

Brightening things up a little

Do Not Miss the Special Gramo-Radio Section on page 47!

Under My Aerial (Continued)



It was like this

One UC

What do you think happened last week, of all things? George and I paid a visit to one of our broadcasting stations. It was like this. I had an appointment at—er—let's call it 1UC, you will easily recognise the station if you have ever been to it, and I thought it would be a good thing for George if I took him with me.

"You know 1UC pretty well, don't you?" asked George as we walked along a busy street towards the studios.

"Yes. I've been there many times and I once spoke from there, you remember?" I replied.

"That was a couple of years ago, wasn't it?"

"Yes, George."

"They never asked you again, did they?"

"As a matter of fact, George, I expect to speak from 1UC again at the end of the month," I replied with some asperity.

When we reached the studio building, I led the way along a dark corridor, round a corner, down a flight of stairs, round another corner, down more stairs, round more corners and down more stairs until there were no more stairs to go down.

"Broadcasting at 1UC is apparently at a pretty low level," remarked George.

A boy from "Inquiries" approached us. Looking at George, he said:

"Audition, sir?"

Before George could think of a suitable reply, I gave the name of the official I had come to see.

In a few minutes we were in the rush and turmoil of a broadcasting station. We saw the studios and we talked with several of the B.B.C. officials.

Altogether, we had a good time at 1UC, and I am glad to say that George has shown a little more respect for me since our visit. If he shows the least sign of getting a bit uppish, all I have to say now is:

"Audition, sir?"

You see there is nothing annoys George more than to be taken for a musician.

◆ ◆ ◆

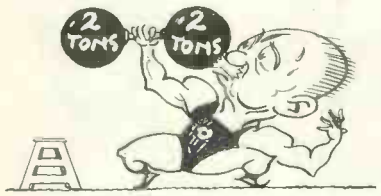
A Better Gauge

Have you ever written to the B.B.C. to tell them whether you have liked or disliked any particular programme they have broadcast? I doubt if you have, any more than I have.

It is really quite astonishing how few of us write to the B.B.C.; indeed the reticence of the average listener must surely be the greatest difficulty our programme builders have to contend with. Those who are concerned with the arrangement of our broadcast programmes would welcome nothing more than a reliable means of gauging the manner in which their programmes are received.

In America, of course, they have the "applause card," and I have often wondered why something of the same kind is not tried in our country. What I would like to suggest is that a packet of fifty-two "applause cards," one for each week in the year, be given to each one of us when we take out our yearly licence.

My idea is that one of these cards should be used for one particular broadcasting station on one particular



Really quite astounding

evening in the week to which the card applies, the station and evening to be at our choice. On the card we should state the item of the programme we had liked the best, and the item we had liked the least. We should then post the card.

LOOK OUT NEXT MONTH FOR PARTICULARS OF A SCREENED-GRID THREE-VALVER. IT HAS SOME SPECIAL FEATURES THAT WILL APPEAL TO EVERY HOME - CONSTRUCTOR.

If some regular system such as this could be adopted our programme builders would have a far better gauge of the listener's opinions than they have at present and I think that better programmes would quickly result.

◆ ◆ ◆

Quick Work

What is the quickest time in which you have put together a three-valve receiver?

I have just assembled a three-valve set for test purposes in a little over three hours, and I am certain

Quick work

that I could reduce that time very considerably if I made an effort to work against the clock.

In building this three-valve receiver, I used a horizontal baseboard and a vertical panel screwed to an edge of that baseboard, and I do not think I ever appreciated the modern baseboard method of assembly so much before. It really is a convenient method, much more convenient than the old back-of-panel method and far and away the best method when it comes to quick work.

My three hours spent in making this set included a certain amount of time spent in hunting about for a convenient baseboard and an old panel. To get my baseboard I had to knock a box to pieces, but I found an old panel just the right size amongst my wireless junk.

I had some trouble in fixing a terminal strip at the back of the baseboard, but when that was done, I tackled the wiring-up with great enjoyment. As the receiver was for test purposes only, I did not use a soldering bit in wiring up.

This test receiver has been giving excellent results. I only hope that it will give the same excellent results when it is built into the fine cabinet I am having made for it. Sometimes they don't, as perhaps you know from experience.

HALYARD.

Some "Home" Additions to The CHUMMY FOUR

FOR the benefit of those who have not previously heard of it, let us say at once that full constructional details of the Chummy Four were given on pages 399-406 of the June issue of the WIRELESS MAGAZINE and further notes were published on pages 483-5 of the July issue.

THIS SET WILL RECEIVE THIRTY STATIONS ON THE LOUD-SPEAKER, AND THE COST OF ALL THE PARTS FOR A COMPLETE OUTFIT IS ONLY ABOUT £15

And what exactly is this Chummy Four, of which so much fuss is being made? Well, it was at the time of its publication the first screened-grid valve portable to be put before the public by any radio journal and is, as far as we are aware, the only set of its kind in existence.

The results it gives are really extraordinary for a frame-aerial receiver which is completely self-contained and which is so cheap—the complete set of parts, including valves, batteries, and a cone loud-speaker, costing only £15 or so.

FULL CONSTRUCTIONAL DETAILS OF THE CHUMMY FOUR WERE GIVEN IN THE JUNE ISSUE OF THE "WIRELESS MAGAZINE." BACK NUMBERS ARE 1s, 3d. EACH, POST FREE.

Tested during one evening by Mr. J. Godchaux Abrahams, the well-known authority on European broadcasting affairs, twenty-three stations were picked up on the loud-speaker and *each transmission was definitely identified*. In a subsequent test a member of the "W.M." Staff received thirty-one stations in an evening, though all of these were not identified.

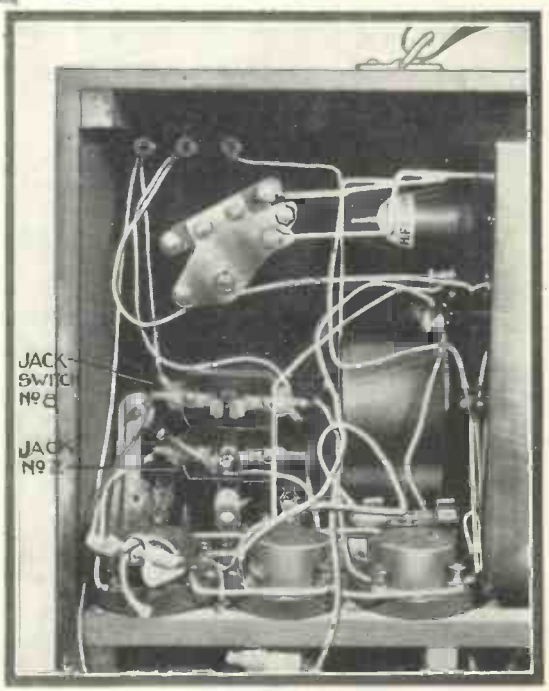
If any further proof is required of the enormous range of this handy four-valver, it is provided by the letter from a WIRELESS MAGAZINE reader reproduced on page 15.

Here is a case of a reader who, *after writing a letter of complaint*, found a small fault in his Chummy Four and after remedying it obtained on the loud-speaker thirty-three stations in a period of three hours. And remember that this was without any elaborate aerial-and-earth system!

In writing later, to give us permission to reproduce his letter photographically exactly as it was received by us, this reader says: "Do you realise that you have made a mistake in publishing details of this set? Whoever makes one of these will never want another set!"

As it was originally arranged the Chummy Four had a rheostat for controlling

Although the weight (30 lb.) of the Chummy Four necessitates a slight angle of inclination on the part of the person carrying it, the case swings freely by the side of the legs



This photograph shows the position of the headphone jack and the jack switch for using an external H.T. supply

"Home" Additions to the Chummy Four *(Contd.)*

Always ready for use is the Chummy Four!

the filament current of the Cossor screened-grid valve and a push-pull on-off switch for controlling all four valves at once, but experience has shown that such critical control of the screened-grid valve is not really essential.

Rheostat

It was therefore decided to dispense with the push-pull switch and control all four valves with the rheostat, this being used as an on-off switch which protects the filaments from too sudden changes of temperature.

A number of readers also asked for some modification for using a pair of headphones as well as the loud-speaker—presumably for D.X. work.

Several other useful modifications presented themselves and the WIRELESS MAGAZINE Technical Staff decided to make such alterations as would be of the greatest utility to the operator.

Range and Volume Unaffected

It should be very clearly understood, however, that these alterations or modifications in no way affect the performance of the set. They will not make the Chummy Four bring in more stations or louder signals, but they do make it handier for use in the home.

The alterations that have been made in the "Home" edition of the Chummy Four are, then, as follows:

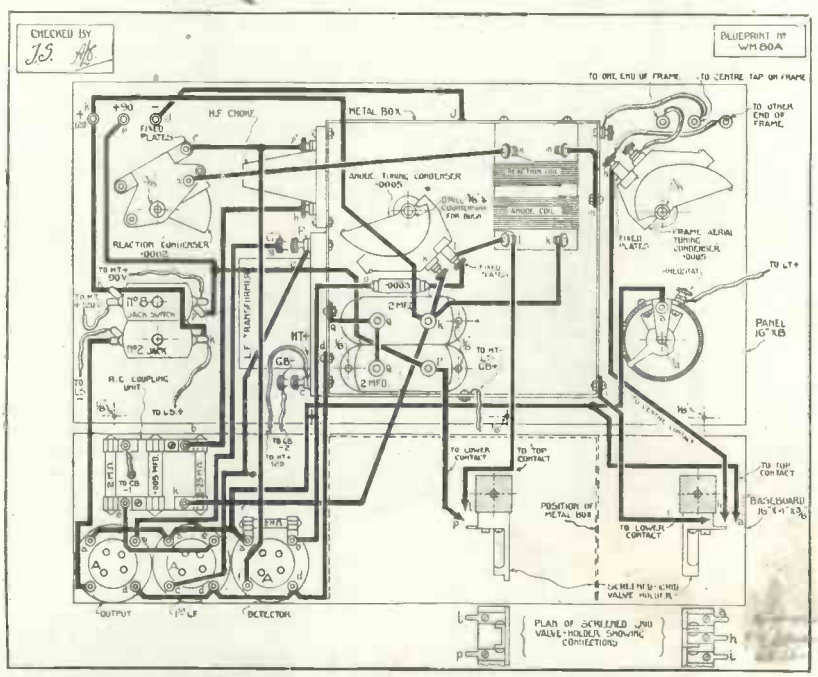
"Home" Additions and Modifications

(1) Addition of terminals for utilising ordinary aerial and earth for experimental work.
(2) Provision for use of headphones or an external loud-speaker. (In the "W.M." experimental laboratory the Chummy Four will operate a moving-coil loud-speaker quite successfully.)
(3) Use of rheostat as on-off switch to protect valve filaments.
(4) Provision for using external source of high tension, such as high-tension accumulator or mains supply unit.

Those wishing to convert their existing models of the Chummy Four in this way will need the following extra components:

3—Terminals, marked: Aerial, Mid-tap, Aerial (Belling-Lee).
3—Small plugs and sockets, 2 red and 1 black (Lectro Linx).
1—Plug and jack (Lotus, No. 2).
1—Double-pole jack switch (Lotus, No. 8).

These additions, of course, mean that a new wiring diagram is required and for this reason a new blueprint (reproduced on the left has been prepared. This is



This revised layout and wiring diagram (No. W.M.80A) can be obtained as a full-size blueprint for half-price, that is 9d. post free, up to the end of August if the coupon on page iii of the cover is used. The original blueprint (No. W.M.80) is 1/6 post free

Here is the Chummy Four with the "home" additions, described in detail in these pages. The phones are Brown's Featherweight type

Thirty Stations on the Loud-speaker !

No. W.M.80A (the original Chummy Four is No. W.M.80 and is still retained) and can be obtained for half-price, that is 9d. post free, up till August 31 if the coupon on page iii of the cover is used by that date. Note that the full price of 1s. 6d. is now charged for blueprint No. W.M.80.

Where to Send Your Postal Order

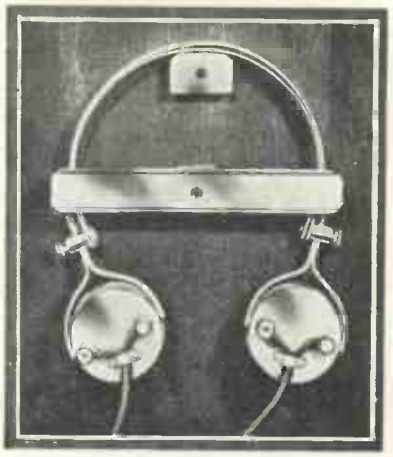
Address your inquiry to Blueprint Department, WIRELESS MAGAZINE, 58/61 Fetter Lane, E.C.4, and your copy will be sent by return. By the way, new readers who want the original constructional article on the Chummy Four can obtain copies of the June issue from the Publisher, at the above address, for 1s. 3d. each, post free.

Some more detailed explanation is needed regarding the provision for using an external source of high-tension, although the remainder of the modifications are self-explanatory.

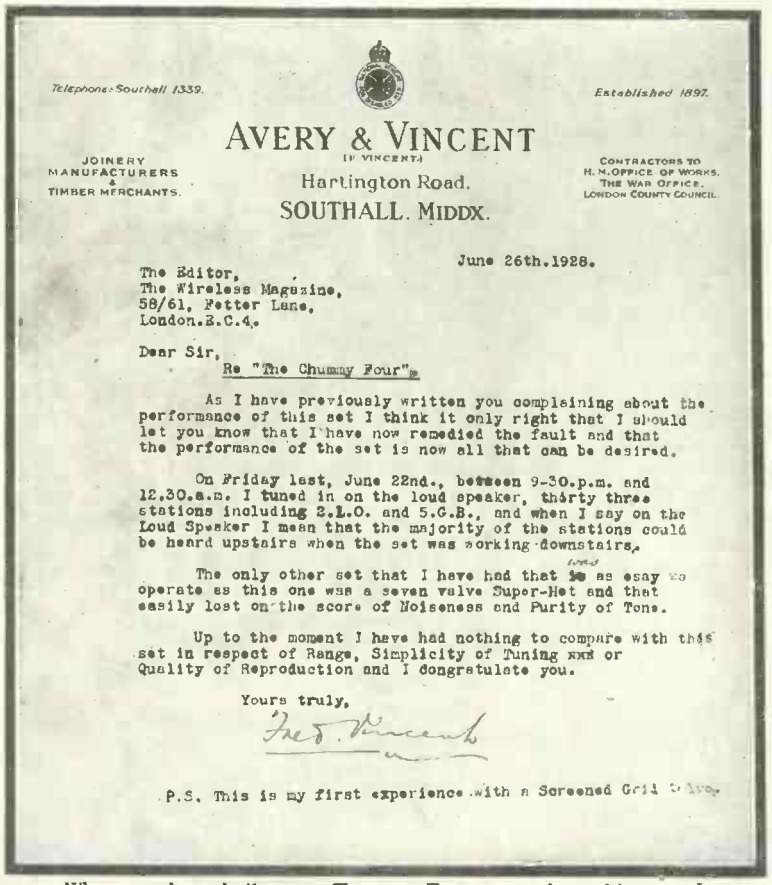
Cheaper H.T.

It was thought that those who had available a cheaper source of supply than dry batteries —that is, a high-tension accumulator or mains supply unit— would prefer to utilise it if possible when operating the Chummy Four at home.

The adaptation is not difficult. In the set there are two high-tension positive leads, one supplying 120 volts or so to the anodes of all the valves and the other supplying 80 or 90 volts to the screening grid of the Cossor screened-grid valve. Now obviously these two leads could be taken to a double-pole switch which would connect them to wander plugs on the batteries inside the case or to two terminals to which an external source of supply could be applied. The negative lead can, of course, remain common to both supplies.



How the headphones are held in the lid



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June 26th.1928.

The Editor,
The Wireless Magazine,
58/61, Fetter Lane,
London.E.C.4.

Dear Sir,

Re "The Chummy Four".

As I have previously written you complaining about the performance of this set I think it only right that I should let you know that I have now remedied the fault and that the performance of the set is now all that can be desired.

On Friday last, June 22nd., between 9-30.p.m. and 12.30.a.m. I tuned in on the loud speaker, thirty three stations including 2.L.O. and 5.G.B., and when I say on the Loud Speaker I mean that the majority of the stations could be heard upstairs when the set was working downstairs.

The only other set that I have had that is as easy to operate as this one was a seven valve Super-Het and that easily lost on the score of Noiseless and Purity of Tone.

Up to the moment I have had nothing to compare with this set in respect of Range, Simplicity of Tuning and or Quality of Reproduction and I congratulate you.

Yours truly,

Fred. Vincent

P.S. This is my first experience with a Screened Grid Valve.

When you have built your Chummy Four try to beat this record

Three Sockets

The three sockets at the top right-hand corner of the receiver are therefore arranged in the following order from left to right: (*a*) negative, black, (*b*) 80 or 90 volts, red, (*c*) 120 volts or more, red. *These sockets are in use when the knob of the jack switch is pushed in.* When the knob is out the high-tension batteries in the case are in circuit; on no account pull the switch knob out when an external source of high tension is connected to the sockets.

Jack for Headphones or External Loud-speaker

Immediately underneath the jack switch for external high tension is the headphone jack (this can also be used for an external loud-speaker as its operation cuts out the cone loud-speaker built into the set).

For portable work, a pair of phones can be arranged inside the lid as shown by the photographs reproduced in these pages.

Some "Home" Additions to the Chummy Four (*Continued*)

COMPONENTS REQUIRED FOR THE CHUMMY FOUR

1—Ebonite panel, 16 in. by 8 in. (Resiston, Becol, or Raymond).
—Metal screening box with lid (Magnum or Formo).
2—.0005-microfarad variable condensers (Formo 1928 Log).
2—Vernier dials (McMichael).
1—.0002-microfarad Bébé condenser with small dial (Cyldon).
1—7-ohm panel rheostat (Lissen, Igranic, or Peerless).
1—Screened-grid valve holder (Burndept).
2—2-microfarad fixed condensers (Lissen, Dubilier, or T.C.C.).
1—Anode coil as specification (Burne-Jones).
1—High-frequency choke (Omnora, Wearite, or Igranic).
1—Low-frequency transformer, ratio 4 to 1 (Mullard).
3—Anti-microphonic valve holders (Redferns).
1—On-off switch (Bulgin Midget, Lotus, or Lissen).
1—Pair small panel brackets (Magnum, Camco, or Bulgin).
2—2-megohm grid leaks with clips (Loewe).
1—.005-microfarad fixed condenser with clips (Loewe).
1—.0003-microfarad fixed condenser with clips (Loewe).
1—.25-megohm grid leak with clips (Loewe).
1—Ebonite strip, 2½ in. by 1¾ in. (Resiston, Becol, or Ready Radio).
2—Ebonite washers, ⅜ in. bore and ¼ in. thick (Ready Radio).
6—Lengths Glazite.
3—yards thin rubber-covered flex (Lewcos).
2—60-volt high-tension batteries (Lissen).
2—9-volt grid-bias batteries (Lissen).
2—2-volt accumulators (C.A.V. type 2NS9, with jellied acid).
1—Loud-speaker unit (Goodman doubt-acting).
1—Piece gold-finished cone paper (Goodman).
1—Piece rubber sheet, 1 ft. square (any sixpenny stores).
10—Wander plugs, 6 red and 4 black (Igranic).
10—Indicating tabs for flexible wire, marked: two H.T.+, one H.T.−, two G.B.−, one G.B.+, one L.T.+, one L.T.−, one L.S.+, one L.S.− (Bulgin).
1—Cabinet with baseboard, battery brackets, loud-speaker front and back (Ready Radio).
2—Oz. No. 28-gauge d.s.c. wire for frame aerial (Lewcos).
8—Ebonite strips, 1¼ in. by 1 in. (Ready Radio).
12—6B.A. 1 in. round-head screws with nuts (Bulgin or Ready Radio).
36—½ in. No. 3 brass wood screws (Bulgin or Ready Radio).
2—1½ in. brass wood screws (Bulgin or Ready Radio).
3—Dial indicators (Bulgin).
1—Station log, small (Bulgin).

This is the original specification as published in the June issue of the "Wireless Magazine"

The earpieces of the phones must not be too thick or it will be impossible to close the lid. We found a pair of Brown's Featherweight (type F) phones very satisfactory for this reason. No attempt has been made to count the number of stations that can be picked up on a pair of phones—they roll in right on each others' heels right round the dials!

No Difficulty in Getting Results

From the correspondence we have had with readers regarding this set during the past few weeks we are certain nobody building it up will have any trouble in getting good results *if the original specification is adhered to*. Constructors who use parts other than those recommended must not blame the WIRELESS MAGAZINE if they do not get satisfactory results.

Almost the only trouble that is likely to arise is a high-pitched and not very obtrusive low-frequency whistle. If this occurs reversing the connections to the low-frequency transformer is almost certain to effect a cure.

Use of Ordinary Aerial and Earth

When it is desired to use an ordinary aerial and earth system for experimental work, make the necessary connections to the terminals at the top left-hand corner of the receiver. Connect the aerial to the left-hand terminal and the earth to the middle terminal. In this way the frame aerial in the lid is utilised as an aerial coil.

Seeing Distortion

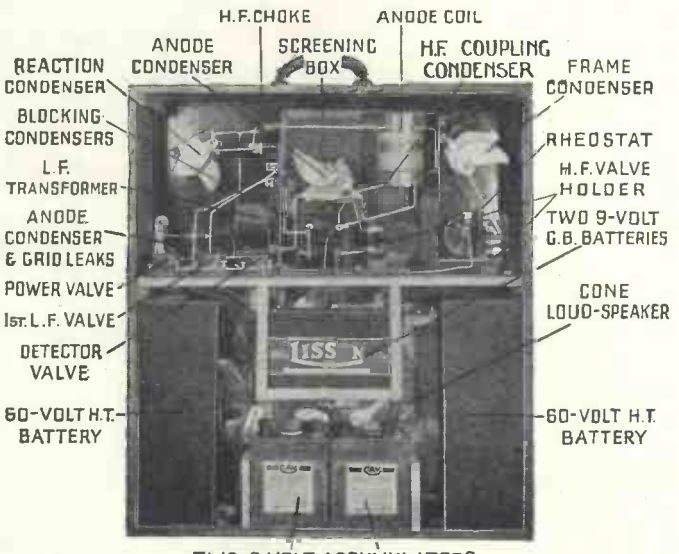
ONE of the oldest radio hints is that of putting a milliameter in the plate circuit of a valve suspected of distorting owing to grid-voltage overload. The hint is not always properly understood, or properly applied, and this despite the fact that it is something of a chestnut.

A mistake is made in believing that when everything is ready for test, with the meter in circuit, the needle should remain rock-steady if there is no overload.

Slight Swing Inevitable

Actually, with a good meter, a certain amount of needle swing is inevitable. If a set passes a total of 10 milliamps, for instance, a swing of from 9½ to 10½ milliamps is allowable, and does not necessarily mean distortion. Serious jumping of the needle at large grid voltage swings should be corrected, however, by alteration of H.T. or grid-bias voltage values.

B. MARSHALL



The arrangement of all the parts in the Chummy Four is clear from this photograph. It consists of a high-frequency amplifier, a detector, a resistance-coupled low-frequency amplifier and a transformer-coupled amplifier. This shows the set before the "home" additions are made

THERE are many who regard—quite mistakenly—the summer as a kind of dead season for the reception of anything but the transmissions of the local station or those of 5XX and 5GB. Actually there is no more interesting time of the year than the summer for wireless reception at long range. True, one does not find stations roaring in all round the condenser dials, as is the case during the darker months. Nor is signal strength, taken as a whole, so great as at other times of the year.

More Difficult to Get

Stations, are in fact, rather more difficult to get in summer time, and therein lies one of the main charms of reaching out at this season. In winter almost anything that is fit to be called a wireless set will bring in in some kind of fashion several stations besides the local and the high-power.

It must, indeed, be a poor thing that will not enable one to receive, say, Langenberg, Frankfurt, or Hamburg on the medium waves, or Radio-Paris, Motala, or Hilversum on the upper band. But in summer, success can be achieved only if the apparatus is really up to the mark.

And not the apparatus only; a good deal depends upon the operator. In winter time stations are easy to find. As you turn the dials, you suddenly hear speech and music at quite respectable strength and no great skill is needed to bring them up to the desired volume.

In summer, a distant station may be so faint, when first picked up, that it is easy to pass it over altogether; and, if it is heard, a certain amount of skill is required to tune it in properly, without allowing the set to oscillate. As a rule, though, transmissions that are very weak are not worth serious attention, if one wishes for reproduction of fine quality. One may tune them in occasionally as a matter of interest, or to test one's skill and the efficiency of the apparatus.

Keep to Powerful Stations

But, if we are in search of genuine alternative programmes, that is, programmes that are thoroughly worth listening to, the soundest of all rules for summertime work is to confine oneself to the more powerful stations. The reason is this. At almost any point on the broadcast band, with an efficient set brought into a sensitive condition, one may hear mush or commercial Morse signals, some so faint as to be hardly audible, others strong enough to be a nuisance.

In summer time, too, electrical disturbances are frequent, so that, even if grinders and crashes are absent, there are always tiny atmospherics from distant storm centres, which become audible if the receiving apparatus is unduly sensitive.

Unwelcome Background

Interference from all these sources is not noticeable so long as the strength of the desired signal is greater than that of the undesired. If we try to work up a very faint broadcast transmission, we shall probably bring up too an unpleasant background of interference from some of all of the sources mentioned.

Some of the winter stations will continue to be good friends to us during the summer. The big Germans, for instance, can be relied upon on most nights on the medium band, and late in the evening the Spanish stations come through with splendid strength and quality. In Spain the evening does not begin until about ten o'clock or end until the small hours; hence the Spanish stations are to be found at work later than almost any others in Europe.

But Spain and Germany, are not

Summertime D.X. Work! (Continued)

the only countries to which we can look for summer entertainment. France, Italy, Denmark, Sweden, Holland, and Poland also deserve attention. It is impossible to say just which stations will be best received in any particular place; one can only make suggestions on general lines.

Satisfactory Method

I am going to introduce to readers a method which I have found eminently satisfactory during several past summers, for ensuring good long-distance reception in the lighter months. Begin by looking down the list of foreign transmissions and select from it twenty stations or so which appear most promising.

The first point to look at is the position of the station and the power that it uses. You may find in your district that reception is generally best from stations lying in certain directions. In summer time the "blanketing" effect of woods, and of large isolated trees, close to the aerial is particularly marked, for trees are then full of sap and covered with juicy leaves so that they form fairly effective collectors of wireless impulses.

In my own case, I know that stations lying between due north and north-north-east, are of very little use in summer time. They are effectively blanketed by big trees and records show the same story, summer after summer: transmissions from these directions have grown fainter with the coming of spring and the rise of the sap.

Good and Bad Directions

Experiment will soon show whether in the case of any reader there are good and bad summer directions.

Let your preliminary list contain only stations of two kilowatts or more. Leave the smaller fry alone for the moment. Do not select any station whose wavelength is so close to its neighbours on either side that is is certain to be heterodyned. To do so is clearly a waste of time. Having made out your list, tune in the stations one after another and make a note of the strength and quality in each case.

Some you will find quite satisfactory, though others will have to be weeded out. You will also discover that some of them are quite good before, say, 9 p.m., whilst others must be classed as late stations.

And now for a trip in summer-time D.X. work, which will be found extraordinarily useful: Don't neglect the stations below 300 metres. With these the power used is not of so great importance as with those on higher wavelengths. The shorter waves have a wonderful way of spanning distance in summer time.

Stanley Peters — *Who Broadcasts from the New Picture House, Edinburgh*

From 300 metres right down to 200, or below, there are numbers of fine stations such as Cologne, Bordeaux, Malmoe, Toulouse PTT, Kiel, Muenster, Nuremburg, and Stettin, whose quality and strength are often remarkable. Curiously enough, the little Swedish relays, whose power is only from .25 to .5 kilowatt, are well heard in many places right through the summer season.

On the long waves, the list of possibilities is a long one, for high power and a high wavelength seem to make for good daylight ranges. The long waves would, in fact, be ideal for summer reception were it not for one unpleasant and important factor—the atmospheric.

Atmospheric Troubles

The higher the wavelength to which a receiving set is tuned, the more violent as a rule is the interference caused, when atmospherics are about. The long-wave stations will, therefore, be available only on evenings when the ether is "all clear." This brings one to another useful tip.

On "atmosphericky" evenings, if stations above 1,000 metres are bad, drop down to the upper half of the broadcast band. Should you find that there is no atmospheric interference here, conditions will probably be better still below 300 metres. You will see, if you think for a moment, how this helps the long-distance man. He wants perhaps, to receive a special programme from Berlin during the evening.

Having tried Koenigswusterhausen and found atmospheric interference prevalent, he drops down to 484.6 metres and sees how Witzleben is sending out the programme. He notices that there is less atmospheric interference, but there is still too much to be quite pleasant. He, therefore, puts a still smaller set of coils into the set and tunes in Stettin on 236.7 metres, with complete comfort. Never forget the relays of the various Continental stations. If one wavelength will not do, there is often another that will bring in the same programme excellently.

List of Reliable Stations

After a few evenings of trying-out possible stations, a fair copy list of the most reliable can be made. It will possibly contain some stations of lower power than those mentioned, for in some localities certain of these may come through exceedingly well.

By R. W. Hallows

It will in any case, save a great deal of trouble, since it enables one to know just what stations are best worth trying for when it is desired to hear distant transmissions.

A further word about atmospherics. No means of getting rid of them entirely has yet been discovered. One can, however, do a good deal to palliate their effects. The more efficient the aerial the better it is as a collector not only of signals that we do want, but also of the crashes that we don't!

Here is an ideal setting for a good portable set!

Why not build the Chummy Four or the Sunshine Five?

Using An Indoor Aerial

In summer time, therefore, it often pays, instead of the outdoor wire, to use an aerial suspended close to the ceiling of a living-room. Again, atmospherics often come most strongly from a certain direction for they may be caused by a thunderstorm which is raging in some place or other. The frame aerial, therefore, with its strongly directional properties, may be of considerable assistance in minimising their effects.

On the Very Short Waves

So far, we have spoken only of the medium and long waves. One of the greatest joys in summer time is D.X. reception upon the very short waves. Far from being at their worst, many short-wave stations are at their best during the summer months. During the whole of last summer I never once failed to obtain excellent reception of broadcasting from America when I wanted to do so.

The Schenectady station, 2XAD, which works on 21.96 metres, is not, as a rule, of very much use in wintertime, unless he is transmitting early in the evening. In the neighbourhood of 20 metres signal strength is greatest and fading least pronounced when it is daylight at either the transmitting or the receiving end.

Schenectady's Strength

At 11 p.m. when 2XAD switches on, it is only 7 o'clock in the evening in Schenectady and, therefore, broad daylight over there. Signal strength is as a rule wonderful for the next three hours—and 2 a.m. is quite late enough for most of us to sit up.

PCJJ, the Dutch station, comes through splendidly during summer months as a rule, and there are stations in every part of the world that can be heard right through the summer with the short-wave receiving set.

If you do not already possess a short-waver now is the time to acquire one. It is one of the most easily made of wireless sets, as you may see by examining the designs that appear at frequent intervals in the WIRELESS MAGAZINE. Inexpensive too, for no high-frequency amplification is needed.

Two-valver Sufficient

All, in fact, that is required in order to hear short-wave stations, thousands of miles away is a grid-leak-and-condenser rectifying valve followed by a single note-magnifier. With two note-magnifiers in cascade many stations may be received upon the loud-speaker. There is no difficulty whatever in operating a modern short-wave set, and to do so is a sheer delight. Don't forget, too, that the short-wave set makes an excellent broadcast receiver.

All that is required to convert it for work upon the longer waves is to provide a suitable set of coils. If I were confined to a single receiving set, I would choose, unhesitatingly, a three-valve short-waver with an extra set of coils suitable for the broadcast wavelengths.

You will find your summer-time long-distance work still more interesting if you keep a log and record in it the dates and the times when reception was at its best, making a note also of the state of the moon and of the weather as well as of barometer and thermometer readings.

Testing Some Theories

By going through the log at the end of the season you can see what conditions appear to make for the best wireless reception on all wavelengths and can judge whether there is truth or not in the many theories about weather and wireless that have been put forward from time to time.

Although a good four-valver will do almost everything that is required for normal use there is a need for a really "super" broadcast receiver, and details of the Connoisseur's Six, which is completely described in this article, are published at the request of a large number of readers—particularly those who reside overseas in distant places. All the parts are standard and can be obtained without difficulty

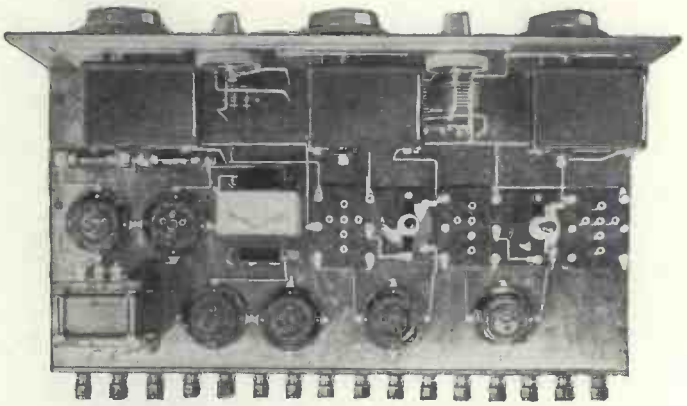
The Connoisseur's Six

LAST TWO VALVES "PUSH-PULLED" FOR PURITY

SIX OR THREE VALVES AT WILL BY MEANS OF SINGLE SWITCH

SWITCH FOR GRAMOPHONE PICK-UP

SIMPLE AND EFFECTIVE VOLUME CONTROL



Plan view of the baseboard of the Connoisseur's Six

COMBINED SURFACE AND SUB-BASEBOARD WIRING

ANODE-BEND DETECTOR WITH POTENTIOMETER

SEPARATE HIGH TENSION FOR EACH VALVE GROUP

DESIGNED BY THE "W.M." TECHNICAL STAFF

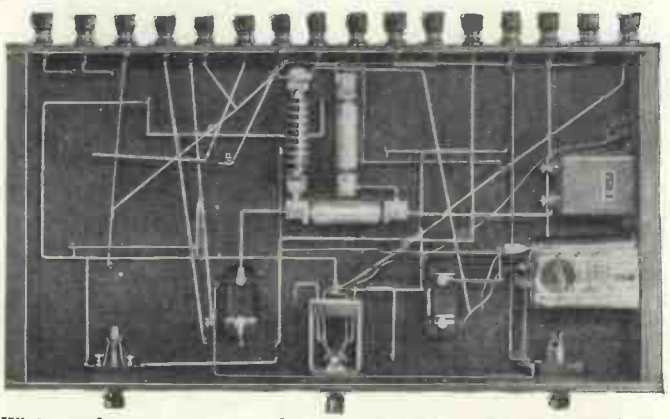
FROM many quarters we have received requests for a "super" broadcast set, incorporating every possible refinement, and capable of "delivering the goods"—a set, in fact, that is quite definitely the best possible in every way.

Many Weeks Spent in Perfecting Design

Thus the Connoisseur's Six saw the light of day after many weeks had been spent on its perfection by the WIRELESS MAGAZINE Technical Staff. The general points of the design will appeal to a large number of readers, even though they do not desire such a powerful combination themselves.

In the first place, however, it should be pointed out that although six valves are employed, there are actually only five stages of amplification, the last two valves being arranged on the push-pull system, so that ordinary super-power valves will give "super-super-power" results, without the need for an impracticable high-tension voltage.

Essentially the Connoisseur's Six comprises two stages of high-frequency amplification, a detector, a resistance-coupled low-frequency stage and a push-pull transformer-coupled stage (two valves). The set is arranged for gramo-radio by incorporating two terminals to which a pick-up is permanently connected; it is brought into circuit by the operation of a simple push-pull switch.



Wiring and components on under side of baseboard of Connoisseur's Six

Further details of the circuit are that the high-frequency stages make use of standard binocular transformers, neutralisation being carried out on the split-primary principle. The detector works on the anode-bend principle, while the first resistance-coupled low-frequency stage is provided with a "motor-boat" stopper.

"Push-pulling" of the final valves is carried out by placing two resistances in series across the secondary of the low-frequency transformer and tapping off from the mid-point. This system has been found by the WIRELESS MAGAZINE Technical Staff to be particularly successful. A special output transformer with a centre-tapped primary is, however, employed.

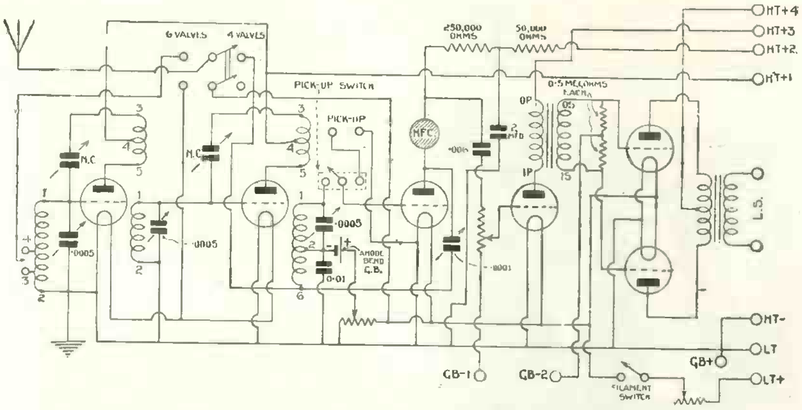
For the convenience of those who desire to listen only to the local station, a switch is provided for transferring the aerial connection from the grid of the first high-frequency valve to the grid of the detector valve, at the same time switching off the filaments of the two high-frequency valves.

Controls for Every Purpose for Best Results

In keeping with the de-luxe nature of the Connoisseur's Six there are a large number of controls. The two small knobs at the top of the panel are the detector anode-bend potentiometer and master rheostat respectively. Across the centre of the panel are three large dials attached

to the condensers for tuning the aerial and two anode circuits.

Between these, on a lower level, are two smaller dials for the reaction condenser and volume control, which takes the form of a variable leak in the grid circuit of the first low-frequency amplifying valve.



Circuit of the Connoisseur's Six with the last two valves "push-pulled"

Three Panel Switches

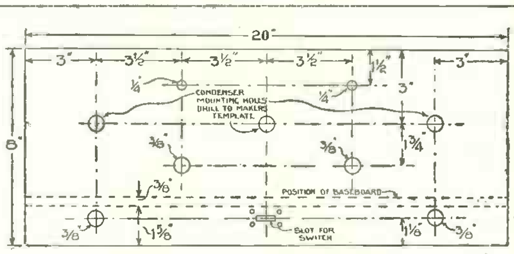
In line along the bottom of the panel are the push-pull switch for putting the gramophone pick-up in circuit, the key switch for cutting out the two high-frequency valves and the main on-off push-pull switch.

As well as these controls on the front of the receiver, there are two neutralising condensers for the high-frequency stages on the baseboard and a tapped grid-bias battery working in conjunction with the anode-bend potentiometer for the detector.

At the back of the receiver are provided no less than sixteen terminals, arranged as follows: Aerial, earth, pick-up (2), low-tension + and —, high-tension positives for the high-frequency stages, detector, first low-frequency and final stages (4) and negative, grid-bias negatives for first low-frequency and final stages (2) and positive, and loud-speaker terminals.

Special Wiring

Yet another special point about the Connoisseur's Six is the combination of surface and sub-baseboard wiring, which gives a remarkably neat appearance to the finished receiver and also saves time in construction.



Panel layout of the Connoisseur's Six

Except that it does incorporate a large number of refinements not found, and indeed not required, in the average broadcast receiver, we desire to emphasise the fact that the Connoisseur's Six is quite straightforward in design, and makes use of standard parts that should be obtained from dealers everywhere without difficulty.

Though all the essential details regarding this set are included in these pages, and we have no desire to force readers to work from a blueprint, yet this course will save a great deal of time and trouble, notwithstanding the fact that the constructor may be well experienced in radio matters.

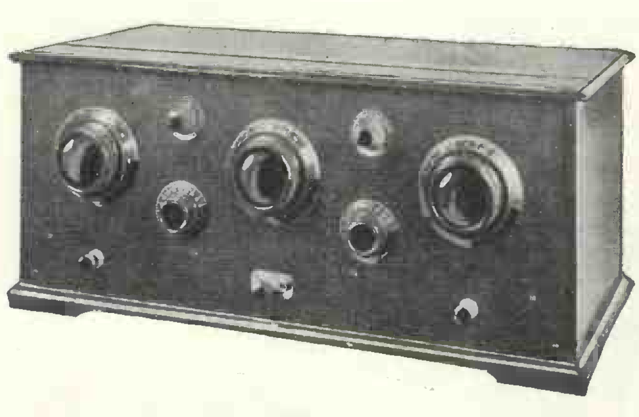
If the original specification is followed (and it is particularly desirable that it should be) the blueprint acts as a full-size drilling template for the panel layout and complete wiring diagram with the most convenient sequence of wiring indicated. Moreover, up to the end of August this blueprint, which measures 20 in. by 30 in. can be obtained for half-price, that is 9d. post free, if a postal order for that amount is sent accompanied by the coupon at the bottom of page iii of the cover.

Where to Send

Ask for blueprint No. WM 88, and address your inquiry to Blueprint Dept., WIRELESS MAGAZINE, 58/61 Fetter Lane, E.C.4, before August 31 if you want the blueprint at half-price.

It is advisable in assembling a set of this type not to begin the construction at all until all the parts have been obtained. But when everything is ready, the panel components can be mounted in position. These include the master rheostat and potentiometer at the top, the three large tuning condensers, the reaction condenser and variable grid leak, and the three switches at the bottom.

The baseboard itself is provided with a strip support at each end and the front edge of the baseboard is screwed to the panel 2 in. from the bottom edge of the latter, no brackets being employed.

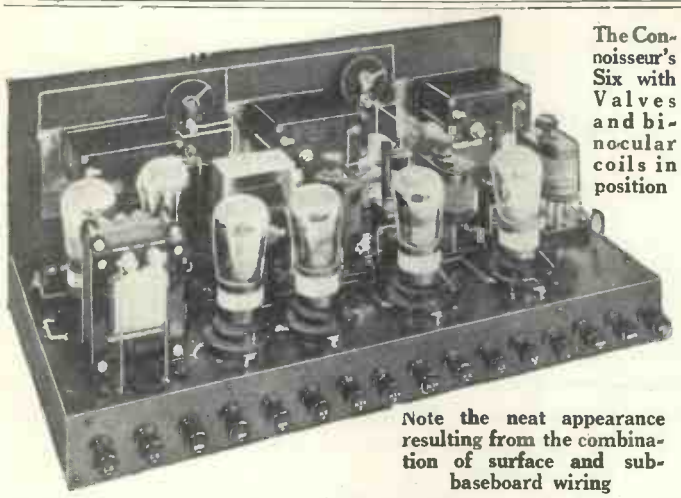

Front view of the Connoisseur's Six showing arrangement of controls

Arrangement of Baseboard Components

There is little difficulty in arranging the baseboard components. The three six-pin coil bases and the two neutralising condensers for the high-frequency valves are arranged in line. At the left of the baseboard, looking from the back of the receiver, are the low-frequency transformer, with the two .5-megohm grid leaks in series across its secondary, and the output transformer.

Underneath the baseboard are the low-frequency

The Connoisseur's Six (Continued)



The Connoisseur's Six with Valves and binocular coils in position

Note the neat appearance resulting from the combination of surface and sub-baseboard wiring

coupling condensers, the anode resistance and the "motor-boat" stopper. The arrangement of all these parts is clear from the photographs and blueprint (or the smaller layout and wiring diagram, reproduced on page 24).

Wiring up the set will be very greatly facilitated (even if the constructor can work from a circuit diagram!) if the full-size blueprint is used. This not only indicates clearly which points are wired together, but the most convenient sequence is also clearly shown.

As soon as all the parts have been firmly fixed, place the receiver with the panel farthest from you and pick out on the wiring diagram those points marked *a*. Some of these will be above the baseboard and others on the under side. First wire together those points which are above the baseboard and drill holes at the points indicated for the sub-baseboard wires.

Wiring on the Under Side of the Baseboard

Now push through all the *a* holes wires which will project through to the under side of the baseboard. Turn the set over and join together all the *a* points on the under side of the baseboard in the most convenient way.

When all the *a* points have been thus wired, connect up the *b* points in the same way, and carry on throughout the alphabet. After the points marked *z* go on with *aa*, *bb*, etc.

Before testing the set, suitable valves and coils must be obtained. There is considerable latitude in the case of the former, but no difficulty at all about the latter. The coils used are Lewcos six-pin binocular transformers, of the split-primary type. These are made in two ranges, one for the band between 250 and 550 metres and the other for the 1,000 to 2,000 metre waveband.

Choosing Suitable Valves for the Receiver

For the high-frequency stages, two valves with impedances in the neighbourhood of 20,000 to 30,000 ohms will be suitable, while for the detector stage (which is resistance-coupled to the first low-frequency valve) a valve with an impedance in the neighbourhood of 60,000 to 80,000 ohms will be best; considerable latitude is, however, permissible in this case.

If a valve with an impedance of the order of 150,000 ohms is used an anode resistance of .5 megohm should be used in place of the .25-megohm resistance specified.

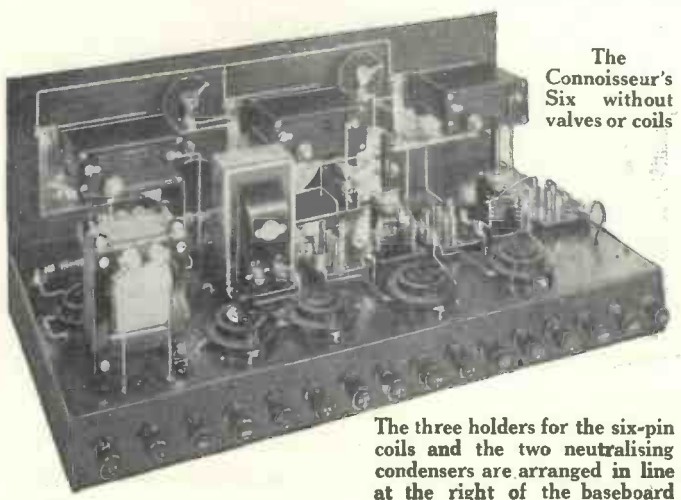
The first low-frequency amplifier should have a much lower impedance, since it is transformer-coupled to the final stage; an impedance round about 15,000 ohms will be quite good.

For the final push-pull stage two super-power valves of identical characteristics should be used. These can have an impedance of anything below 6,000 ohms. Using two super-power valves in "push-pull"

VALVES TO USE IN THE CONNOISSEUR'S SIX

Make.	*H.F. Amplifiers.*	*Detector.*	*1st. L.F. Amplifier.*	*Push-pull Valves.*
Cosmos	DE50	SP50B	SP50R	SP50R
Cossor	610HF	610RC	610LF	610P
Ediswan ...	ES5HF	RC610	ES5LF	PV610
Marconi ...	DEH610	DEH610	DEL610	DEP610
Mullard	PM5X	PM5B	PM6	PM256
Osram	DEH610	DEH610	DEL610	DEP610
Six-Sixty ...	SS6075HF	SS6075RC	SS610P	SS625SP

Equivalent 2-volt and 4-volt valves can, of course, be used.



The Connoisseur's Six without valves or coils

The three holders for the six-pin coils and the two neutralising condensers are arranged in line at the right of the baseboard

A "Super" Set for the Discriminating Listener

gives double the grid swing of either of the valves on its own; thus it is possible to get what may be termed "LS5A results" without the need for what in many cases is an impracticable high-tension voltage.

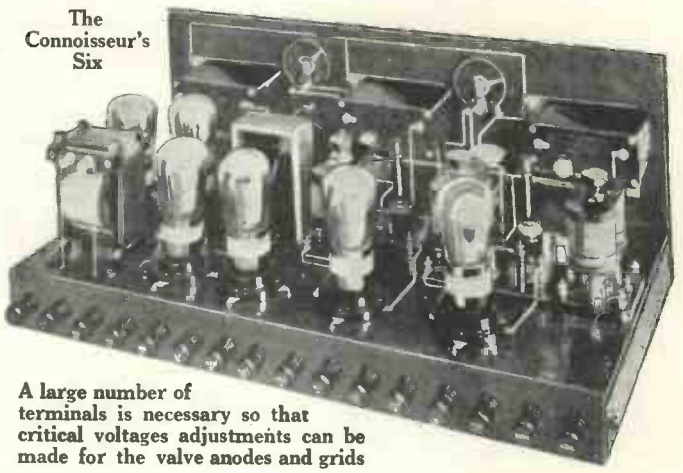
Testing Out the Connoisseur's Six

To test out the Connoisseur's Six, insert the required valves and coils in their respective holders and connect up the various batteries.

Normally the grid-bias battery for the detector valve, (mounted on the under side of the baseboard), which works in conjunction with the anode-bend potentiometer should be tapped off at the 1½-volt point and the potentiometer used for varying the actual voltage applied to the grid.

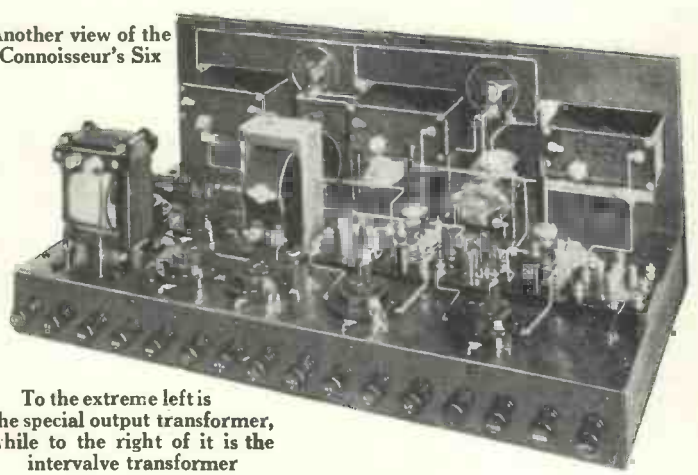
To H.T.+1 (which supplies the anodes of the two high-frequency amplifying valves) apply 60 to 80 volts positive; to H.T.+2 (which supplies the detector) a higher voltage can be applied as the valve has a much higher impedance and there is also a high resistance in its anode circuit—say 90 or 100 volts.

Normally the full voltage of the battery, which should be at least 120 volts, can be applied to both H.T.+3 and H.T.+4 (the former feeds the anode of the first low-frequency valve and the latter the final "push-pulled" valves.) When an eliminator is available, however, it may be possible to apply 150 volts, or more, to the last two valves, in which case not more than 120 volts should be supplied to H.T.+3.



The Connoisseur's Six

A large number of terminals is necessary so that critical voltages adjustments can be made for the valve anodes and grids



Another view of the Connoisseur's Six

To the extreme left is the special output transformer, while to the right of it is the intervalve transformer

It is not so easy to recommend the amount of grid bias that will give the best reproduction, as so much depends upon the actual valves used. Normally 6 to 9 volts negative should be applied to G.B.—1 and probably as much as 12 to 18 volts negative to G.B.—2.

H.T. Battery for Grid Bias

It is convenient to use a 36-volt high-tension battery for obtaining grid bias for the Connoisseur's Six. Remember that the more grid bias that is applied the lower is the high-tension consumption, a point of some importance when six valves are in use.

The degree of selectivity can be varied by taking the aerial connection to either terminal No. 3 or No. 4 of the aerial coil and both positions should be tried.

To tune the set, pull out the right-hand push-pull switch (which lights all the valves) and see also that the knob of the left-hand switch is "out" (otherwise the gramophone pick-up will be connected in circuit). The

COMPONENTS REQUIRED FOR THE CONNOISSEUR'S SIX

1—Ebonite panel, 20 in. by 8 in. (Parfait, Becol, or Raymond).
3—.0005-microfarad variable condensers (Burndept, Cyldon, or Igranic).
3—Vernier dials (Burndept, Igranic, or Formo).
1—.0002-microfarad reaction condenser (Cyldon Bébé, Bulgin, or Igranic).
1—7-ohm panel rheostat (Lissen, Peerless, or Igranic).
1—400-ohm panel potentiometer (Lissen, Igranic, or Burndept).
1—High-resistance potentiometer, 500,000 ohms (Dubilier or Igranic).
2—Dial indicators (Bulgin).
1—On-off push-pull switch (London and Provincial, Lotus, or Lissen).
1—Single-pole change-over push-pull switch (Lotus, Lissen, or Bulgin).
6 Anti-microphonic valve-holders (Lotus, W. & B., or Ashley).
3—6-pin coil bases (Lewcos or Cason).
2—Baseboard neutralising condensers (Peto-Scott, Bulgin, or Gambrell).
1—Low-frequency transformer, approximately 4 to 1 (Igranic type G, Marconi Ideal, or R.I. and Varley).
2—.5-megohm grid leaks with holders (Mullard, Dubilier, or Lissen).
1—Output transformer with centre-tapped primary (R.I. & Varley).
1—Double-pole change-over key switch (Wearite, Dubilier, or Burndept).
1—250,000 ohm wire-wound resistance with holder Dubilier, Mullard, or (R.I. & Varley).
1—50,000-ohm wire-wound resistance with holder (Dubilier, Mullard, or R.I. & Varley).
1—2-microfarad fixed condenser (Dubilier, Hydra, or Lissen).
1—Horizontal high-frequency choke (C.D.M. or Cosmos).
1—.006-microfarad fixed condenser (Dubilier, Mullard, or Lissen).
1—.01-microfarad fixed condenser (Dubilier, Mullard, or Lissen).
1—Flashlamp battery clip (Bulgin type GB2).
1—4½-volt grid-bias battery (Siemens, type G1, or Ever Ready).
1—Cabinet and baseboard, 10 in. deep (Camco).
1—20 in. by 2 in. terminal strip (Parfait, Becol, or Raymond).
16—Terminals, marked: Aerial, Earth, Pick-up (2), L.T.+, L.T.—, H.T.—, H.T.+1, H.T.+2, H.T.+3, H.T.+4, G.B.+, G.B.—1, G.B.—2, L.S.+, L.S.— (Belling-Lee).
2—Wander plugs (Lectro Linx)
1 yd. flex with spade tag.
12—2-ft. lengths Glazite.

The Connoisseur's Six *(Continued)*

middle switch should be in the right-hand position for all six valves (left for three valves only).

Reaction

Adjust the reaction condenser until the slight rustling or hissing sound is heard from the loud-speaker, which indicates that the receiver is on the verge of oscillation. Now turn all three main tuning dials in unison, until a station is picked up. (Note that right round the scale the three readings will be the same within about one or two degrees either way.)

As soon as a transmission is picked up, adjust the anode-bend potentiometer and re-adjust the reaction control until the best results are obtained. Finally adjust the volume control.

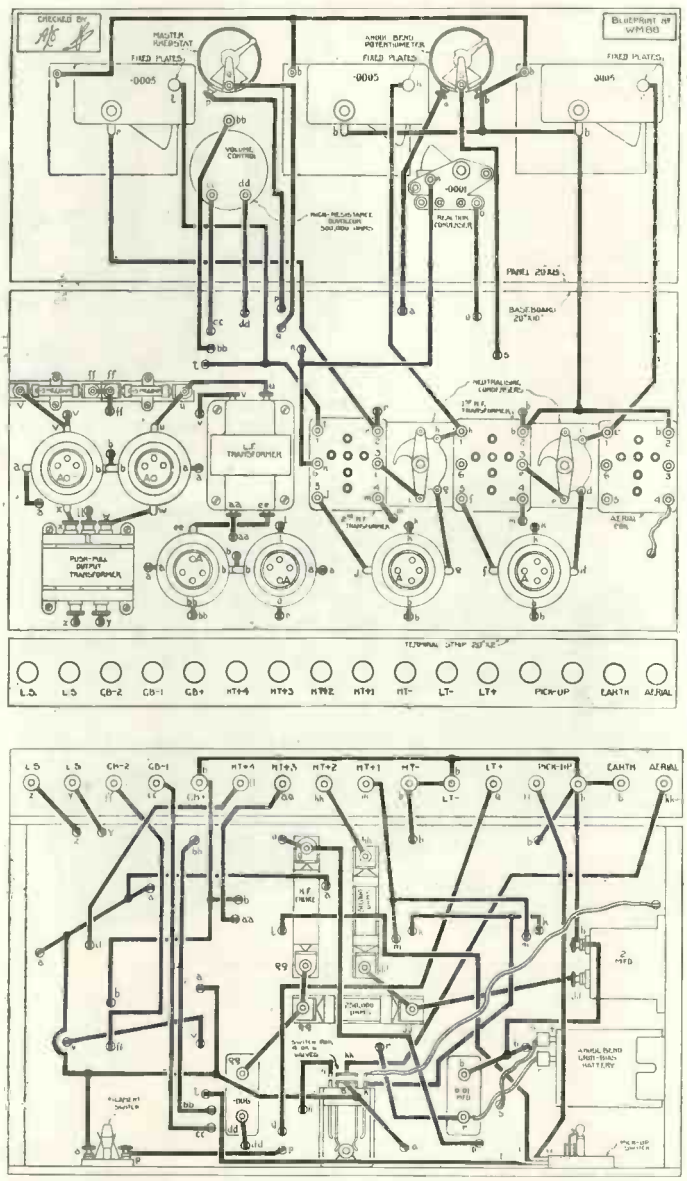
Neutralisation

Before the Connoisseur's Six is put into general use, however, there is another point that needs attention, and that is the neutralisation of the high-frequency valves.

To do this remove one filament connection of the first valve (having first tuned-in a station) and adjust the first neutralising condenser until signals become quite inaudible. Re-make the filament connection and repeat exactly the same process with the second valve.

If the valves are neutralised on the lower waveband it may be necessary to re-neutralise for reception on the upper waveband and vice versa.

When the centre switch is in the left-hand position, only the detector and low-frequency amplifying stages are in use, the filaments of the two high-frequency being automatically switched off. It is then only necessary to tune the right-hand condenser dial, the secondary of the second high-frequency transformer in this case functioning as an aerial coil.



This layout and wiring diagram of the Connoisseur's Six can be obtained as a full-size blueprint for half-price, that is, 9d. post free, if the coupon on page iii of the cover is used by the end of August. Ask for No. W.M.88.

No Screening

For the benefit of novices in radio, it may be pointed out that binocular coils have a negligible external field and, therefore, no metallic screening is required.

To operate the Connoisseur's Six as a gramo-radio amplifier, put the middle switch in the left-hand position so that only three valves are in circuit and push in the knob of the left-hand switch, after having connected the pick-up to the two terminals provided at the back.

Volume Control

In this case, the only control that needs adjustment is the variable grid-leak for controlling volume.

From this brief description it will be realised that the Connoisseur's Six makes the best possible use of existing components and can be relied upon to give really good results. It is difficult to estimate the range of such a powerful receiver, but it will be possible in most cases to rely upon the reception of fifteen or twenty stations at loud-speaker strength every evening.

Because of its great power, the Connoisseur's Six is an ideal receiver for use during the summer months, when reception conditions are never ideal by any means.

More About the Chummy Four on Other Pages of this Issue!

How Wireless Helped to Win the War!

Some New & Interesting Disclosures by CAPT. H. DE A. DONISTHORPE

In this article the WIRELESS MAGAZINE *is able to give its readers a new insight into the part that wireless played in our lives long before broadcasting was inaugurated, or even thought of. The author was one of the officers who introduced the valve to our forces in France in* 1919 *for the first time —only nine years ago!*

BY reason of the fact that broadcasting did not come into being until after the Great War had been finished for some four years there are many people who do not realise the important part that wireless played in everyday life prior to the inception of this wonderful new form of entertainment.

A Broadcast from Newcastle

Recently I was giving a special broadcast from the Newcastle broadcasting station entitled "Wireless and the War" and since that talk I have been asked by a number of my listeners, who were associated with me during the war, to give the contents of this talk in story form. What better medium is there, therefore, than the WIRELESS MAGAZINE to disseminate these wireless war stories?

I do not think it is generally known that the thermionic valve, which is used so universally to-day for magnifying and detecting signals coming from broadcasting stations, came into commercial use round about the time when the Great War started.

Recognising the Value of the Valve

Coinciding, therefore, with the beginning of the war, the British officials quickly realised the value of valves for detecting and magnifying wireless signals coming from long distances, and stations were erected immediately the war started in various parts of the country for intercepting messages from enemy wireless stations.

It was my honour, with two other officers, during December 1919, to introduce the thermionic valve to the British Expeditionary Force in France. In France, prior to that date, the listening-in for enemy messages by the British Wireless Signal Corps was accomplished by means of crystal receivers only, and the competition between the British Wireless Corps and the French Wireless Corps in this direction was very keen, and each day the messages intercepted by the two armies were pooled together, and deciphered at a central headquarters, with the result that much valuable information was obtained therefrom.

Astonishing Increase

Immediately we introduced the thermionic valve into the wireless sets of the British listening stations the number of messages which we were able to intercept over the French increased astonishingly, and the information so obtained became extraordinarily valuable, because signals were picked up from Germany army stations located at a considerable distance away from the front.

This fact caused much consternation amongst the Frenchmen, who could not realise at once why we were doing so much better in this direction than themselves, and they, therefore, asked whether they might be allowed to come over and inspect our special receiving apparatus.

I remember very well the day that the French inspecting officer entered my wireless cabin. He just took one look at my valve and said: "Ah! That is the secret, it is the little lamp that is giving you the advantage over us," and from that day the French army also introduced the thermionic valve into their wireless receivers.

As a matter of fact wireless messages from the German field stations were often received and deciphered by the Allied Armies before the German station to which they were addressed had properly received them.

Interesting Work

One of the most interesting parts of the work carried out by the wireless signals during the war was that of direction-finding. By means of a series of wireless direction-finding stations, it was possible for us to locate the positions of German wireless stations.

A wireless direction-finding apparatus is an instrument capable of detecting the direction from which wireless signals originate, so that if you have two or three of these stations on a base line it is actually possible to locate the exact position whence the signals are coming. You will readily appreciate the value of this work as far as war is concerned.

Listening for the German Fleet

In England on the east coast there were a number of these stations, whose sole work it was to watch the movements of the German fleet. Every time a German battleship, submarine, or destroyer sent out a wireless message, these signals were immediately picked up by all these direction-finding stations and their position was plotted out on a large chart at the Admiralty, as was

How Wireless Helped to Win the War! (Continued)

intimated by Sir Alfred Ewing in his recent Press disclosures.

I do not think it is generally known that this direction-finding apparatus was to a large extent responsible for the great battle of Jutland.

The Zeppelins when they made raids on England also used their wireless to a great extent, and here again our wireless direction-finding stations were exceedingly useful for plotting out their journeys across the North Sea. As a general rule, however, as soon as they crossed the coast-line they ceased utilising their wireless, no doubt appreciating the fact that they were being watched by our wireless stations.

A Zeppelin Raid

On one particular occasion, however, I remember rather an interesting story in connection with one of our direction-finding stations, located in the Midlands. A Zeppelin raid was taking place and one particular Zeppelin was using its wireless considerably—all its messages being intercepted by this particular direction-finding station, and its direction from that station was periodically noted.

At one particular stage of this Zeppelin's journey, however, the operator at the direction-finding station became considerably alarmed by reason of the fact that his wireless direction-finding apparatus would show no direction whatsoever as to where the Zeppelin was. He could not understand this for the moment, and then it suddenly dawned on him that since there was no direction the Zeppelin must be directly overhead.

Directly Overhead!

He rushed out of his wireless cabin, and sure enough there was the big airship almost directly overhead with its engines purring away.

Another interesting story about the wireless war which I did not relate on the "ether" is one concerning the East.

A certain station was erected by the British Army on the eastern front for the transmission of wireless messages and for the interception of enemy messages. This station had an aerial supported from an enormous mast, and as soon as this station was erected it immediately performed most useful work, and was of great value to the service.

Unfortunately this mast lay directly in the path between Jerusalem and Mecca. Here lay the difficulty!

Shortly after operations had started an officer from general headquarters arrived one day together with one of the eastern potentates and informed the wireless officer-in-charge that the site would have to be altered forthwith as the mast, in view of its location, was offensive to the local natives' religious susceptibilities.

The station was changed at once,

LIONEL TERTIS, THE WORLD-FAMOUS VIOLA PLAYER

and the mast with considerable difficulty was dismantled and re-erected only a few hundred yards away which satisfied, politically, those on whose ground we were fighting.

In conclusion I would like to tell you an amusing story regarding a hoax which was played on the wireless section of the British Army, by a certain sergeant. This sergeant came to the wireless headquarters and said that he had invented a new wireless apparatus which made use of some hitherto unknown ray. He said that by means of his apparatus it was possible for him to take pictures of and locate pieces of shell embedded in wounded soldiers.

He was asked to demonstrate his apparatus, and was taken to one of the military hospitals, where we put his apparatus to test. It is reported that his apparatus consisted of a revolving cylinder with a needle moving across it after the fashion of the old phonograph. The manipulation of the apparatus was accompanied by the crackling of sparks. He took several photographs with his apparatus of wounded soldiers and located the positions of pieces of shell, and these photographs when developed were remarkably clear, and apparently helped the surgeons in their operations for removing these pieces of shell.

Extravagant Claims

Elated by his success, however, his claims became rather extravagant in that he said his apparatus was so potent that the rays from it would kill a rabbit if they were directed on this unfortunate animal although a few yards away. He demonstrated this effect and somewhat aroused the suspicions of his spectators. The rabbit, therefore, was taken away afterwards, unknown to the sergeant, and it was found that the unfortunate animal had been poisoned.

It was, therefore, necessary for his whole apparatus to be thoroughly investigated. This was difficult to do without arousing his suspicions. However, eventually, but not until after six weeks had elapsed, it was discovered that in spite of the fact that most of the wires of his apparatus had been substituted by pieces of string, unknown to the sergeant, he produced the results just the same.

Fooling the Army!

It was then found that the photographs which he had been producing were actually pictures drawn out by him on a sensitive plate by means of a piece of chemical in the dark room, where hitherto nobody except himself had been allowed to enter. He was a wonderful draughtsman, and had a good knowledge of anatomy, and had so fooled the medical and wireless sections of the army. As a reward for his little hoax he was given eighteen months hard labour.

Some time afterwards an officer in the War Office, with a towel round his head, endeavoured to explain in an official report how it was it had taken six weeks to detect this hoax.

Valve Soot: What It Is

VERY close examination of valves which prove to be getting defective will often disclose, when held up to a strong light, small quantities of black, fine, powder-soot—the "mystery," to most people, is concerning where this carbon deposit comes from.

Fig. 1.—Greatly magnified view of the valve mirror (inside), showing its semi-crystaline structure. It consists of sub-limed magnesium

This substance commonly arises only from the combustion of organic matter—for example: coals, paper, wood, cloth, and so on. The metal filament, and the bulb glass, are inorganic!

Now valve soot issues from glass-gas mainly, and partly from metal-gas, and water vapour, which can be readily demonstrated in the laboratory.

Liable to Deterioration

When high-quality valves are in good working order, and are carefully tended, their efficiency is remarkable; but on account of this high degree of superiority they are liable to deteriorate under influences which are not popularly known.

Whether the valve is filled with inert gas, or any other kind, or is merely a vacuum, minute leaks may permit the entrance of air; so also may water vapour pass.

The gas concerned with the trouble in question is known as carbon-dioxide, carbonic anhydride, carbonic acid gas, and CO_2. It is absolutely invisible; yet soot can be chemically precipitated from it.

A similar procedure follows within a valve. The filament gets over-heated, or otherwise affected, with the result that the oxygen of the invisible gas inside the bulb is gradually absorbed by it, and partly corrodes the wire. The carbon element of the gas, having thus been deprived of its oxygen companion, falls down as fine-grained soot.

"Silvered" Valves

Many valves have their glasses so completely "silvered" that the interior can hardly be seen; yet when they are carefully examined, the tiny black specks can be seen, and may be shifted about like a pinch of dust.

It represents a loss of energy in the current which only the most delicate instruments can measure; yet it accounts for faults in reception which often puzzle the listener!

Researches are still being conducted into the amazing compound known as "*glass-gas*," consisting of carbon-dioxide and water-vapour delivered from the air. Valve-glass has actually been proved to be *ultra*-minutely porous—panes, in a similar sense,

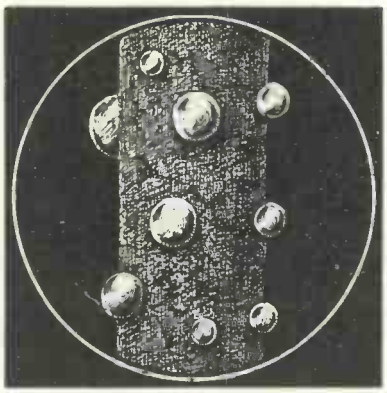


Fig. 2.—Greatly magnified view of valve wire with globules of condensed water vapour thereon. As the wire cools, and is subsequently electronised, these items appear and disappear

transmit daylight. Mr. Clifford C. Paterson, Director of the Research Laboratories of The General Electric Company, Ltd., Wembley, said in an address before The Royal Society of Arts, on February 16, 1927:

> The word "occluded" is used to cover this latter state, the precise nature of which is not very well understood.

But we can *see* the results, partly explained in the diagrams. The air,

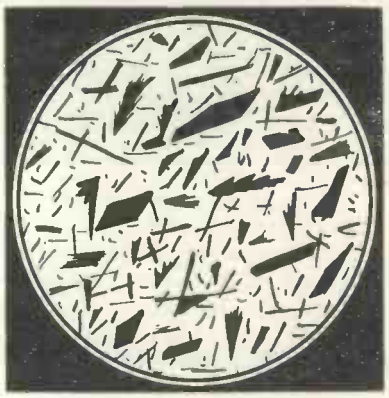


Fig. 3.—Greatly magnified view of valve soot, precipitated from carbon-dioxide, derived from "glass-gas," and "metal-gas," water vapour, etc.

etc., passes in between the paler areas shown in Fig. 1; settles on the filament as shown in Fig. 2; and has its soot (carbon) isolated from it as shown in Fig. 3. JAMES SCOTT.

LA POLITESSE!

HOWLING to show disapproval of a certain broadcast item is the latest form of radio bad manners. If the howling were vocal, and confined to the home, well and good: but when it comes to *radio* howling, and done in the middle of something of which the oscillator does not approve, well, I ask you. . . .

A Certain Cure

There is nothing much which virtuous listeners can do to prevent this, but if anybody knows a friend or a neighbour who makes a habit of "booing" at radio artistes in this manner, here is an appeal to stop him at it.

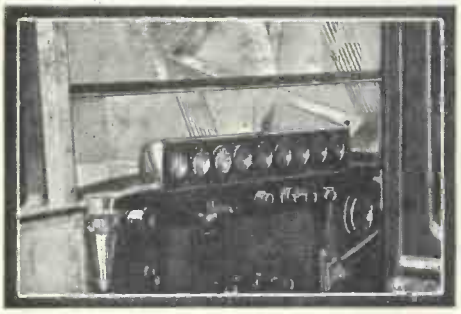
Phoning the B.B.C. to say "Please shut it off," is better for all other listeners—and just as effective.

A. B. B.

If You Want A Portable Set For Your Sidecar Turn To Page 497

You Will Not Be Getting the Best Out of Your Set Until You Know

What Simple Meters Can Show You



Do you realise that by using meters in a set you not only get better adjustments and better results, but actually save money by being able to check the consumption from your batteries? On the left is a photograph of a motor-car set equipped with no less than nine different meters. This article explains their uses

THE facia-board equipment of most modern cars includes a clock, speedometer, ammeter and oil-pressure gauge. None of these instruments is really essential, of course, but there are few drivers who would not feel uneasy if they could not obtain at a glance the information that the dials give concerning the running of the engine and so forth.

Meters are Handy Adjuncts

Although only infrequently does one come across a wireless set so lavishly equipped with instruments of all kinds as are the majority of car facia-boards, there are many reasons why voltmeters, ammeters and milliammeters are handy adjuncts of a wireless set.

The most obvious reason, too, is that it is possible to tell what is happening in very many receivers only by what comes out of the loud-speaker. It does not follow that the volume or purity of reproduction is an accurate guide to how a set is working, even when the reproduction seems quite good.

Hard to Trace

Matters are even worse when reproduction is *not* quite good, for then the cause of poor signal strength, distortion, or whatever it may be, is doubly hard to trace if loud-speaker output is the only guide available.

The type of measuring instruments which are useful accessories to an ordinary receiver are not necessarily expensive. Neither are they only suitable for bulgy-browed experimenters, or for use in laboratory sets. There is room in most broadcast receivers for at least two instruments, and there are, in the writer's opinion, few receivers that would not give better results owing to the accurate indication given of what is going on "inside."

Perhaps that may seem rather a big claim to make, but it is not so far-fetched as some of the hit-and-miss methods which many use to "test" their sets and to track down troubles.

A Concrete Case

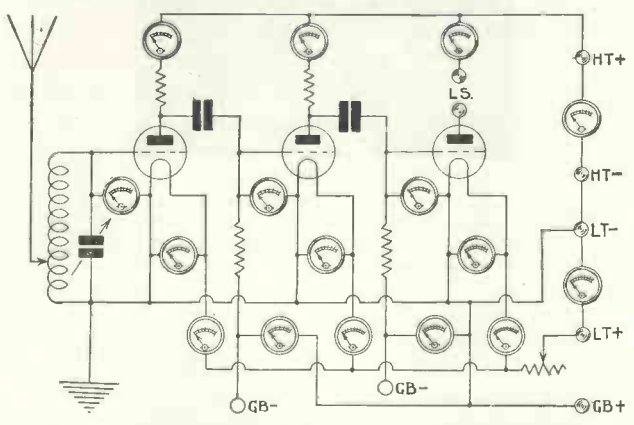
As an instance, let us take a concrete case. A three-valver, shall we say, incorporating two stages of L.F. amplification, suddenly refuses to work as it should. Volume is reduced a little, and there is quite noticeable distortion. The set is, nevertheless, quite sensitive and pulls in the distant stations in the normal manner expected of it.

"Ah," the Wise Man will say, "there must be some little fault in the L.F. part of the set, the detector being O.K." The question then is: In which part of the amplifier is there a fault?

Cutting Out a Valve

The loud-speaker is disconnected from its normal output terminals and put in place of the primary of the last transformer, so cutting out the third valve. Distortion is still noticeable and strength is not up to normal.

"Ah," says the Wise Man again, "then the fault must be in the first low-frequency stage." A pair of phones is substituted for the primary of the first transformer, bringing only the detector into use. There is no distortion, and in every way the detector appears to be functioning correctly. The fault, therefore, is in the L.F. side, which is what was suspected at first, and the elimination "test" has done nothing but waste time and confuse.



This diagram gives some idea of what a three-valver would be like were it equipped with every possible meter

Possible Faults

Thereafter, without proper measuring instruments, the unlucky set-owner is working in the dark to trace the mysterious trouble. High- and low-tension voltages may be incorrect (the H.T. battery or accumulator having become discharged), one of the valves may have lost its emission, and many similar faults may be present which are most difficult to track down without ammeters, milliammeters and voltmeters.

There is no prize for guessing the cause of the distortion and loss of volume in the receiver cited in the foregoing example !

Increase of Resistance

The whole trouble was due to a slight accidental increase in the resistance of the master filament rheostat. Low-tension current was reduced, causing distortion in the L.F. stages, but not affecting detector sensitivity in any way. The fault could have been located in a few minutes with a low-range voltmeter placed across each set of filament legs in turn.

A good high-range voltmeter reading up to about 120 volts (and by a *good* voltmeter is meant one which requires a minimum of current for full-scale deflection) would be a positive assurance that the H.T. battery was not run down.

A milliammeter placed in the final output circuit is a check on high-tension current consumption and also detects distortion

Moreover, it would have shown that each section of the battery was in order, and that the voltage at both first-L.F. and detector tappings was approximately what it should be.

A milliammeter placed in turn in the anode circuit of each valve would show whether or not the emission was satisfactory, and without much difficulty would show if distortion was being produced in first or second low-frequency stages, or both.

Indicating Distortion

When the receiver was once more working satisfactorily the milliammeter could occasionally be placed in the anode circuit of the power valve, in series with the loud-speaker, to indicate if distortion is occurring. Tests might also be made with high-tension and grid-bias voltages in an attempt to cut down the steady H.T. current without affecting purity of reproduction.

When a milliammeter is placed in the anode circuit of a valve, distortion which is produced in that valve (by the grid signal voltages swinging over on to the top and bottom curved parts of the characteristic) can be *seen*, and often it is possible to check very slight distortion which is shown by the milliammeter and yet which is not noticeable to the ear.

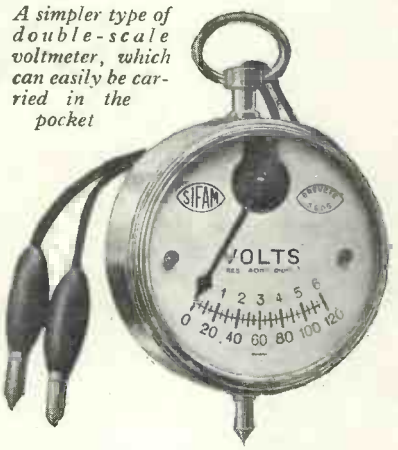
A valve working properly on the straight part of its curve gives a practically steady milliammeter reading. Swing-over on to the top or bottom curves, and consequent distortion, will cause the milliammeter to show a large deflection from its normal reading. This is a positive test.

It is not suggested that valve-set owners should go to the expense of purchasing instruments of laboratory accuracy, nor when good instruments are obtained need they be permanently incorporated in a set.

Dual-purpose Meters

Dual-purpose ammeters and voltmeters are to be obtained: for example, a meter to read both high- and low-tension voltages, or to show high-tension voltage and current may be purchased, and saves the cost of two distinct instruments for two distinct purposes.

Tapping points should be provided in the set so that the flexible leads from the meters may conveniently be placed in circuit. In the anode circuit of each valve, for instance, there should be two small terminals mounted on an ebonite strip, each pair being ordinarily connected by metal straps. When there is reason to suspect distortion the straps may be removed and the milliammeter placed in turn on each pair of terminals, the needle deflection being noted.

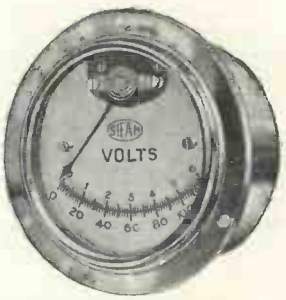


A simpler type of double-scale voltmeter, which can easily be carried in the pocket

Perhaps the best way to become convinced of the real need for accurate electrical measuring instruments is to purchase a full set—milliameter and high- and low-voltage meters. The frequency with which your wireless neighbours will want to borrow one or the other of the set will more than convince you !

And now, just a word as to the construction of the instruments themselves, and to the points for which purchasers should be on the look-out.

Most amateurs will be aware that



This is a double-scale voltmeter which can be used for checking low-tension and high-tension voltages

voltage measures of all kinds have as high a useful resistance as possible, this being obtained by winding on a large number of turns of wire. Current measurers, however, no matter whether ammeters or measurers of milliamps, must have as low a resistance as possible, for meters of this kind are placed in *series* with the circuit to be tested. Any undue resistance in the meter itself would upset conditions and cause a false reading to be obtained.

High-resistance Voltmeters

Cheaply-made voltmeters, say for testing H.T. values, will give a false reading if there is insufficient wire on the armature or field. The resistance of the meter will be such as to cause appreciable current flow from the battery which is being tested. The load will be above the normal, and a false reading will be given. A *good* voltmeter should consume the minimum of current for full-scale deflection. Similarly, ammeters and other *current* measurers should have as low an internal resistance as possible. With these points to guide him, the reader should have no difficulty in choosing a reliable instrument. QUEUE.

Continental Studios

How They Put the Broadcast Artist At His Ease

An interesting article by BERNARD NEWMAN, the Leicestershire humorist, who has broadcast from many of the principal Western European stations

THERE is a school of thought, I believe, which holds that even an inanimate object creates its own atmosphere. I am quite ready to subscribe to this doctrine so far as broadcasting studios are concerned; the identification of studios by their atmospheres would be no impossible task.

Those atmospheres are influenced by two principal contributories—the mere furnishings and decorations, and the personality of the studio staff.

Little to Learn

The B.B.C. has little to learn from Continental radio organisations in respect to wireless technicalities, on the contrary, the Continent can—and does—learn a good deal from the B.B.C. We are primarily a practical nation; most Continental races are primarily intellectual.

So it is not surprising to find that, while following us in technical developments, they lead us in many psychological details. The detail in which I am particularly concerned is the mental comfort of the performer.

The London studios represent the last word in manipulative efficiency—but their effect upon a sensitive mind is appalling. One's own personality is quite lost in the purely neutral surroundings. Thick carpets cover the floor; the walls are completely hung with heavy curtains, maybe the roof is padded. All this is to eliminate reverberation—a very essential precaution.

Prevailing Deadly Gloom

But the colour scheme is deadly in its gloom. I cannot recall the shades—so confused is the effect—but there is a medley of fawns and greys and drabs—an unreal mixture of all that is damping to the spirits. The colour atmosphere is that of a sombre vault; even the microphone itself is camouflaged to suit its dreary surroundings.

The place is as unreal as the drawing-room set used by an amateur dramatic society; the atmosphere is that of a certain non-calorific frigidity.

I have met this atmosphere of depression at no Continental station. One difference alone suffices for explanation—colour. Abroad, true, they have their carpets and curtains—but pleasing and enlivening shades everywhere present an entirely altered aspect.

Primary colours are a little startling at first to the English eye—but the start is a vigorous impulse, not a depressing droop. Soon the atmosphere tells; I recall the greens and reds of Cologne, where the principal studio is an artistic delight.

BILLY MAYERL, OF SYNCOPATION FAME

I remember noticing at a Paris station that even the music stands for the orchestra were painted a vivid scarlet. I do not suggest such extremes for England. But who can overestimate the influence of colour? Who would not rather fight among the green hills of Champagne than the brown plains of Flanders? And why not changeable colour schemes, to match the type of piece being broadcast?

I have said, too, that the atmosphere of the studio is affected by the personality of its staff. In London the artist is greeted with a politeness which is unfailing, but which is impenetrable. People move about in a detached manner of aweing silence; even the mechanicians perform their task with a grim efficiency that is disconcerting.

The artist feels that he cannot "get under the skin" of the organisation. Everything is so impersonal.

Compare this with the frank effusion of the reception at a Continental studio—it may be overdone. but it is very agreeable to one about to face an ordeal. The artist is welcomed as a friend, as a comrade in art. He is introduced to everyone in the station, and is made to feel that the place is at his service. Before he performs, the artist has caught the atmosphere of a family party, and can give of his best.

No Nerves at Brussels

Of all the Continental stations, I award the palm to Brussels, for the warmth of its welcomes. It is a small station, rather meanly housed—it occupies merely the attic floor of a building devoted to companies connected with the Congo. But no one could broadcast from Brussels and be troubled with nerves.

At Barcelona, too, the social atmosphere is delightful, And there, it must be remembered, the artist does not get the superficial politeness of the Castilian, but the natural courtesy of the Catalan. At Barcelona they have an excellent method of putting a stranger at his ease—invariably an audience is provided. This makes a wonderful difference—for the audience is select and sympathetic.

Bridging a Gulf

The art of true entertainment demands that the entertainer and his audience should be one; usually the microphone breaks a vital link in the chain. But the gulf can be bridged by the presence of a small understanding audience in the room.

At Barcelona they specialise in producing audiences which will respond to the artist's own mood. Here is an idea for a new profession. We have professional performers—why not professional listeners? Of the two, I would not say that the competent listener is the lesser artist.

Successful Short-Wave Reception

By J. H. REYNER, B.Sc., A.M.I.E.E.

WITH the increasing number of short-wave broadcasting stations in operation, there is a great deal of pleasure to be experienced in these regions. The fact that reception is obtainable from such relatively enormous distances (half-way round the world being achieved at certain times with clock-like regularity) adds considerably to the fascination of listening.

A Little Prophecy

One feels inclined to prophesy that in a little while short-wave reception will become much on a par with ordinary broadcast working and every enthusiast will have a short-wave set permanently wired together with his broadcast receiver, so that he can switch over to his programme from America, Australia, or some other part of the world whenever he feels disposed.

It was determined quite early in the days of wireless transmission that the absorption of waves by the atmosphere increased rapidly as the wavelength was reduced. This led to the assumption that reception on short waves (below 200 metres) would be quite impracticable.

Moreover, as the frequency increased so the stray capacity effects became more and more troublesome and such difficulties as hand-capacity effect became very pronounced. All this tended to the production of a myth regarding short waves that they were exceptionally difficult to handle.

Long-distance Work

As a matter of fact, this is not the case. Amateurs, driven largely by regulations to experiment below 200 metres, found that long-distance reception was indeed quite possible on such wavelengths. They found certain difficulties due to the higher frequencies employed, but these were successfully overcome and, to-day, we are working satisfactorily on frequencies ten to fifteen times as great as those employed on the ordinary broadcast band with the same facility as obtained with an ordinary receiver.

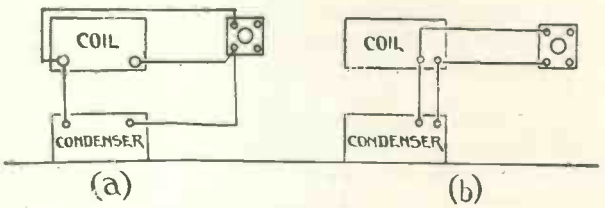
The principal point to be remembered is this large difference in frequency. Any effect which tends to increase this frequency, therefore, will be more pronounced on the short waves. Hand-capacity effects have already been referred to, these being due to the capacity between the operating parts of the set and the body. Therefore, as far as possible, all parts with which the hand comes in contact must be arranged to be at earth potential or connected to the low-tension terminal.

The use of a metal panel is often employed on short-wave sets since this acts as an effective capacity screen and obviates such capacity effects. Another important point lies in the greater sharpness of tuning necessary on short waves owing to the fact that the modulations occupy a relatively smaller space.

A telephony modulation will occupy about a 10,000-cycle band. At a frequency of 1,000 kilocycles (one million cycles per second) this is 1 per cent. At a frequency of 10,000 kilocycles, corresponding to 30 metres, this difference is only .1 per cent. Thus, if we are tuning with the same value of condenser, the actual space occupied on the condenser will be only $^1/_{10}$ as great, which means that the tuning is extremely sharp.

In practice, largely owing to this effect, we utilise rather smaller condensers, and a value of about .00015-microfarad instead of .0005-microfarad is more usual, since this produces a discrepancy of the order of 3 to 1 instead of 10 to 1.

Slow-motion dials or slow-motion condensers are essential, and a certain amount of care must be taken to avoid extraneous noise in this connection. For example, if there are two rubbing surfaces in the condenser of dis-similar metals, there is a danger from contact potential effects, so that when the condenser is rotated, cracking noises may be obtained.



Figs. 1a. and 1b.—How a Short-wave Tuner can be connected up

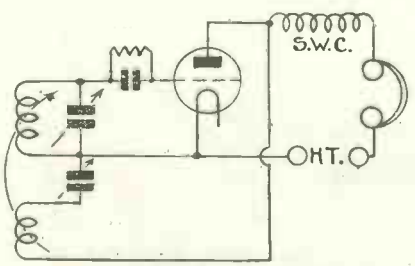


Fig. 2a.—Straightforward Reinartz Circuit

Pigtail Difficulties

This is sometimes obtained with pigtails if this has several convulutions which touch as the condenser is rotated. Small short-circuited loops are formed in which currents are set up momentarily every time a contact is made or broken and this results in interference. The difficulty is not usually serious, but occasionally gives trouble. Difficulties have been known to arise due to noisy slow-motion dials, contact potential effects being set up by the mechanism of the dial itself.

Apart from any electrical features such as this, it is necessary that the dial or condenser shall give a very smooth and steady action without any backlash. It may not be possible to observe such backlash by eye, yet on tuning, it is found that if the dial is rotated one way and then rotated back again a small amount, it does not tune-in the station once more, but either lags slightly or goes

Successful Short-wave Reception (Continued)

too far and runs right through the required point.

Such points as these, of course, are taken into account by the designers of short-wave apparatus, and condensers used in WIRELESS MAGAZINE short-wave receivers may be relied upon to be satisfactory since they have actually been tried in operation.

Various Factors

In the design of a short-wave receiver various factors have to be examined. While it is true that a set capable of operating satisfactorily on short waves will also work excellently on broadcast wavelengths, the converse of this is not true.

Owing to the very high frequencies involved, it is necessary to use small inductances of the order of 5 or 10 microhenries only, and these consist of a very few turns of wire. Indeed, on the very short waves the tuning coil itself may possess only three or four turns, and in such circumstances the actual length of wiring in the receiver may have some considerable effect.

Permissible Long Leads

The principal point to remember here is that any long leads which may be necessary must not be included in the actual tuning circuit. The leads from the tuned circuit to the valve may be fairly long without causing any serious difficulty.

This point is better explained by reference to Fig. 1. Here two alternative arrangements are shown for wiring a tuning coil to a variable condenser, and connecting the tuned circuit to a valve. In the first place the lead to the valve is kept very short and the leads connecting the coil and the condenser are long and far apart. There is thus a completely closed loop of wire as indicated, and such a loop may have an inductance equal to, if not greater than, the short-wave tuning coil actually in use.

Better Layout

The second layout is far better, for the tuning circuit is wired with relatively short leads, these leads being kept comparatively close together. There is then a longer lead to the valve, but this lead is not carrying any appreciable current. It simply serves to transfer the voltage developed across the circuit to the valve, and, therefore, beyond a certain small leakage due to the capacity-current, no serious difficulties will result.

The principal case where difficulty would occur from such a cause in a simple single-valve detector circuit would be in obtaining the necessary oscillation. Often it is found that a circuit rigged up as a perfectly straightforward Reinartz arrangement will refuse to oscillate, and on a closer inspection it is found that there are closed loops in the wiring giving sufficient coupling in the wrong direction to nullify completely the effect of the deliberate reaction provided, so the circuit will not oscillate.

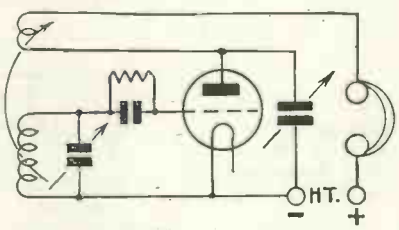


Fig. 3—In this circuit reaction is controlled by a shunted condenser

Clearly in any case where high-frequency amplification is used, this point must be given particular attention and the possibility of high-frequency amplification on short-waves is not by any means too remote. There are, indeed, one or two arrangements already in existence whereby good and definite amplification can be obtained prior to the rectifier valve.

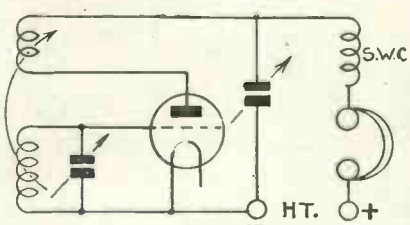


Fig. 4—This circuit shows the use of a short-wave choke

This question of reaction is one of great importance for, when using a simple detector valve, it is clearly necessary that the circuit should be capable of being brought right up to the oscillation point. The valve is then in its most sensitive condition and will give a very large amplification, and it is only under such circumstances as this that satisfactory reception is possible.

To do this, it is necessary first of all to ensure that the layout is good and, secondly, that the reaction is smooth in operation. The first point lies within the province of the designer, while the second point is also very largely under his control. It is usual to vary the reaction effect obtained by means of a condenser inserted in the reaction lead and some modification of the Reinartz principle is usually employed. Various possible forms of circuit are shown here.

Reinartz Circuit

The first (Fig. 2) is a straightforward Reinartz circuit, the variable condenser being so arranged that its moving plates are at earth potential to avoid hand-capacity effects. This is most important. The second method is shown in Fig. 3 in which a permanent reaction effect is arranged, the current passing through this being shunted by the condenser. Increasing this variable condenser causes the oscillation to cease.

Third Variation

A third variation is shown in Fig. 4, where the impedance of the telephones and batteries in series is allowed to act as a choke. This impedance is shunted by a variable condenser and as the value of the condenser is increased so more and more reaction effect is produced. If necessary, a high-frequency choke may be deliberately inserted at the point S.W.C. in this circuit, such a choke being one of the short-wave components specially designed for this class of work.

Good and Smooth Reaction

Any of these circuits properly arranged will give good and smooth reaction provided that the detector valve is operating satisfactorily. This is, perhaps, the most vital point of all, it being necessary to ensure that the detector valve is operating on a satisfactory part of its characteristic. There are various ways of accomplishing this; one of the simplest is to provide a variable grid leak for the

detector. The grid leak must be of a type which will give silent operation, as any crackling or other noise will immediately spoil the reception.

Value of Potentiometer

Another very good way of achieving the required results is to connect the grid leak, not to low-tension positive, but to a potentiometer across the low-tension battery. With the grid leak connected to low-tension negative the reaction is very smooth, but the rectification efficiency is impaired. As the slider of the potentiometer is moved over towards the positive side, so the strength gradually increases until a point is reached where the reaction becomes ploppy or jerky. Just before this point is the best operating condition.

When the best arrangement has once been found it can be left set, so this potentiometer can be mounted on the baseboard if desired. The actual setting depends upon the valves in use. A final point is that it is usually preferable to take H.T.— to L.T.—, as this again gives smoother reaction in practice.

Special Points

These are some practical points of interest to the short-wave worker. There are numerous points which can be discussed in this connection and it is impossible to go into these all in one short article. In general, however, one can summarise in the following terms:—

1.—Always follow the actual layout given by the designer as far as possible. The apparently trivial alteration of a wire may make a considerable difference to the operation of the receiver.

2.—Read what the designer has to say about the operation of the receiver. He will tell you its various idiosyncrasies, and indicate the way of obtaining the best results.

VALVE-LEG SPACING

VALVE-LEG templates are handy things, but often when needed most they are not to be found. Here are the actual measurements between the centres of the various legs, so that, at a pinch, a template may be dispensed with. Grid and plate-leg centres, 21/32 in. apart; filament-leg centres, 5/8 in. apart; distance between filament-leg centres and grid-leg centre, in a line parallel with that joining plate and grid, 1/4 in. BIM.

Broadcasting Organs and "Organestras"

WITHIN the last year or so organs of the "Wurlitzer" type have sprung into favour in all the modern "super" cinemas, and as the conditions are eminently suitable for broadcasting, the peculiar tones of cinema organs will be well known to most listeners.

The music, as primarily suitable for film-play accompaniment, is always of the "popular" variety, or mettzo-brow, as one might say.

TO A FICKLE JADE

Who is using a Television Instrument

Though thou sayest with decision
Thou art sad without me, Grace,
Thou forgettest television—
'Tis refuted by thy face.

Thou hast told me that thou yearnest
To be with me, to be here—
But I see the face of Ernest
(Nasty blighter!) lurking near.

Television oft reminds us,
Though Love's dream may seem sublime,
There are other chaps behind us
And thou flirtest all the time!

Leslie M. Oyler

That makes it very acceptable to many.

Cinema organs differ from conventional church organs in very many respects; in fact it is hardly correct to refer to the former as "organs." They are, more correctly, organestras; they replace a combination of organ and orchestra.

Most of the pipes are reeds, that is, they produce sound by the forcing of air against a metal lip enclosed in the pipe, exactly as is done in a motor horn of the bulb variety. This produces the reedy tones which are peculiar to cinema organestras and to the "swell" manual of church organs Church-organ pipes, for the most part, are giant penny-whistles, and produce sound by blowing air against a sharp-edged lip. There are a certain number of reed pipes in a church organ, however.

Best for Broadcasting

The reed tones are more suited to broadcasting, owing to the peculiar arrangement of the harmonics. Moreover, the lowest bass notes of any instrument do not broadcast well. Cinema organs, as a rule, do not have very deep "pedal" notes, whereas many church organs have pipes 64 ft. in length, giving notes too low to reproduce well on most loud-speakers.

The "quivering" of cinema organs is caused by a fan placed in the main air duct, and while high-brows may not always approve of the persistent use of this device, known as the tremulant (which is fitted to, but seldom used on most organs for "serious" work) it certainly breaks up the reedy tones and makes them more acceptable.

It is generally known that organs have more than one manual or row of keys. Most "organestras" have two manuals, and there are, of course, literally hundreds of pipes in connection with each keyboard. Cinema-organ pipes are all enclosed in large compartments, known as swell boxes, fitted with a moving front like a venetian blind. The volume of sound is regulated by opening or closing these shutters.

Easy for the Engineer

From the broadcasting engineer's point of view it is easy to arrange a position for the microphone in which it will be at an equal distance from the one or two swell boxes.

In the case of church organs, however, the pipes are not always grouped. Some may be close by the "console," or keyboards, while others may be in a different part of the building. This increases the difficulty of microphone placing, and hence the engineer's fondness for the "one unit" cinema organs. DIAPASON.

The PILGRIM PORTABLE

An Unobtrusive Headphone Set for the Holidays: Designed, Built and Tested by the "W.M." Technical Staff

BY dispensing with a loud-speaker and using headphones the bulk and weight of a portable set can be cut down very appreciably, since there is no need for high amplification and large power output: whilst, in addition, it is possible to use a much smaller frame aerial, which means that the dimensions of the cabinet can be reduced.

Headphones have been condemned by some as uncomfortable and unsociable, but still they have their advantages; and under some circumstances, can be used where loud-speakers are out of place.

Good for a Walking Tour

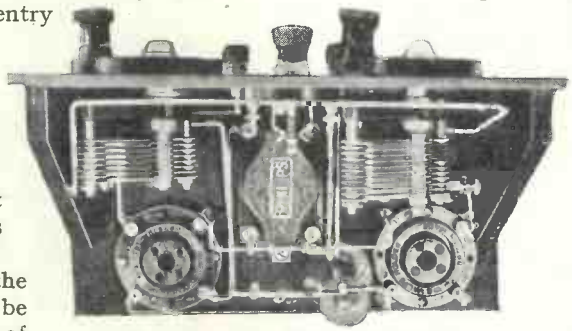
The object in designing the Pilgrim was to build a set which could be called portable in the true sense of the word; a set, in fact, which might be taken by one person on a walking tour without adding appreciably to the bulk or weight of his baggage.

The receiver, for which constructional details are given in this article, is housed in a cabinet measuring only 13 in. by 11 in. by 6 in.; whilst the weight, complete with batteries and headphones, is almost negligible.

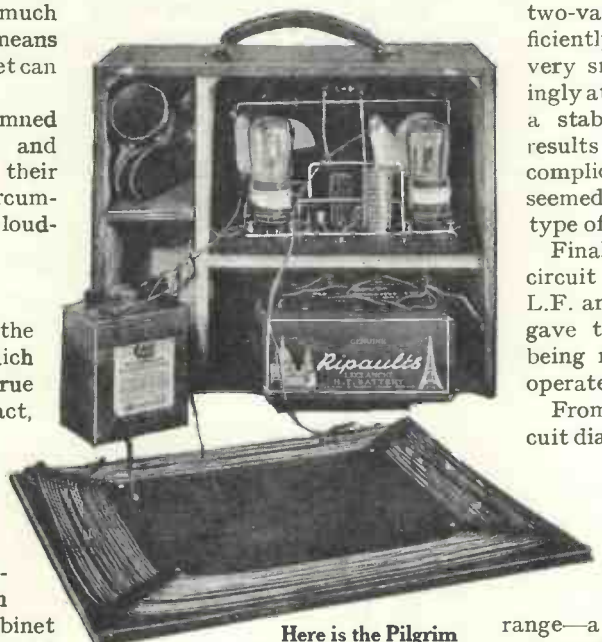
Both in daylight and at night loud phone reception is obtained from the local station within at least forty miles and from Daventry Experimental within at least 100 miles. There would be few places in this country which would be out of range of one station, whilst in most parts two stations could be heard.

From a glance at the photographs it can be seen that the interior of the cabinet is divided into several sections. The set itself fits into the top compartment; immediately below this is a compartment for the 60-volt H.T. battery which has tappings for grid bias. At the side an unspillable C.A.V. accumulator is housed, whilst immediately above this there is space for a pair of headphones.

The back of the cabinet, which is made of three-ply wood, supports the frame aerial: this must be removed in order to inspect the H.T. and L.T. batteries. The headphones can be reached by opening the hinged flap in front of the cabinet, which exposes the tuning controls. A leather strap is fixed to the top of the cabinet so that the set can be carried when broadcasting is actually being received.



Plan view of the Pilgrim Portable



Here is the Pilgrim Portable from the back

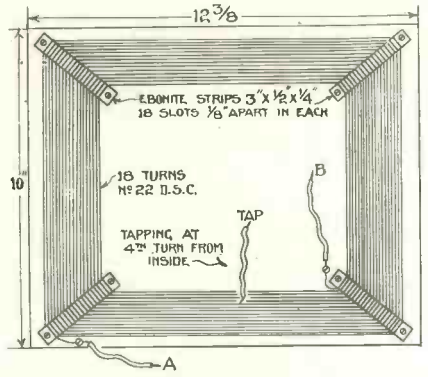
Ideal Portable Circuit

Some experiments were made with the object of finding an ideal two-valve circuit for portable use; it was at first doubtful whether a straight two-valve circuit would be sufficiently sensitive to operate with a very small frame aerial. Accordingly attempts were made to obtain a stable reflex circuit, but the results did not justify the extra complications and distortion which seemed to be unavoidable with this type of circuit.

Finally the straight two-valve circuit with a detector and one L.F. amplifier was chosen, since it gave the required results whilst being more stable and simple to operate.

From an examination of the circuit diagram, it will be noticed that both the grid and reaction inductances are included in the frame winding; with this arrangement, the reaction is almost constant throughout the tuning range—a boon to the operator.

In consequence 5GB and the local



Details of the frame winding for the Pilgrim Portable

station could be received well without altering the reaction condenser, although the latter was uncomfortably loud for the headphones and could be heard on the loud-speaker.

The Wearite H.F. choke undoubtedly helps in obtaining constant reaction control and also prevents H.F. oscillations from getting into the L.F. amplifier and causing distortion. One of the new Philips transformers has been used since its compact size and large primary inductance, combined with a step-up ratio of 3 : 1, make it particularly suitable for portable sets.

Compact Condensers

The compact size of the variable condensers, used for aerial tuning and reaction, make it possible for the size of the panel and baseboard to be kept small. These condensers are controlled by diminutive slow-motion R.I. and Varley dials, which on account of their size and smooth motion are most suitable for a small portable set.

No difficulty will be encountered in the construction of the Pilgrim Portable if use is made of the full-size blueprint. This is No. W.M.94, and can be obtained for half-price, that is, 6d. post free, if the coupon on page iii of the cover is used by August 31. Address your inquiry to Blueprint Department, WIRELESS MAGAZINE, 58/61 Fetter Lane, E.C.4.

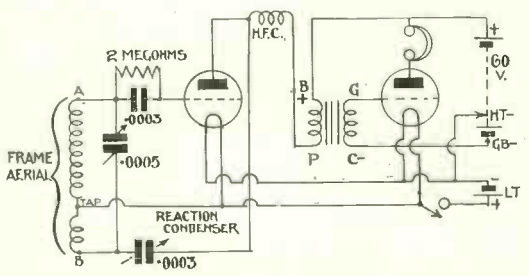
Since the panel measures only 9 in. by 6 in. and the baseboard 9 in. by 4½ in., the components must be spaced carefully. It is advisable first of all to drill the holes for the variable condensers. It is necessary to place a few washers behind the panel in order to prevent the single-hole fixing sleeve of the variable condenser from extending beyond the fixing nut and, in consequence, keeping the dials away from the panel.

As soon as the condensers are mounted on the panel the latter can be placed up against the baseboard and the L.F. transformer mounted on the baseboard exactly between the two condensers. Then the remaining components, consisting of the valve holders, H.F. choke, and grid leak, with condenser, can be fixed in position.

Place the valve holders sufficiently far from the variable condensers to allow insertion of the valves. The grid leak and condenser will have to be mounted behind the first valve holder, since there is insufficient room in front.

As soon as the components are screwed into position, the two telephone terminals and "on-off" switch can be mounted on the panel.

(Above) Tuning-in the Pilgrim Portable. (Right) A happy half-hour out of doors



Circuit of the Pilgrim Portable

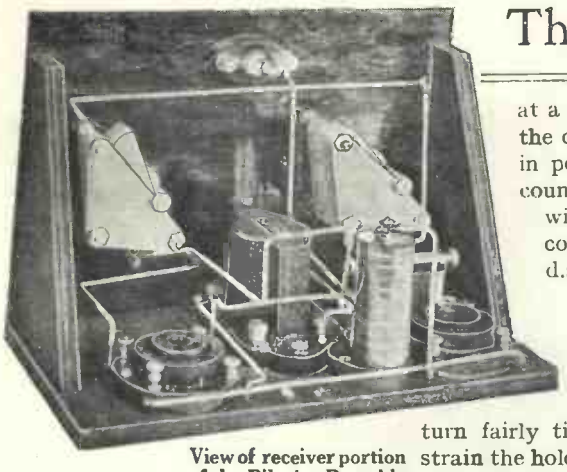
No Difficulty in Wiring

The actual wiring should present no difficulty; it will be simpler to commence with the grid leak and condenser, as this component is not fully accessible and might be further obstructed by leads from the aerial-tuning condenser. Connect the moving plates of the aerial condenser to positive filament, in order to reduce hand-capacity effects when tuning in.

A short length of red and black twin flex terminating with plugs, forms the connections to the H.T. battery; whilst a similar length with spade connectors is taken to the L.T. accumulator. A single lead only from the "G—" terminal of the L.F. transformer is required for grid bias. Otherwise, wire up in the alphabetical sequence indicated on the wiring diagram.

Winding the frame aerial requires a little care if it is to look neat and fit properly into the back of the cabinet. The

The Pilgrim Portable (Continued)

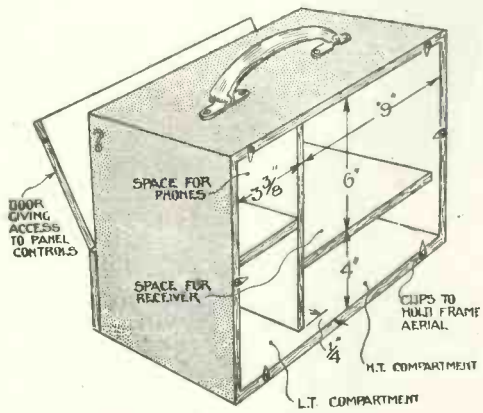


View of receiver portion of the Pilgrim Portable

total thickness of the $\frac{3}{16}$ in. plywood back and winding must not exceed $\frac{3}{8}$ in.; therefore $\frac{3}{16}$ in. is allowable for the thickness of the winding supports.

Supporting Strips for Wire

With a small hand-saw or fret-saw, cut 4 strips of $\frac{3}{16}$ in. three-ply wood, measuring $3\frac{1}{2}$ in. by $\frac{1}{4}$ in. At a distance of $\frac{1}{4}$ in. from the end cut a succession of twenty-three grooves spaced $\frac{1}{8}$ in. apart in each strip, using a saw and slanting the grooves slightly in order that the frame winding will hold itself in position.



Details of cabinet for the Pilgrim Portable

IF YOU WANT A REALLY GOOD LOUD-SPEAKER PORTABLE BUILD THE CHUMMY FOUR.—FULLY DESCRIBED IN THE JUNE ISSUE OF THE WIRELESS MAGAZINE

Winding the Frame Aerial

Place the strips at the corners of the plywood back, pointing diagonally at a distance of $\frac{3}{4}$ in. from the corners and screw them in position with $\frac{3}{8}$ in. brass countersunk screws. The winding may then be commenced with No. 22 d.s.c. or d.c.c. copper wire, first anchoring the end by winding it round a small brass screw fixed in the back. Pull each turn fairly tight, but do not overstrain the holding strips.

When the full twenty-three turns have been wound on, the end may be anchored to the back. It is advisable to stick a strong piece of paper or material over the grooves which carry the winding; Seccotine is an admirable adhesive for this purpose.

The winding must now be tapped at four turns from the inside end. Flexible leads are taken from this tapping to filament positive, from the inside end to the reaction condenser, and from the outside end to the grid leak and condenser.

The Pilgrim can now be finally assembled. Fit the panel and baseboard into its compartment, pushing the panel back sufficiently to allow the hinged flap on the outside of the cabinet to shut without touching the controls. Holes should now be drilled into the various compartments for the battery and phone leads.

As soon as the batteries are in position and connected up, the valves may be inserted in the holders and the frame aerial clamped in place. The grid-bias lead from the L.F. transformer should be plugged into the negative end of the H.T. battery and the negative H.T. lead put in the battery socket, giving from 1½ to 3 volts positive.

The set is now ready for use. Switch on the L.T. supply and rotate the reaction condenser until the set is just oscillating.

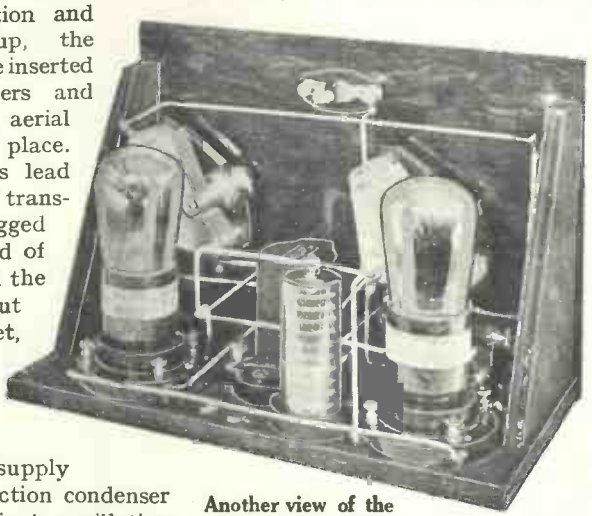
COMPONENTS REQUIRED

1—Ebonite panel, 9 in. by 6 in. (Becol, Radion or Parfait).
1—.0005-microfarad variable condenser (Peerless).
1—.0003-microfarad variable condenser (Peerless).
2—Anti-microphonic valve holders (W.B., Lotus or Benjamin).
2—Vernier dials (R.I. and Varley).
1—.0003-microfarad fixed condenser (Graham-Farish or Lissen).
1—2-megohm grid leak (Graham Farish, Lissen or Dubilier).
1—High-frequency choke (Wearite, Cosmos or Magnum).
1—Low-frequency transformer (Philips).
1—On-off filament switch (Bulgin, Lissen, or Lotus).
1—60-volt high-tension battery (Ripault, chocolate label).
1—2-volt unspillable accumulator (C.A.V. type 2NS9).
2—Terminals, marked: Phones +, Phones — (Belling-Lee).
1—Cabinet (Pickett's).

Operate the aerial-tuning condenser until the strongest carrier wave is heard; then rotate the entire cabinet. There will probably be one position of the cabinet when the carrier wave will become very weak: turn the set so that it is facing at right angles to this position and decrease the reaction until oscillation ceases. Then retune until comfortable strength is obtained.

Suitable Valves for the Pilgrim

A number of different types of valve will work efficiently in this set, perhaps the best combination is a medium-impedance valve (20,000 to 30,000 ohms) for the detector stage, and an L.F. valve with an A.C.

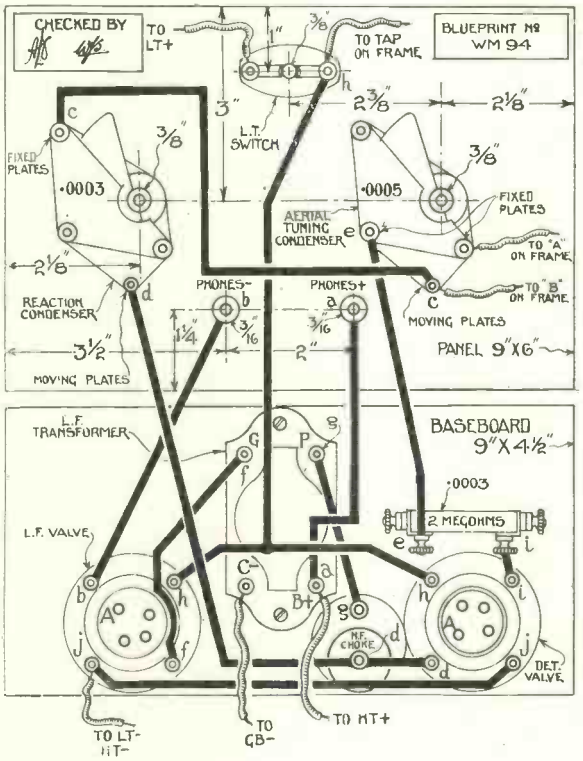


Another view of the Pilgrim Portable

For Really Good Headphone Reception

resistance varying from 11,000 to 22,000 for the final stage. Since an L.F. transformer having a high primary impedance is used some advantage may be obtained by using a fairly high impedance valve (40,000 to 60,000 ohms) in the detector stage. An ultra high impedance valve is not recommended.

Almost any headphones can be accommodated without difficulty in the Pilgrim Portable, and those who wish to keep down the cost of construction will find a pair of Lissen phones very satisfactory. This photograph shows a pair being packed into position at the end of a pleasant afternoon's outing



This layout and wiring diagram of the Pilgrim Portable can be obtained as a full-size blueprint for half-price, that is 6d. post free, if the coupon on page iii of the cover is used by August 31. Ask for No. W.M.94. When wiring up first connect those points marked *a*; then those points marked *b*; and so on, in alphabetical sequence

"Different" Crystal Circuits

"THE humble crystal set," as some people call it, does not, sad to say, present so much opportunity for stunt-merchants' activities as do valve sets.

When All Is Said

By this I mean that, when all is said and done, a crystal set consists of a tuner, a detector, and a pair of phones. One may have phone-shunting condensers, dual detectors, unique tuning arrangements and so on: but the basic circuits are not really altered.

Crystal sets have not yet reached finality, however, because, relatively speaking, their present actual signal efficiency is poor. Chiefly this is due to detector resistance, and to overcome this it is possible to use two detectors simultaneously. This can be done by placing the detectors in parallel in an ordinary set, but with H.F. chokes in each of the leads from the detectors to the phones. The phones are thus in the common circuit. Without the H.F. chokes the arrangement will not work at all, as one detector will "short" through the other.

In the Shadow

The advantage of using two detectors to lower the resistance is to be found when a set is worked right under the shadow of a broadcasting station, and one detector alone may have a limiting effect. P. K.

Toy Balloons and X-Rays

RECENTLY, I witnessed an interesting little laboratory experiment which gave me "furiously to think" about ionised air, the Heaviside layer and similar matters.

Two balloons were each suspended on silk thread and slightly charged statically so that they repelled one another. A small X-ray tube (working from a quarter-inch spark coil) was then set in operation and an X-ray beam projected towards the balloons.

Immediately the beam came in their locality they fell from their erect position as though the static electric charge had suddenly leaked away—as, indeed, it had.

The X-rays ionised the air and made it impossible for the balloons to retain their mutually repelling charges.

If there are natural X-rays—by no means a physical impossibility—they must exert a similar effect upon non-ionised air near the Heaviside layer, and perhaps increase its depth.

Incidentally, this balloon experiment is the basis of a simple method of measuring the intensity of X-rays. QUEUE.

Half Hours with the Professor

A CHAT ABOUT SCREENED-GRID VALVES

"I SAY, Professor," said young Amp one day, as Megohm and he were out for a stroll, "what are these screened-grid valves that people talk about such a lot now?"

Megohm smiled. "You're insatiable, aren't you Amp?" he said, shaking his head sorrowfully. "Here we are walking along a perfectly good country road in perfectly good sunshine——"

Still Wireless!

"With perfectly good grass in the fields and perfectly good birds in the trees," chanted Amp, "and still I want to talk about wireless. Is that what you meant to say? Well, anyhow, why shouldn't I?"

"I suppose there is no reason why you shouldn't," said the Professor half regretfully. "What was it you wanted to know, anyway?"

"Well, I thought perhaps you might spill a few beans about screened-grid valves."

Megohm shuddered. Then: "What about them. I suppose you've seen one?"

"I saw one at the last Exhibition, but that didn't help me very much. It seems to have two ends to it, anyway, and I couldn't tell which way up it was and that's about all 'cos I could not afford to buy one."

Megohm's Magic

Megohm put his hand in his capacious pocket and produced a screened-grid valve and a pair of pliers. Amp, speechless with amazement, watched him return the pliers quite unconcernedly to his pocket, after which he held the valve up between his finger and thumb. Then, as he caught sight of the boy's astonished gaze he said: "Why, what's the matter, boy? You don't think it will explode, do you?"

"Do you mean to say that you carry valves about in your pocket like that—all mixed up with pliers an' things?"

"Why not?" said the other with a short laugh. "It's as safe as leaving 'em on a bench to get knocked over. I don't usually take them for a walk with me, I admit, but it's rather fortunate for you that I have. I forgot to take it out of my pocket before we came out to-day."

SCREENED-GRID VALVE SETS FOR THE HOME-STRUCTOR

The Screened-Grid Three, October, 1927 (page 219), Blueprint No. WM21.

The Chummy Four (portable) June, 1928 (page 399), Blueprint No. WM80.

The Screened-grid Four, June, 1928 (page 418), Blueprint No. WM77.

The All-the-world Five, March 1928 (page 107), Blueprint No. WM63.

A new screened-grid three-valver will be described next month

Amp gulped. He could not help feeling that if he had one of these treasured screened-grid valves, it would be kept very carefully wrapped in cotton wool, when it was not in use and, in fact, he would hardly dare to use it for fear of breaking it. "There's no hope for it," he thought, "I'll have to become a Professor."

Arrangement of Pins

"Perhaps, you will one day, my lad," agreed Megohm with a smile and Amp, realising that he had spoken his thoughts aloud, blushed furiously. "In the meantime," resumed the Professor, "let's have a look at the valve. You will see that it has three pins at one end and two at the other." Amp nodded. "The three pins are connected to the grid and the filament, and if you look you will see the triangular or V-shaped filament with a flat grid around it."

Here he passed the valve over to the boy who very cautiously examined it and distinguished for himself the filament and grid as the Professor had said.

Fine Wire-gauge Screen

"Now," continued Megohm, "right across the whole bulb, forming a partition across the middle, is a wire-gauze screen. This is actually continuous with a metallic ring which runs round the side of the bulb. You can make that out although you cannot see the ring very clearly because the inside of the glass on the right-hand side of the screen is silvered, due to the 'gettering'."

"I had an uncle who lived there once," said the boy, gravely.

"Merciful heavens," exclaimed the Professor in anguish. "A joke! Do you mean to tell me that you do not know what 'gettering' is?"

"Something to do with magnesium," said the boy, brightly.

How A Valve Is Silvered

"A little vague, but on a par with your average intelligence," was the reply, at which Amp grinned. "When a valve is made, a small piece of magnesium or other suitable substance is placed on the anode. During the exhaustion process the anode gets sufficiently warm to volatilise this and since magnesium is a powerful oxidising agent, it cleans up the residual gas inside the valve. The unused magnesium deposits itself on the inside surface of the glass, giving the silvered appearance as you have observed. However, that is quite incidental. To resume our discussion.

"If you look through the gauze screen which I have just told you about, you will see the anode of the valve beyond it. In fact, it almost looks as if it were part of the same piece of metal, but if you examine it

closely, you will see that it is separate."

"I can make out something of the sort, Professor," agreed the boy. "Then is the connection for that anode brought out to the pins at the other end?"

"It is brought out to one of the pins, the other pin being connected to the screen or partition in between the anode and the ordinary grid."

What the Screen is for

"Oh, I see. Then the screen's quite separate from the rest of the works. What's it there for, anyhow?"

"It serves two purposes. You know yourself how high-frequency circuits will oscillate due to back-coupling to the valves and you know that we often use neutralised circuits which are really carefully arranged bridges in which the effect of the valve capacity is balanced out by some other capacity."

Amp nodded, remembering the various times when the Professor had discussed neutralising with him.

Capacity Effectively Reduced

"The presence of this screen between the anode and grid reduces the effective valve capacity to something very small indeed, as a result of which this feedback through the valve is practically eliminated."

"Gee," cried the boy. "That's useful, isn't it?"

"Very," was the laconic reply. "As a matter of fact, however, this is only part of the story, and is to some extent an incidental effect. For a long time valve manufacturers have been trying to increase the amplification factor of valves. We have, indeed, with the ordinary three-electrode valve types having amplification factors between 30 and 40, but the difficulty is that in order to obtain such high amplification factors the internal resistance of the valve has to be extremely high. If we want to go any higher than this the valve resistance rises so rapidly that the valve becomes impracticable."

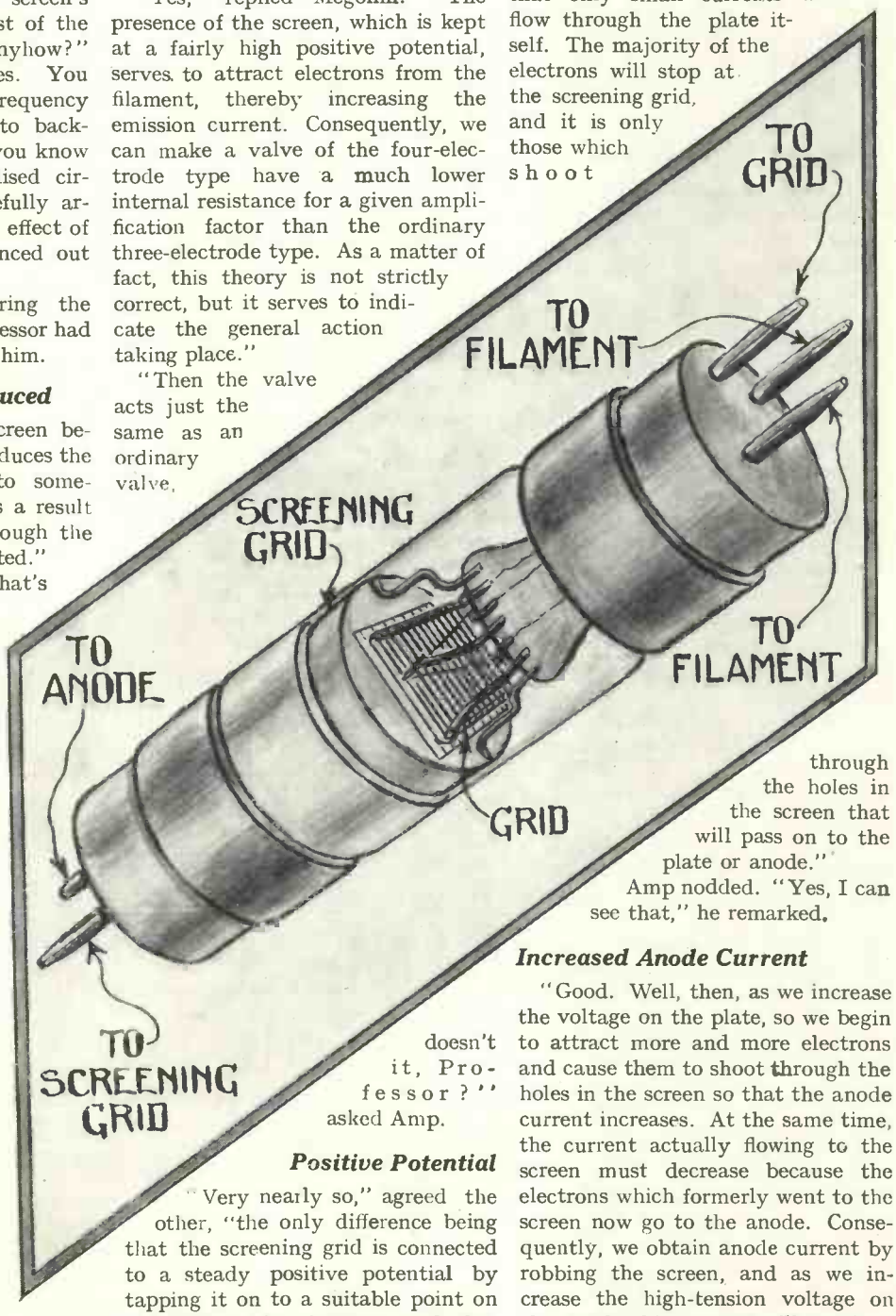
"Why should that be, Professor?" Amp queried.

"Because we can only make use of an amplification factor of a valve if we can make our external circuit have an impedance comparable with that of the valve. Our external impedance is determined by certain practical considerations, and therefore we obviously cannot continue to increase the internal resistance of the valve indefinitely."

"I see," said the boy. "Then does this new valve get over the difficulty?"

"Yes," replied Megohm. "The presence of the screen, which is kept at a fairly high positive potential, serves to attract electrons from the filament, thereby increasing the emission current. Consequently, we can make a valve of the four-electrode type have a much lower internal resistance for a given amplification factor than the ordinary three-electrode type. As a matter of fact, this theory is not strictly correct, but it serves to indicate the general action taking place."

"Then the valve acts just the same as an ordinary valve, doesn't it, Professor?" asked Amp.



Positive Potential

"Very nearly so," agreed the other, "the only difference being that the screening grid is connected to a steady positive potential by tapping it on to a suitable point on the high-tension battery, and that this point has to be somewhat carefully chosen to give the best results."

"Does it make very much difference, then?"

Varying the Characteristic

"It does, because it enables us to vary the characteristic of the valve to suit our own requirements—a thing which we cannot do with the ordinary valve. If we make the voltage on the plate and screening grid both the same, it will be clear that only small currents will flow through the plate itself. The majority of the electrons will stop at the screening grid, and it is only those which shoot through the holes in the screen that will pass on to the plate or anode."

Amp nodded. "Yes, I can see that," he remarked.

Increased Anode Current

"Good. Well, then, as we increase the voltage on the plate, so we begin to attract more and more electrons and cause them to shoot through the holes in the screen so that the anode current increases. At the same time, the current actually flowing to the screen must decrease because the electrons which formerly went to the screen now go to the anode. Consequently, we obtain anode current by robbing the screen, and as we increase the high-tension voltage on the anode this process will continue

Half Hours with the Professor (Continued)

until very nearly the whole current which originally flowed to the screening grid flows to the anode."

The boy remained silent, turning it over in his mind while the Professor continued his explanation.

"In the early stages a small excess of plate voltage over screen voltage will cause quite a big current, but clearly as we take more and more current away from the screen, the action must fall off and we shall ultimately reach a point where we stop.

Resistance Increases Also

"Now the internal resistance of the valve depends upon the change in anode current which can be produced by a given change in anode voltage. Clearly, therefore, as we increase the anode voltage, the increase of current becomes less and less and therefore the internal resistance of the valve increases.

"As a matter of fact, the valve which you have just been looking at has an internal resistance of 150,000 ohms, when the voltage on the anode is 96 volts and the voltage on the screen is 80 volts, and at that point it has an amplification factor of 60."

Amp whistled. "Sixty did you say? That sounds pretty good."

Megohm smiled. "We can do a bit better than that if you like. If we increase the anode voltage to about 110, then the internal resistance of the valve rises to 450,000 ohms, that is nearly three times as great, but at the same time, the amplification factor rises to 180."

Amp was thunderstruck. An amplification factor of 180! Why, you would not need any more valves at all!

"You would have a little difficulty in getting 180 out of it," broke in the Professor, realising the probable trend of the boy's thoughts, "because you would have difficulty in making the tuned circuit have an effective impedance of anything like 450,000 ohms, whereas in order to obtain the full amplification factor from the

Madge Bellamy, who broadcast recently

valve, we must make our external circuit many times greater. The point is that you can vary the characteristics of a valve to suit your circuit by merely adjusting the relative values of the voltage on the screen and on the anode."

"What sort of amplification do you get in practice then, Professor?"

"Between 30 and 40," was the reply.

"That sounds awfully good," said the boy. "Then do the internal resistance and the amplification factor remain proportional?"

"Yes," answered Megohm, "with this particular valve they do and this is one of the important advantages over the ordinary three-electrode type. With a three-electrode valve, if you wish to increase the amplification factor, you must alter the spacing of the grid wires or otherwise change the configuration of the electrodes. When you do this, you find that the internal resistance increases much more rapidly than the amplification factor does and, as I said at first, it is impossible to obtain an *m* value much greater than 40 without excessive internal resistance.

Constant Ratio

"With this valve, however, we vary the characteristics of the valve without affecting the relative disposition of the electrodes at all and therefore the ratio of amplification factor to internal resistance—or the mutual conductance as it is called—remains constant; as we vary the voltages on the anode and screen, we can vary the characteristics of the valve almost indefinitely and at each point the ratio of amplification factor to internal resistance will remain constant.

"But," broke off the Professor. "Bless my soul, if it isn't Mrs. Amp! What lovely weather we are having, to be sure," he said as he hurried forward.

"And that's that," growled Amp to himself, "I shan't get any more out of the old fossil to-day."

Mixed Grill

THE wavelengths of the B.B.C. stations are not always constant and true to their designations. One of the southern stations is occasionally .5 metre above or below normal length.

◆ ◆ ◆

"All that's broadcast is not broad," said a listener who was listening one Sunday evening. His wife who was knitting answered, "Neither is it cast."

◆ ◆ ◆

Cologne has a reputation among the German stations of being the most English. There are broadcast lectures of no mean merit on English grammar and literature. However, the station reminds one of a book published in New York a few years ago, which was entitled *English Learned in Twelve Lessons*. But then Germans are prodigious learners and prolific scholars.

◆ ◆ ◆

In a few years time it will not be an easy task for the B.B.C. to get all the anniversaries, centenaries, and tercentenaries into the year's programme if the policy adopted this year so far is to be persevered with. It is strange how many non-musical men seem to have celebrations in their honour just now.

◆ ◆ ◆

It is assumed that there are twelve million listeners in the British Isles. One authority assumed further that ten million of these listen on an average evening. In a street where there are eighty listeners not one was listening on a particular evening last week.

Intervalve Couplings for Your Portable!

Readers of the "Wireless Magazine" who are thinking of designing their own portable sets will find this article by Capt. H. J. Round, M.I.E.E., of considerable help in choosing the most efficient circuits

WHEN we couple two valves together or couple a valve to a crystal, an electrical network is used and this network takes on different forms for different purposes.

Thus in its simplest form it becomes some arrangement of resistances and condensers of which the commonest form is shown in Fig. 1 which diagram pretends to illustrate the actual condition of affairs. But if we could assume that this arrangement really represented the facts, some branches of our art would be very much simplified

Practical Need Only

I may note that the reason for the resistance, capacity, resistance arrangement in this combination is, of course, only a practical one, as, but for the presence of D.C. voltages, we could avoid the necessity of the condenser and second resistance—and in general we design this condenser and second resistance so that the action of the circuit over the particular frequency range in which we require good working is the same as though they were not there.

In effect, we really need only consider what results between the interaction of the first valve and its resistance, and then we can assume that the voltage produced across this resistance is applied directly to the second valve. With normal valves, at low frequencies, magnifications of 20 to 30 are quite realisable by means of resistance-capacity coupling.

Amplification Obtainable

The low-frequency amplification of valves with resistance in the plate circuit are given by the formula $M\frac{R}{R+Rv}$, where M is the magnification constant of the valve, Rv its resistance and R the external resistance. Thus if R is small compared with Rv the magnification is small and if R is large then the magnification approaches M.

These values of M and R are those given by the valve makers, but accurate calculations always have to be done with the curves, because although M is roughly constant for all conditions, Rv varies a lot with the adjustments of the valve.

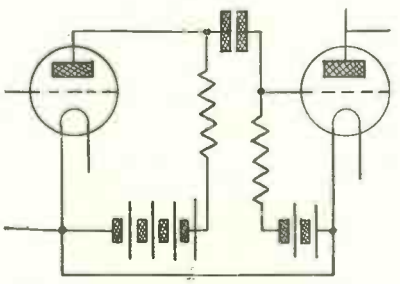


Fig. 1.—Common form of intervalve coupling

A similar formula applies if the external circuit is an impedance, either due to capacity or inductance, or both.

The capacity of the valve has to be taken into account at the higher frequencies for, instead of being able

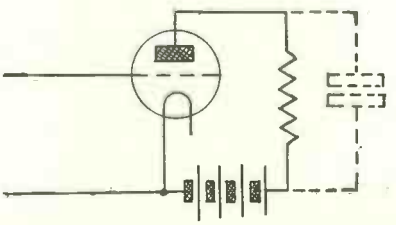


Fig. 2.—This arrangement gives good amplification at low frequencies but fails at high frequencies because of the valve capacity (shown dotted)

to consider a plain resistance in the plate circuit, we have to think of this resistance as shunted by a condenser equal to twice the valve capacity because, of course, there are two valves across the coupling network as a usual thing.

In addition, there is a stray capacity due to the resistance itself and the wiring, resulting in a total value which may amount to as much as .00003-microfarad with modern valves.

Manufacturers' Prejudice

Unfortunately valve makers have fought bitterly against the introduction of low-capacity valves. Any valve which differs from the traditional four-pin standard is damned at once and our art is being handicapped by the inability of the designer to force valve design in the direction really required. I introduced as far back as 1916 extremely low-capacity valves—the V24 and Q type—but these valves were declared to be unmakeable in mass production.

With such valves, resistance-capacity couplings become quite manageable down to 300 metres, although the magnification at that wavelength is not too large, but if the circuit designer could really have his way, R.C. coupled valves with H.F. magnification up to 20 at 300 metres could quite easily be produced.

However, here we are with large-capacity valves, and we have got to find out how to use them under practical conditions.

Balancing Valve Capacity

Let us take the arrangement of Fig. 2 (which gives good magnification at low frequencies, but which fails at H.F., because of the valve capacity) and across the resistance R put a network LC which we will initially suppose is a combination with no losses in it. (Fig. 3.)

Such a shunt combination of L and C will have an impedance depending upon the frequency which is being used and it is well known that this impedance is infinite at the resonant frequency, *so that at that frequency we can assume the magnification will be*

Intervalve Couplings for Your Portable! (Continued)

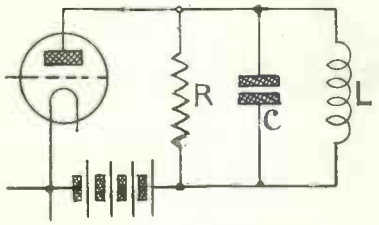


Fig. 3.—Previous circuit with addition of network LC

the same as would be obtained with the valve and R alone on low frequency.

It will be noted that the effect of the valve capacity is wiped out by being absorbed into the tuning capacity C.

This effect, however, is only at the point of tune and we must examine carefully what happens away from the tuning point, for in certain receivers there will be no tuning arrangements.

Impedance of the Network

Approximately we can say that the impedance of LC is equal to $\frac{1}{4\pi Nc}$, where N is the difference of the frequency we are using from the resonant frequency. Obviously the larger N is the smaller the impedance is, and as this impedance shunts the resistance R the magnification must fall off, as the difference from tune increases.

But note that the smaller C is, the larger the impedance is, so that if C is small we can go farther from the tuning point and get good magnification or, vice versa, if we want very sharp tuning, C should be made large.

The lower limit of C is obviously given when it represents only the valve capacity, and this arrangement is in a modified form now used in portable receivers.

For Portable Receivers

In these portable combinations, a large inductive winding is arranged to be in tune with the middle of the broadcast band, and the amount of magnification possible at the two ends of the band is to a great extent a matter of luck—no tuning usually being done except by switching to a new set of coils.

Grid-anode capacity with ordinary valves makes the calculation of circuits—particularly those with a small value of condenser C, and large inductances in the network—almost impossible, but some attempt can be made with the shielded valve to estimate what can be done.

Before showing the effect more quantitatively of this network, I must point out that the resistance R need not be a real resistance and actually in most cases represents the loss in the LC circuit.

Thus a tuning coil with a series resistance R (series) will act like a coil with a shunt resistance R (shunt) if

$$R_{(shunt)} = \frac{L}{C\,R_{(series)}}.$$

Suppose we now wind up some inductances and estimate on the values involved. A Litz inductance of 200 micro henries will wind up quite easily to about 6 ohms series resistance. A coil of about the same dimensions with twice the number of turns will have four times the inductance and four times the resistance (series).

Tuned to 360 metres in each case, the equivalent shunt resistances will be 200,000 ohms and 800,000 ohms.

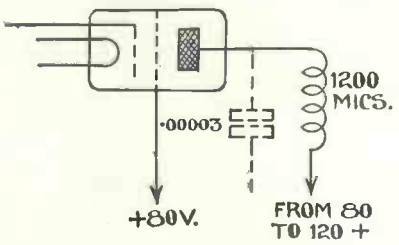


Fig. 4.—Screened-grid valve circuit

Wave-length	250 *metres*	360 *metres*	500 *metres*
Frequency	1,200,000	833,000	600,000
N	367,000	0	233,000
$\frac{1}{4\pi NC}$	8,300	infinite	12,000
Amplification with M = 100	5	100	7
Amplification with M = 20	5	20	7
Amplification with M = 6	3.8	6	4·5

Fig. 5.—Magnification obtained from the circuit arrangement of Fig. 4

As the general coils in portables are even higher inductance than this, even if wound rather inefficiently, their effective shunt resistance will be so high that this resistance can be neglected in calculations—particularly as the valve will be of comparatively low resistance in most cases and we shall only have to take account of the L and C values.

In sharply-tuned receivers the coil losses enter quite seriously, but in the semi-aperiodic arrangements of portables we can almost neglect them.

Some Practical Estimates

I am now going to use the information we have obtained to estimate what will happen in a number of cases and the valve I propose to use is a shielded one, so as to avoid interaction between grid and plate circuits.

I have shown elsewhere that the mutual conductance of a shielded valve $(\frac{M}{R})$ remains airly constant over large ranges of plate volts, but that M and R vary from quite low to very high values.

Thus in a particular case $\frac{M}{R}$ was .6 milliamperes per volt, but M could be varied from 4 to 200 by simply varying the plate voltage and, of course, R was likewise varied.

Shielded Valve Circuit

Let us see what will happen if we put such a valve into connection with an LC circuit in which L is 1,200 microhenries and C .00003 microfarad (Fig. 4). Let us choose several settings of M—say, 5, 20, and 100, and calculate out the resulting magnification.

In the table Fig. 5 I gave the magnification at 3 points—250 metres, 360 metres, and 500 metres, in all three cases.

It will be seen that if we were to choose an M value such as 100, the magnification at 360 metres would be very great—in fact, with two stages, it would be unmanageably big, whereas at the limits of 250 and 500 metres it would be quite small.

Unpractical Arrangement

This arrangement would not make a practical non-tuning coil arrangement. But the 20 M value is better, and the 5 M still better—one might say that

An Exclusive Article by Capt. H. J. Round, M.I.E.E.

this latter arrangement was fairly flat in tuning.

If we had an arrangement in the circuit of the valve plate so that the voltage was fully under control, we could choose our voltage so that the circuits were just stable and it is fairly obvious that if two sets of these inter-coupling arrangements are used, it will be wise to stagger their resonance points, making one say about 300 metres and the other 430, or thereabouts.

Variation of plate volts could easily be done by a series variable resistance of high value, shunted with a condenser.

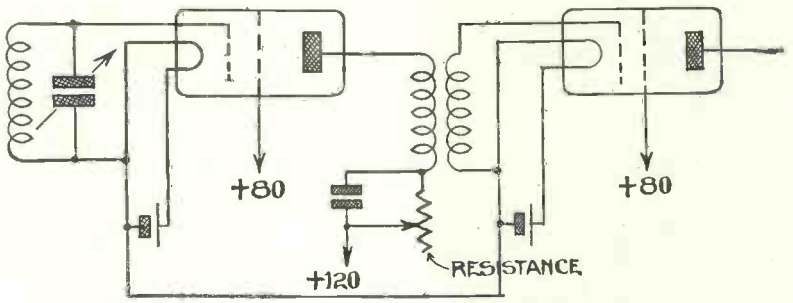


Fig. 6.—Screened-grid valve coupled by fixed-tune transformer with variable voltage arrangement on plate

Transformers or Chokes

In actual practice, two such L values (Fig. 6) well inter-coupled to make a transformer are usually used, but I am not at all sure this could not be preferably replaced by a simple L with a grid leak and condenser (Fig. 7), as such a transformer is liable to increase capacity effects more than the grid leak and condenser.

As an alternative to this method I suggest adjusting the plate volts of the shielded valve to flatten the tuning; a little less efficient way would be to shunt the inductance with a low resistance which could actually be the leak used in the network—and then the shielded valves can be used at the normal high values of M.

This method does not lend itself to a simple continuous adjustment which the first method does.

Use of Resistance Wire

A third method which I have used extensively is to wind the inductance with resistance wire, but this method is not too easy to handle except professionally in standardised gear.

It will easily be seen that still more acceptable results could be obtained by getting still greater values of L and on the long-range broadcast band there is no difficulty whatever in obtaining flatness of tuning with very high amplification; but on the short-range band, a practical limit is fixed by the valve capacity below which it is not possible to go.

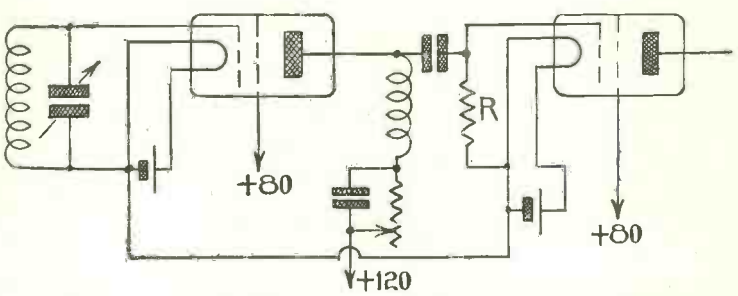


Fig. 7.—Screened-grid valve coupled by fixed-tune choke, capacity coupled to next valve. Tuning can either be flattened by adjusting plate voltage of first valve or by having a low value of R

Aperiodic amplification on very short waves, such as the 20-60 metre band is, at the moment, difficult. I am rather in favour of an attempt to use some crude method of tuning in those aperiodic transformers so as to raise the possible magnification per valve and some years ago I made up many sets of a semi-aperiodic type, tuning by primitive variometer methods.

Sliding Iron Core

One such scheme consisted in sliding in and out of the inductance an iron core, made of finely divided (chemical) iron mixed up with paraffin wax. I also used a tube of copper sliding in and out of the inductance.

The tuning is so flat that several of these rough-tuning devices in the separate styles can be coupled together if necessary; no great accuracy being required.

[Another Capt. Round article Next Month]

An Efficient Frame Aerial

FRAME aerials on portable sets usually suffer from the fact that they are too small to be properly efficient. Compactness is essential in a portable, and much is sacrificed to this end.

For use with "transportables," and with experimental sets used indoors, where compactness is not a necessity, a frame aerial benefits by being quite large.

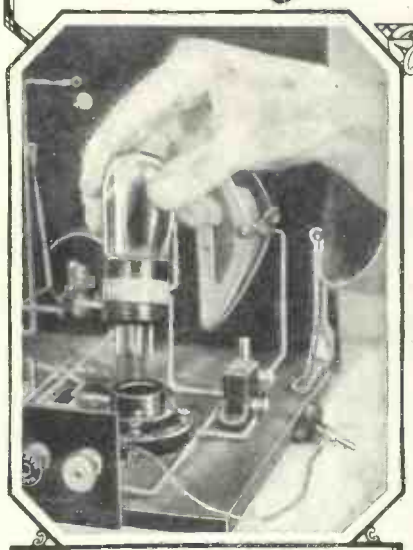
A really efficient pick-up can be obtained with a frame having sides 4 ft. in length, and it is interesting to note that a frame having these dimensions, and with six turns of wire spaced about ¼ in., has a natural wavelength of 175 metres.

This is not too large a value for general-purpose receiving, and the fact that the sides of the frame are large makes it a very useful accessory for sets having one or two stages of H.F.

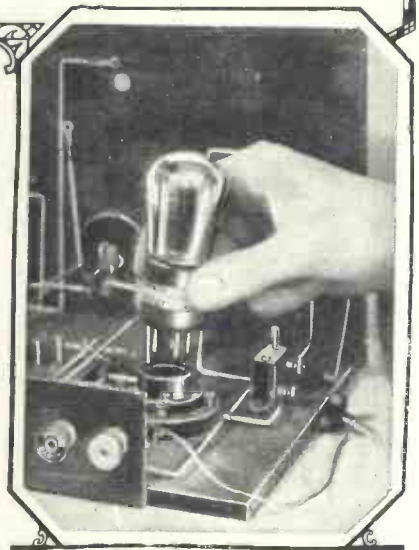
E.D.H.

Are You a Valve Buster?

By R. W. HALLOWS



Wrong way to hold a valve



Correct method of gripping valve

THE valve buster that I can claim to know most intimately is myself, though, after duly touching wood, crossing my fingers, and doing all the other things generally held to be necessary in such circumstances, I can claim that it is quite a long time since any fit of temporary insanity on my part led to the untimely demise of a perfectly good valve.

However, the last time that I was guilty of anything of the kind I did things on the grand scale, blowing up five valves all at once. It happened during the period when it was fashionable for some queer reason to connect H.T. and L.T. batteries in series instead of negative to negative.

Setting Matters Right!

I noticed that some small component or other was not very tightly fixed to the baseboard and proceeded to set matters right with a long-bladed screwdriver. The connections in that particular set were made with bare wire, and for an instant the blade happened to touch H.T. positive and L.T. negative. There was a blue flame and that was that.

The moral of this touching story is two-fold. In the first place disconnect your batteries before you start prodding into the entrails of the set with any metal tool and secondly always connect the batteries in opposition and not in series. There is absolutely no point in connecting them up in series, for if you do so a short is almost certain to lead to valve busting on a scale depending upon the size of the set.

Should yours happen to be a super-het and you insist on making your connections in this way, you may live for one glorious or inglorious moment at the rate of about ten million pounds a year.

An Absent-minded Friend

An absent-minded friend performed quite a good valve-busting act only a few days ago. His batteries were properly wired, but he managed for all that to burn out four valves at a blow. How did he do it? Well here is the story—a perfectly true one.

Having wired up the set he found that there was a small fault somewhere so he disconnected it from aerial, earth, and batteries, placed it on his workshop bench and decided to go over it with a galvanometer to see whether he could find the short which apparently existed. There was an old high-tension battery lying on the table which still showed about 30 volts out of its original 60. Just the thing for the job, says he to himself, say he.

Having tried the battery plus the galvanometer across the H.T. terminals and obtained negative results it occurred to him that possibly there might be a disconnection in the filament circuit. He connected the battery to the L.T. terminals. Four simultaneous blue flames showed him (*a*) that there was no disconnection and (*b*), that absentmindedness does not pay when conducting tests upon a wireless set.

Skeleton Valve Holders

A second friend is very fond of valve holders of the "skeletonest" of skeleton types. He generally makes his own, soldering the four valve legs to strips of brass and fixing the latter to suitable points round the rim of a big circle cut out in a square piece of ebonite. These valve holders are the jolliest things in the world so long as you don't try to change valves with the set in a dark corner and without pulling out the H.T. wander plugs.

On a recent evening I remarked to this friend that the one crab to this sort of valve holder was the ease with which a filament-destroying short could be made. He assured me that such a thing was utterly impossible if one only took a reasonable amount of care.

The Vanishing Trick

"All you have got to do," said he, "is this." He pulled a valve out of its holder, held it between his thumb and forefinger, like a conjurer about to perform a vanishing trick, and then stuffed it back again. There was quite a nice little flame for he had touched the plate and filament negative legs with the two filament pins. The moral?

If you use these holders flick out the wander plugs before you change valves, or, at any rate, use a pocket flashlamp to throw light in dark places.

Friend number three is the kind of fellow who is always making neat little gadgets. He keeps, as a rule, a fairly large stock of valves and it occurred to him some time ago that it would be awfully handy to make a stand in which his spares could be kept. "Some people keep

'em rolling about on the table," he said, "and that of course, is simply asking for trouble. Just look at this nice little stand I've made. You will see that they are as safe as houses."

What he had done was to make a number of holes in a piece of plywood. This had legs at each of its four corners and the valves sat comfortably in the holes just as eggs sit in egg cups.

That Spring Clean . . . !

He was delighted with his stand until during his absence one day his better-half thought that his den would be the better for a spring-clean. Somebody dropped the stand . . . The moral of this episode is: Don't put your eggs all in one basket.

Then there is Blinkinflatt, who has more trouble with his valves than all the rest of my wireless friends put together. He is always being bothered by noisiness in his receiving set and finding it impossible to trace the cause. Also valves have what he calls an uncanny way of coming to pieces in his hands. He showed me one just the other day, which had resolved itself into two separate and distinct parts. One of these was the bulb with a few forlorn wires protruding from it; the other was the cap with its pins.

Blinkinflatt, you see, is one of those people who find that the bulb of a valve fits so nicely into their hands that they always grasp it firmly when pressure has to be exercised by removing a valve from its holder. It is not of the slightest use telling him that the proper place for one's fingers when a valve is being withdrawn from its holder is upon the cap.

One A Month

If you do so he tells you at once that he once got a shock by touching the plate and filament pins with his fingers in the process. He maintains that the bulbs of modern valves are not properly glued into their caps and that it is the makers' fault and not his if they come unstuck when he pulls them out. Since he does in valves at the rate of about one a month he must be a sheer joy to the valve manufacturer.

Actually few bulbs come straight out of their caps at the first pull. What happens is that he gradually loosens them and breaks one lead in the process. When this has been done he complains on the calmest of nights that atmospherics are too appalling for words. The moral here is too obvious to be mentioned.

Pottlethwaite holds that most of us fiddle about too much with filament potentials. All that you need, he maintains, is a fixed resistor for each valve and you need not worry any more about it. There is something in this idea if only you use the right fixed resistors. Pottlethwaite, though, does not care two hoots whether a valve needs 5.5 volts and passes .25 ampere or is intended to eat .1 ampere at the same potential.

The result is that he is always finding that valves of his behave disgracefully by losing their emission long before they should. If you overrun a dull-emitter valve you can very soon turn it into a bright-emitter. Moral? If you use fixed resistors, use 'em sensibly.

Gubbson is all for employing the lowest possible filament potential. "Cut down the amps," he says, "and your valves will last for ever." Somehow his don't. His filaments last for ever, but far too early in their careers they cease to do really useful work. He does not realise that the thoriated filament if worked at too low a potential soon has a surface of pure tungsten without the desirable admixture of thoria. The moral here is that when the makers give figures they generally know what they are talking about.

THAT INTERFERING "LOCAL"

Dear reader, please have pity on
A poor, benighted man,
While I recite a ditty on
The troubles of a "fan";
Each night whene'er I listen late
To music (bands and vocal)
From foreign lands, I can't abate
That interfering "local."

I've tried my best to butt it out
(A hopeless occupation),
But dashed if I can cut it out,
That rude, ill-mannered station!
I've a neutrodyne well wired, sir,
I've an Armstrong supersonic,
I've got wave-traps (bought and hired, sir),
But the trouble still is chronic.

Will nobody relieve me
From this troublesome affair?
I'd give anything, believe me,
Just to push it off the air.
Think I'll have to build a station
In the middle of the town,
And in utter desperation
Shout the horrid beggar down!

C. P. P.

Radio Music Revivals

SOME hundreds of our songs would not only be dead by now were it not for radio, they would have been completely forgotten. Radio, and radio only, has kept them alive. It is true that the gramophone has helped us to retain some of these songs in the memory, but radio has a much larger repertoire. It is no exaggeration to say that radio has lengthened the average popular song by five years. Indeed, many of the modern foxtrots would have been still-born without radio.

When We Were Boys

When a boy, "We're all single by the sea," was the favourite song that was sung by everybody everywhere. Were it not for radio that song would have been dead to me years ago. "Dolly Grey" is another song that has been revived by wireless. The popular songs sung during the Great War have been kept going by no other medium as much as wireless.

There does not seem to be any appreciable revival in literary matters through this medium. What there is is out of all proportion to that of music. The average listener does not know more of Kipling or Browning through radio, although he may be more acquainted with the playwrights because of the loud-speaker.

Acquainted with the Masters

We are becoming acquainted increasingly with the subtleties of Bach, Beethoven, and the other masters in music every week. One wonders what would have happened to many of the works of these geniuses if we were allowed to develop along musical lines as we were before the advent of radio. One wonders, more, whether the ordinary listener would ever have heard many of the greatest musical works apart from radio.

Whatever radio has done in art, literature, mechanics, hygiene, and housecraft, we are sure it has given to music the greatest revival of all times. Music is having its true place in the life of to-day and that through the medium of wireless. E. B. R.

What Readers Think of Our Sets

Q-COIL TWO

CONSISTING of a detector and one stage of transformer-coupled low-frequency amplification, the Q-coil Two (WIRELESS MAGAZINE, *April*, 1928) *receives on both wavelength ranges without changing coils. Its good performance is described below by a Yorkshire reader :*

I feel that I must write and congratulate you on the magnificent performance of the Q-coil Two. I hooked up this set about a fortnight ago, and, although York is a notoriously bad position for receiving broadcast, yet I have already received the following stations, those being marked with an asterisk on the loud-speaker, the rest being on phones :

Long Waves.—Huizen, Moscow*, Kalundborg*, Leningrad, Radio-Paris, Königswusterhausen, Warsaw, 5XX*, Boden, Hilversum*.

Short Waves.—5GB*, Reval, Manchester*, Berlin (Voxhaus)*, Bilbao*, Cardiff*, Bern*, Stuttgart*, Huizen, Copenhagen, Newcastle*, Leeds*, Petit Parisien*, Belfast*, Sheffield*, Breslau*, Cologne, Glasgow.

Total on loud-speaker, 18.

Additional on phones, 10.

This gives a total of 28 stations, and I have no doubt that there are many more that I can manage to get yet.

◆ ◆ ◆

GIRDLE TWO

FROM all parts of the world we are still receiving splendid reports of the Girdle Two (WIRELESS MAGAZINE, *September*, 1927). *As this issue is now almost out of print, we would point out that the Crusader* (*May*, 1928) *is a similar type of set and should give equally good results. Here is a New Zealand reader's experience of the Girdle Two :*

From time to time I notice in your journal reports from readers who have made up various sets. Some time ago I wrote telling you of the success obtained with the Girdle Two in this corner of the world.

As a regular reader, I have not noticed any reports from Australia and New Zealand. However good previous reports on the Girdle Two have been, I think the following log will convince you the set is worthy of its name :

New Zealand : 2AT, 2AQ, 2AL, 2AP, 2AW, 2CO, 2BO, 2BI, 2AB, 2BH, 2XA, 2AI, 2BA, 3AU, 3AP, 3AJ, 3AL, 3AR, 3AH, 4AM. Australia : 2FC, 2SS, 3LO, 6AG. Russia : RFM. Japan : AV. America : 2FAL, 2XG, 2XAF (2XAF relayed WFBL, WGY, WMAK, and WHAM). South America : RCB8. Holland : PCJJ. England : 5SW.

Using three valves, 2XAF, 2FC, 3LO, PCJJ, 5SW, and RFM came through on the loud-speaker. 5SW was the only station that was really weak on the loud-speaker. In fact, it was more distinct on the phones with two valves.

In every case the announcement and call of each station was heard distinctly, and the only trouble experienced was when I tried 5SW on the loud-speaker. For some reason the set howled before it was correctly tuned, and rather than have weak signals, I went back to the phones.

In tuning, I find several dead spots, but I have never regretted building the set, as it is far ahead of other short-wave sets I have heard.

◆ ◆ ◆

FIVE SETS IN SIX MONTHS !

BELOW we reproduce portions of a letter from a reader in Co. Wicklow, who has built five "W.M." sets since Christmas. These were the Five-guinea Three (WIRELESS MAGAZINE, *November*, 1927), *the Trapped Three-Four* (*March*, 1928), *the Everyday Three* (*February*, 1928), *the Britannia Three* (*April*, 1928), *and the Crusader* (*May*, 1928). *We have not had any adverse reports of the Everyday Three or the Britannia Three from any other reader :*

WON'T YOU LET US KNOW WHAT RESULTS YOU ARE GETTING WITH YOUR "W.M." SET? ANY KIND OF REPORT IS HELPFUL TO OTHER READERS —THE OPINIONS REPRODUCED HERE MAY HELP YOU TO DECIDE WHICH SET TO BUILD NEXT!

Having now constructed five of your valve sets *since last Christmas*, I thought I would write and let you know my experience of them. First of all, before this I had never even tuned-in a valve set, having used only a crystal set with amplifier.

I began with the Five-guinea Three, and got seventeen stations in one evening, fifteen at loud-speaker strength.

My next effort was the Trapped Three-Four, built with the standard R.I. tuner, instead of R.I. & Varley type B as laid down in list of components. I found I had, however, to use a wavetrap to prevent local station (Dublin, fourteen miles away) disturbance, and built the trap described on page 246 of your October, 1927, number, which works excellently. The tone and volume of this set are very fine, and I have had excellent results, especially on Daventry (5XX) waveband, getting 5XX, Königswusterhausen, Kalundborg (especially loud), Paris (both Radio and Eiffel Tower), as well as Motala. Hilversum, and another station, not yet identified, but which I believe to be Warsaw, came through, but *not* so well.

I get a good number of broadcast waveband stations, but curiously enough have *not* yet succeeded in getting 5GB on this set !

I next built the Everyday Three and the Britannia Three, but I scrapped both these, as I found them very unstable and non-selective, although of fair volume.

My last effort was the Crusader, and personally I can't imagine a better two-valver. Last night I had sixteen stations on this set, mostly on the broadcast waveband; 5GB is particularly good. The phone strength is so good that most stations, including Budapest, can be heard on loud-speaker !

I tried the short waves one night, and got 2KAD, relaying Schenectady, at about 12.30 a.m. I could hear the base-ball scores quite plainly and music later, although atmospherics were bad. My wife, who had gone upstairs to bed, could actually hear the music through the loud-speaker, though, of course, rather faintly.

5GB is particularly good in this set, and so far hasn't *faded by day or night*, a fault generally found here in Ireland with this station. It is so bad on my Five-guinea Three that sometimes I almost lose this station, while at other times it is roaring through !

In conclusion, may I thank you for your excellent magazine? All instructions are so clear and the blueprints so easy to follow. I wait anxiously for the twenty-fifth of the month and my new copy.

◆ ◆ ◆

THE CRUSADER

NOBODY who builds up the Crusader (WIRELESS MAGAZINE, *May*, 1928) *will be disappointed with it. The results obtained with two valves are really excellent, as this letter from a Sheffield reader proves :*

I feel I must write to say what remarkable results I have obtained from the Crusader, the most outstanding feature being the absence of hand-capacity on the short waves.

The following short-wave stations have been logged : WGY, 2XAF, 7RL (on loud-speaker), PCJJ (on loud-speaker), AFK (on loud-speaker), and yesterday morning 3LO Melbourne. Speech was particularly good.

Dozens of amateurs can easily be tuned in by the beginner, another point being that this set can be made from many old parts.

On the long and broadcast bands results are all that can be desired, and many stations will give real loud-speaker results, even in a district like Sheffield.

I advise anyone having spare parts in their "junk" box to get them out and put this set together; they will be astounded at the results.

"Wireless Magazine" GRAMO-RADIO SECTION

Trying out the new Lissenola portable gramophone, which is excellent value for money

"STARTING OFF"

"CAN you play anything?" queries a fair admirer.

"Rather," says the blonde-preferring gentleman. "I play the gramophone quite well." (*Chuckles of laughter from the fair admirer, which modulate into a jazzy tune as the B.-P. G. puts on a record of the latest swamp noises.*)

As a matter of fact, I would quite like to bet on the fact that although the B.-P. G. plays the gramophone and pick-up equipment well enough to allow him to dance with the F. A., he does not play the gramophone properly. Few people take the trouble to do so.

Here is a test of knowledge, if not of skill. Most people, nine of every ten, perhaps, set the turn-table revolving, giving it a good start with a greasy finger rotated on the record face, and then drop the pick-up needle once or twice on the edge to see if that is the "start." Often as not it isn't, and several snatches of melody are heard before the item starts properly.

Then the lid is closed, and the "performer" settles back in comfort, or dances, confident that that is the be-all and end-all of gramophone manipulation.

If the cap fits, wear it. It is not advisable to speed up the turn-table, in the case of most motor units; fingers should never be placed on the record face, anyway. Most important, though, is the fact that a pick-up or sound-box should never be dropped on a record. The needle should be allowed to rest on the outside plain edge of the record and pushed in with the forefinger until the needle point engages with the sound grooves. QUEUE.

"FAKING" THE CURVE

THE low-frequency equipment of a gramophone amplifier provides ample scope for experimenting with values of various L.F. components. The kind of alteration that will chiefly be made is in the natural pitch range of the amplifier.

Maybe the pick-up itself does not give very even amplification, or, if transformer coupling is used in the amplifier, the iron cores of the transformers may be distorting.

It is always better, when possible, to remedy the trouble at its source. But, even when possible, this is not always easy. It is difficult to arrange the L.F. side of a medium-power receiver so that amplification is constant over a wide frequency range; the difficulties are much greater in gramophone amplifiers, where the grid-swings are large and an equally broad frequency band has to be covered evenly.

Nevertheless the amplification curve may be faked to accentuate the higher or the lower of audio frequencies, so making up for defects in other components.

A fairly small fixed condenser placed across the secondary of the coupling transformer will attenuate the high frequencies, while an L.F. choke across the primary will alter the low frequencies. B.

IS THERE ANYTHING SPECIAL YOU WANT TO KNOW ABOUT GRAMO-RADIO?

Whatever you want to know about Gramo-Radio, consult the "Wireless Magazine" Technical Staff. For many months they have kept abreast of this latest development and can reply to any query that may be raised in connection with it.

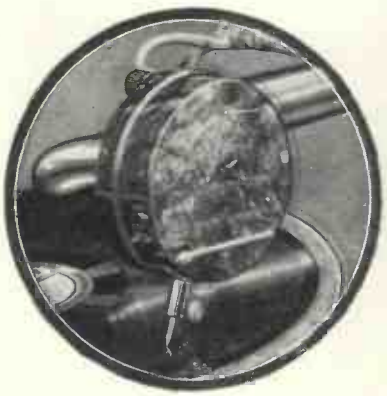
If your pick-up does not give the results you think it should—if your amplifier is not quite distortionless—in fact, if you are in trouble of any sort, the Technical Staff can put you on the right track.

So that the Staff is not absolutely overwhelmed with queries (and to avoid the trouble of answering any of a frivolous nature, which results from a free service) a nominal fee of 1s. is charged for each question asked.

Write your query or queries (not more than two can be answered for each reader) on one side of a sheet of paper and send it, together with a stamped addressed envelope, a postal order for 1s. and the coupon from page iii of the cover, to Gramo-Radio Queries, "Wireless Magazine," 58/61, Fetter Lane, E.C.4.

Pick-up Angle and Weight: Are Yours Correct?

By H. T. BARNETT, M.I.E.E., who in the June issue of the "Wireless Magazine" discussed gramophone motors, the centration of records on turn-tables, the prevention of skidding and the correction of faulty needle-track alignment



Dubilier electrostatic pick-up

THE month before last, in reference to the primary factors necessary for playing gramophone records so as to get the best results, no matter whether the amplification be mechanical or electrical; we considered motors, centration of records and needle-track alignment.

The last subject named is by far the most important thing in gramophone science, so that new readers who have not perused this article should at once take steps to do so. (It appeared on page 460 of the June issue of the WIRELESS MAGAZINE.)

STYLUS-BAR ANGLE OR NEEDLE ANGLE

On the majority of gramophones sold to-day the angle at which the stylus bar (and consequently the needle) is set to the horizontal is 60°. This is the angle made by the hour hand of a clock at 7 o'clock. The re-entrant H.M.V. machines have the sound boxes set so that the needle is at an angle slightly more steep than this.

Angles Less Than Sixty Degrees

Many machines now have the needle angle arranged to be *less* steep than 60°. I can name several in which the needle angle of 50° (corresponding to the position of the hour hand of a clock at twenty past seven) that I have continually recommended for electric recordings has been adopted.

For fibre needles, and for those only, the angle of 60° is correct because the points are so cut that when the needle is placed in a stylus bar at 60° angle, then the actual point of the needle is vertical, which is its necessary position.

Fifty Degrees Preferable

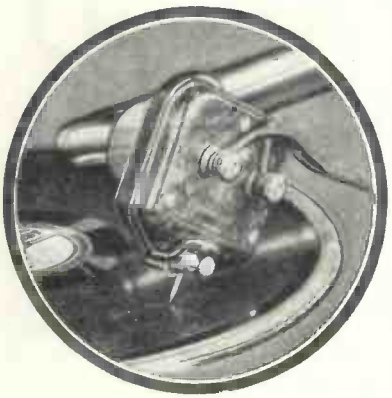
For steel needles, and especially for fine-gauge steel needles, whether of the soft-toned variety or those loud-toned needles held in grips or adaptors, I much prefer the working angle to be 50°, because in the first place surface noise is much less; secondly, the records do not tend to wear so rapidly; and, thirdly, owing to the diminished jarring and jumping on surface flaws and on heavy wave form, the *average* quality of definition is greatly improved.

It is quite an easy thing to try out this matter of needle angle, and anyone who feels doubt whether perfection of reproduction will suffer as regards cleanness of outline and instrumental characteristic should he adopt the angle giving reduced surface noise and reduced wear on records, should experiment for himself on all kinds of records, new and old.

Changing Needle Angle

It is important, in changing from one needle angle to another, that one should look to the needle-track alignment to see that it has not been prejudiced by the change. The same care is needed should one change the sound-box diameter or the length of the needle one is using.

Needle-track alignment should not be permanently adjusted until one has finally determined what



Amplion Vivavox pick-up

needle angle, what kind of sound box or pick-up, and what needles are to be used. The last adjustment is best made in the case of a gramophone by shifting the motor back or forward a little, but in using a pick-up with a gramophone motor, and tone arm mounted perhaps on a soap box, it will be easier to shift the tone arm.

Less Surface Noise

The fact that a 50° angle gives less surface noise than 60° in itself proves that it is better for the life of the records because at the more sloping angle there is a greater surface of the needle in contact with the record, so that reduced scratch under these adverse surface contact area conditions is a quite certain indication of greatly reduced digging effect.

Taking the pattern from a segment of your clock face, you can easily cut a triangle of cardboard to set your stylus bar to, should your eye not naturally be accurate enough for the purpose.

NEEDLE CANT

Some stylus bars are not at right angles to the sound box or pick-up neck axis. Some swivel-neck tone arms are not properly set on the

motor board in relation to the height of the turn-table and the diameter of the sound-box and the length of the needle. The result in either case may cant the needle towards one side or the other of the groove.

I have never found a slight degree of cant cause any trouble when using fine-gauge steel grip needles, but obviously it should not be appreciable, for surface noise reasons if for no others. When the point of such a needle is bearing in the extreme bottom of the "V" groove, the surface noise is demonstrably less than when the needle is canted so that perhaps all one side of it is in contact with one side of the groove.

Final Adjustment

Final adjustment can sometimes be got by putting a spare record or two under the non-skid mat on the turn-table. If raising the tone arm by washers under its base is necessary, great care should be taken in the case of a gramophone to make the centre or tone hole through the washer exactly the size of the internal base diameter of the tone arm.

WEIGHT ON NEEDLE

In nearly all machines the weight on the needle is very excessive. Makers of gramophones having a steep needle angle have had to pile on weight in order to prevent the needle from jumping right out of the groove when it comes to an obstruction or roughness. Of course the effect is to cause the needle to tear the record surface instead of jumping the obstruction.

Almost by every post I get letters from people who have bought expensive modern machines, many of them having correct track alignment, unfortunate people who find their new records tear up in a few playings; they are at their wit's end to fathom the cause of the trouble.

Excessive Weight

Where the track alignment is good and the needle angle is 50°, the cause of the difficulty is almost invariably excessive weight on the needle. Bad needles may cause the trouble, even when everything else is right, but in nine cases out of ten the fault lies in the excessive weighting and not in the kind of needle chosen.

So far as my experience goes, both fibre needles and fine-gauge steel grip needles work best with from two to four ounces weight on the needle. For ordinary needles the weight should not exceed five ounces. Of course I am presupposing correct reproducing conditions in other respects.

People sometimes ask me how they can tell what weight their machine puts on the needle. In order to find this out, a friend of mine got a piece of his wife's elastic. He tied a piece of string on one end, tied the string round the neck of the tone arm, and then raised the sound-box from the record by stretching the elastic upwardly. He measured the length of the elastic when stretched. Then, with an envelope and some bits of card, he weighted the elastic to the same extension and took the envelope and its contents to the post office and had it weighed!

TWO FINE GRAMO-RADIO SETS ARE DESCRIBED ON OTHER PAGES OF THIS ISSUE —THE CONNOISSEUR'S SIX (PAGE 20) & THE GLEE-SINGER THREE (PAGE 55)

Means by which one may decrease the weight on the needle are many. I prefer an absolutely dead weight directly fastened in the case of one-piece tone arms to the back of the tone arm itself, and in the case of swivel-end tone arms to the opposite side of the swivel from the sound-box and close up to the swivel point.

In my Peridulce, and with the Columbia type of tone arm generally, about a pound and a half of lead made into a weight capable of lying close to the back of the tone arm base works wonders.

This not only counter-balances the tone arm so that only the weight of the sound-box comes on to the record, but its weight right over the tone arm base keeps the tone arm base bearing down to its job (any rattle here rapidly ruins records), but also its mass opposes movement of the tone arm as a whole by the needle and increases the amount of the motion of the needle communicated to the diaphragm, thereby increasing tone volume and improving definition.

For swivel-end tone arms from 6 oz. to 12 oz. of lead should be fixed on the swivelling portion close up to the swivel joint and on the opposite side of it to the sound-box. The weight required will depend on the weight of the swivel end and its leverage.

Making Your Own Weight

If you cannot get the weight desired cast to shape for you and nicely plated, it is easy to make such a weight by rolling up a strip of roofing lead, and such a weight is very easily hammered into any desired shape. Lead is at all times very ductile, and especially so when in coiled strip.

In the case of swivel-end tone arms, as well as with the straight pattern kind, the dead-weight counter-balance has two useful functions in addition to lessening weight on the needle; it keeps the tone-arm joints from rattling and, by its weight, opposed to needle vibration and situated right behind the sound-box, increases tone volume and improves definition.

For Experimenters

Experimental people often prefer to sacrifice the two extra advantages of the fixed dead-weight device in order to have the counter-balance adjustable for experiments with different kinds of needles. A sound-box will shortly be marketed by the Limit Engineering Co., Ltd., of 17 Albion Street, London, N.1, that incorporates its own weight adjuster. This will not be applicable to magnetic pick-ups however.

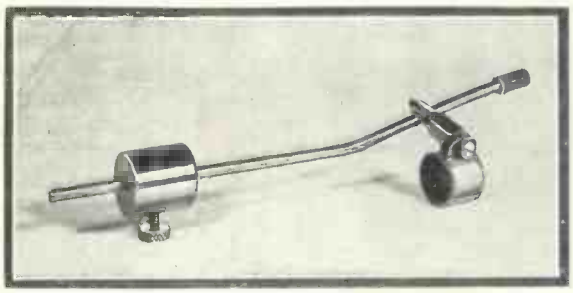
There is a castor trolley wheel that runs on the record and carries a spring (having a screw adjustment) that presses the sound-box upwards.

For tone arms of the H.M.V. type an excellent adjustable leverage device is marketed by H. L. Wilson, of 245 Shaftesbury Avenue, W.C. The actual counterweight works through a pivoted lever on one end of which it may be slid and clamped in any desired position.

ADHESION

Before going on to the subject of needles, considered particularly in reference to the wear they produce

Pick-up Angle and Weight: Are Yours Correct? *(Continued)*



Weight adjuster for swivel-end tone arms, made by Cramptons

on records, it is necessary to consider the chief factor producing frictional wear.

Fine-gauge Needles

My advocacy for the use of fine-gauge steel needles made of exceedingly hard metal (it is essential that it should be tempered so as to be tough as well as hard) has often led to the query: "But surely these very sharp needles must wear a record more than the ordinary steel needles do?"

Such is *not* the case; the harder the steel and the sharper the point the *less* the record will wear, assuming of course that the needle is lying in the groove on a fore and aft line that is a tangent to the circle, that it has a reasonable inclination—say 50°—and that there is not too much weight put upon it.

If this were not the case, we should play our records with needles made of copper or brass or something of that kind.

Wear Re-acts

The whole question resolves itself in one of *adhesion*. If the needle adheres to the record, the needle will wear and the record will wear too; if the needle is too hard and its structure not sufficiently crystalline to permit it to adhere to the record, then the wear on the needle will be very small and the record will not wear at all, but will *burnish*.

If an engineer has a steel shaft to rotate and wishes to avoid wear upon it, he does not mount it in steel bearings, but in bronze or white metal, for the reason that a steel shaft and a steel bearing having the same internal structure tend to adhere to one another, but steel and bronze, or, better still, steel and white metal, having different internal structures, the tendency to adhesion and consequently to wear is greatly lessened.

A glass worker desiring to make a hole through a glass plate does not try to pierce it with a steel drill, he uses a *copper rod*; the copper adheres to the glass and engages the glass particles as soon as they are detached, and so a screw hole may rapidly be cut through a mirror or whatever it may be.

Our stone-age forefathers, when they wished to shape their arrow-heads from flints, did not use a hard substance for the purpose, they used *chisels of reindeer bone*; the bone adhered to the flint and brought it away in flakes so easily that a man could make hundreds of arrow-heads in a day.

Another weight adjuster, made by H. L. Wilson

Burnishers for use on metal are made of agate, the hardest material commonly obtainable. So long as too much weight is not put upon them they do not scratch the metal, but produce a beautiful polish upon it.

ANOTHER WEIGHT ADJUSTER

Since writing the above, I have received from the manufacturers, Cramptons, 346 Denman Street, Radford, Nottingham, a sample of their Castle weight adjuster for swivel-end tone arms.

Leverage Type

It will be seen that it is of the leverage type, the fulcrum clamping on to the tone arm proper, with a rubber-lined clip very like a cycle clip. The end of the lever having a little bit of rubber tube on it, rests under the swivel end of the tone arm and tends to reduce the weight on the needle in proportion as the sliding weight on the other end of the lever is moved farther away from the fulcrum.

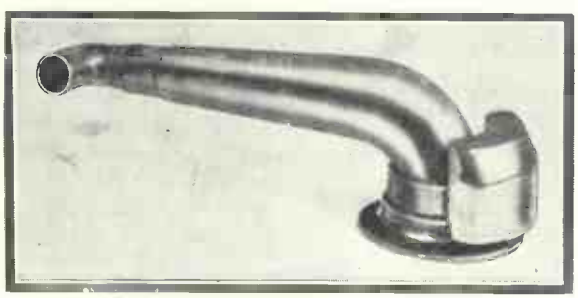
N.B.—Should the matter of this or of any subsequent article be unclear to any reader, I shall be pleased to reply personally to any inquiries addressed to me at the offices of the WIRELESS MAGAZINE, if complying with the rules outlined on page 47.

Lissen Portable Gramophones

TWO new portable gramophones which are both excellent value for money have just been placed on the market by Lissen, Ltd., of Friars Lane, Richmond, Surrey.

The smaller model, known as the Lissenola No. 1, costs only two guineas. One of these is in constant use in the WIRELESS MAGAZINE Constructional Dept., and is giving very satisfactory results; it is illustrated on the first page of this section. This model is fitted with a Thorens motor.

The other model, the Lissenola No. 4, is slightly more expensive and is fitted with a Garrard motor.



Weight adjuster fixed at base of tone arm which increases tone volume and improves definition

An Outline of Gramophone Developments

The first part of this article appeared on page 536 of the July issue

THE comparatively new method of playing records electrically is of considerable interest to the wireless amateur, as it enables him to use his receiver in a double capacity. If the receiver is capable of giving good quality reproduction from a modern cone loud-speaker, the owner should obtain results equal to those heard from the most expensive mechanical gramophone. And in some respects the results will be superior.

Good Components

This is assuming that he is using a super-power valve for the output and plenty of H.T., and that the low-frequency part of the set consists of the popular combination of resistance-capacity and transformer, using only the best components.

On the other hand, if the amateur constructs a well-designed amplifier to be used with valves having the correct characteristics for the job and operates a moving-coil loud-speaker, he will obtain results that no mechanical gramophone can ever give. Electrical reproduction has the further advantage over the mechanical method in that the listener has complete control over the volume, it being possible to obtain anything from a whisper to full volume without changing the needle and while the record is being played.

Great Boon to Dancers

Dancers find the electrical method an advantage because, by placing a loud-speaker in several parts of a house, it obviates the necessity for them to crowd into one room to hear the music.

The gramophone pick-up, which makes possible the playing of records electrically, usually operates on electro-magnetic principles. The needle is screwed into an iron reed which is in the centre of a bobbin of fine wire and between the poles of a permanent magnet. The vibrations picked up from the record by the needle cause the reed to vibrate likewise, many thousands of times a second, thus cutting the lines of force between the poles of the magnet and generating small electrical impulses in the pick-up coil.

Playing desk unit of the His Master's Voice electrical reproducer. It is made by the Gramophone Co., Ltd., of Hayes, Middlesex.

These impulses are fed to the input of the amplifier and, after being amplified, are converted into audible sound by the loud-speaker.

On the mechanical gramophone a great deal of the brilliance of a record is lost because many of the small sound waves on a record which constitute the "light and shade" of the music have not sufficient amplitude to be made audible. In other words, the needle vibrations are too small for the sound-box to convert them into air waves.

The pick-up, however, is sensitive enough to respond to them and so many of them become audible. Thus, although a good receiver may have a musical range no greater than that of a modern gramophone, a record will sound more brilliant because of the better reproduction of the weaker sound waves.

Manufacturers

Since the electrical reproducer has certain advantages over the ordinary gramophone, it is only natural that the manufacturers should turn their attention to this new development.

The latest commercial product is the His Master's Voice electrical reproducer, designed for use in cinemas, etc. It gives out tremendous volume without a trace of distortion and is particularly good on organ records. It is doubtful if a cinema audience could tell the difference between a record and the actual organ, especially if the record is of that particular organ.

The H.M.V. reproducer consists of three main units—the playing desk, on which is mounted the motor and pick-up, the amplifier, and the loud-speaker.

Advanced Design of Pick-up

The pick-up is of advanced design. The poles of the magnetic field face a small steel diaphragm to which the needle-holder is attached. A heavy permanent magnet provides the necessary flux across the gap in front of the poles. The damping is provided by oil of the correct viscosity circulating between the magnetic poles, this being far

An Outline of Gramophone Developments *(Continued)*

more satisfactory than the usual system of rubber damping. The diaphragm, which is not more than $\frac{1}{3000}$th of an inch thick, is gold-plated to prevent corrosion.

Correct pressure on the record is obtained by pivoting the pick-up, a counter weight being concealed in the tone-arm. The pick-up is low resistance wound, so long leads can be used to the amplifier without the capacity having any effect on the quality. The amplifier is A.C. mains operated, suitably rectified, no batteries being required.

Two-stage Amplifier

If the mains are D.C. a motor is used to provide the A.C. power. The amplifier is a two-stage amplifier with a modified push-pull coupling. Induction noises are prevented by earthing the centre tap on the input transformer primary, the secondary being connected to the grid of a special valve. Precautions are taken to prevent parasitic oscillation in the amplifier.

Osram valves, type DET1, are fed by the push-pull transformer, the transformer in the anode circuits having a centre-tapped output winding which is earthed. A low-resistance winding is used so that the loud-speaker can be some distance away without the leads affecting the quality of reproduction by undue capacity.

The loud-speaker itself is of unusual design. The diaphragm is no less than 30 in. in diameter and is of very thin aluminium sheet. It is clamped between strong aluminium rings and is maintained in a taut condition. The drive is a moving-coil of edgewise-wound copper strip mounted on the diaphragm at a point removed from the centre. A small air gap is provided, across which an intense field is created with a consumption of about 25 watts.

Baffle Board Unnecessary

The large diameter of the diaphragm makes a baffle board unnecessary; and owing to its freedom of movement, it brings out the bass notes in their true value and without any sacrifice of the upper register. The loud-speaker is mounted in a large cabinet with a grille front.

For an ordinary horn-type loud-speaker to have the same musical range of this one, it would have to be about 9 ft. high, 8 ft. wide, 6 ft. deep, and weigh about a ton and a half! It would still, of course, suffer from the defects of the horn-type loud-speaker, such as the direction effect and its attendant disadvantages. The H.M.V. electrical reproducer probably gives the most perfect reproduction of gramophone records yet attained, and readers should take the first opportunity of hearing this wonderful instrument.

The construction of a valve amplifier to give natural and reliable reproduction is easier when it is to be used for records than when it is to be used for broadcast reception. The reason is that with the latter there is always the risk of high-frequency currents creeping in and causing distortion. Further, owing to the varying signal strength, it is easier for the output valve to be overloaded. For record reproduction, however, there is no H.F. to contend with and the amplifier can be designed so that there will be no overloading of the last valve.

Limited Pick-up Input

This is because a pick-up has a limited input, no matter how loud a record may be. If the constructor knows the maximum voltage swing of his pick-up (the best type gives approximately 3-volt maximum) he can then arrange his circuit so that the last valve never receives more than its maximum grid swing.

It is best to use resistance-capacity coupling throughout for the proper reproduction of the bass notes. Low-value anode resistances and medium-impedance valves should be used, otherwise there will be a serious loss of the high notes. The amplification will not be great with two stages, but the quality will be excellent.

Greater volume can, of course, be obtained with three stages, but steps must be taken to prevent L.F. oscillation. Plenty of H.T. must be used and a super-power valve is needed for the output. Transformer or choke coupling to the loud-speaker is essential in these days of heavy anode potentials. Good quality components *must* be used, otherwise the constructor will get plenty of noise but no music!

Do not spoil a good outfit by using a cheap gramophone motor. When a needle has to track a big sound wave it tries to act as a break on the record, and so if the motor is at all weak it will slow down, producing a wail-like note. This is a particularly unpleasant fault and completely spoils good reproduction. It is occasionally the fault of the record, due to the hole in the disc not being quite central, but a cheap motor is mostly to blame.

Gramophone of the Future

Enough has been said to show the reader the trend of gramophone developments, and it is hoped he will have a better idea both of the improvements in the mechanical gramophone and of the electrical method of reproduction. There is no doubt of the latter's superiority and the gramophone of the future will assuredly be of this type, although the mechanical machine will remain for many years owing to its simplicity.

Records will probably remain as they are for some time to come, the improvements being the elimination of surface noise and a toughening of the composition.

The only disadvantage of the gramophone to-day is the impossibility of having a complete opera or symphony on one record. This may be overcome by the development of a "music film." Many readers must have heard the "Movie-tone" talking film. The music, etc., is recorded on the film itself in the form of light rays. These are converted by a light-sensitive cell and valve amplifier back again into the original sounds and heard by the audience through loud-speakers.

A Subscription Library

Possibly records may one day take this form, and we shall then be able to hear our favourite opera when we like and without having to keep changing records. It may be possible then to join a subscription library, just as users of a player piano can for the hire of music rolls or the owners of home cinemas for the hire of films.

C. H. GALLOWAY.

Specially Garnered by JAY COOTE

POLAND is rapidly coming to the fore and within the next six months should be in possession of one of the most up-to-date European broadcasting systems. By the end of this year the Warsaw programme will be available daily to a greater number of listeners in the United Kingdom to the same degree as are to-day Kalundborg, Vienna (when not obliterated by morse), and Koenigswusterhausen, for the capital transmitter by then will be broadcasting its programmes on a power of some 25 kw. in the aerial. Some noise !

A Step in General Scheme

This improvement is but one step in the general scheme adopted by Polskie Radio for the development of its system. Posen, which has become one of its main stations, will extend its sphere of influence to Bromberg or Thorn, both of which cities similarly to Posen formed part of Prussia before the Great War. The new relay, however, in imitation of the German plan to be carried out at Flensburg, Magdeburg and Stettin, will work on a wavelength common to the mother transmitter.

Moreover, as Radio Posnan is anxious that its entertainments should be heard by the many thousands of its citizens who have emigrated to the New World a powerful short-wave station is to be installed in one of its local theatres.

A New 18-kw. Station

The new scheme also provides for an 18-kilowatt station at Lemberg—of which the native name is Lvov—formerly in Austrian Galicia, now a member of the Polish Republic, and the Wilno station, of recent birth, is already to be endowed with new broadcasting plant, its old equipment to be transferred to Lodz, the centre of an important industrial district.

For some little time past Polskie Radio has been working actively in co-operation with Berlin and Vienna on a regular interchange of wireless programmes with these foreign capitals, the main idea being that each city in turn should provide its very best native talent on these evenings. Warsaw is proud of its Opera House and Concert Hall, and from them star performances are to be relayed.

For your guidance also I may tell you that the summer and autumn months promise pleasant surprises from the Polish studios, as I hear that Jan Kiepura, the famous tenor, has been engaged for the opera season

THIS IS FRANK ASHWORTH

Who broadcasts dance music from the Hotel Metropole

at Posen, from which centre regularly every week entertainments are fed to the Polskie Radio system.

With the official opening at Linz of a 500-watt relay station, "Ravag," the Austrian broadcasting company, controls six separate transmitters including the new Rosenhuegel, now in perfect working order. Linz, on the right bank of the Danube in Upper Austria, is but 100 miles from the capital, but the broadcasting station fills a long-felt want because the city is the centre of a thickly populated industrial district.

Within a few months we shall also see a new transmitter at Salzburg, an old-world town situated in the Hohe Tauern region of the Austrian Alps, some 95 miles E.S.E. of Munich. It will act as a connecting link between the Bavarian capital and Vienna, and through it passes the special cable which is used for the exchange of programmes made by these two cities.

Great Increase in Licences

Seven broadcasting stations for a comparatively small country such as is now post-war Austria seems a high number, but it appears that their establishment is justified by the number of licence holders. At the beginning of 1928 the Ravag possessed some 280,000 registered listeners or roughly 4.5 per cent. of the total population, to-day there are nearly 200,000 subscribers in Vienna alone, a figure representing over one-tenth of the inhabitants of the Austrian capital.

The broadcasting tax is not a fixed one as in most Continental countries but variable in proportion to the income enjoyed by the owner of a wireless receiver, the lowest monthly fee being two Austrian "schellings," roughly 1s. 2d. As some well-to-do radio fans might be assessed at the higher rate of, say, £3 10s. per annum, it has been the custom to register the set as belonging to Baby or to Cook in order that the concerts may be received at the lower fee !

Collected by the Postman

As in Germany the tax is collected by the postman on his rounds, the Post Office authorities following Great Britain's lead in pocketing a portion of the proceeds to cover administrative expenses—and then some !

Whether the decisions taken at the last Washington Conference will turn out to our advantage or not will be proved only by practical experience, but by the end of this year there is a strong probability that we shall see a complete re-shuffle of the wavelengths allotted to the broadcasting stations operating outside and above the middle broadcasting band

Jay Coote's Continental Notes (Continued)

It is evident that many tests will have to be made before these stations get into their proper positions, that is, if the same kind of interference as persists at present is not to mar the programmes of the high-power transmitters.

Seven Countries Satisfied

At the recent Conference held at Lausanne by the International Union of European Broadcasters, the question was seriously discussed and of the fifteen applications received for an allotment in the ether, provisionally, it was found possible to satisfy only Great Britain, France, Germany, Holland, Russia, Poland, and Sweden. As to the others, the only prospect offered was to find them a situation in the already congested broadcasting band.

For the present at least, the suggested wavelengths are as follows: Huizen 1,852 m., Radio-Paris, 1,752 m., Koenigswusterhausen 1,649 m., Daventry 1,561 m., Moscow 1,483 m., Warsaw 1,414 m., and Motala 1,352 m. An attempt will be made, I understand, to treat with Russia with a view to a release of the 1,483 m. wavelength to be adjudicated to Kalundborg.

The main difficulty consists in the fact that there exists some seventeen stations in all in operation or proposed, and that they wish to be fitted in the 1,340—1,875 metre waveband. It is just this question of the quart and pint pot which adds years to the age of the engineers responsible for carrying out the Washington proposals.

I do not approach the subject in any spirit of carping criticism, but I cannot help feeling that our B.B.C. shows considerably less initiative than the German broadcasting authorities in the matter of relaying outside events of national interest.

Grand Opportunity Lost

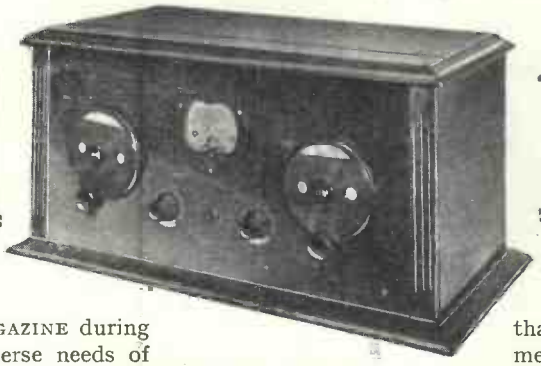
When the seaplane *Friendship*, with the aviator Stultz and Miss Earhart landed off the coast of Wales, our home stations lost a grand opportunity in failing to give us an interview at the microphone with the plucky adventurers. Was there any reason for which it could not have been carried out on the spot within a few hours of the historic event?

Through the German stations I was able to visualise official receptions given to Lindburgh on his return

(*Continued on page* 61)

Wavelength in Metres	Station	Call Sign	Wavelength in Metres	Station	Call Sign	Wavelength in Metres	Station	Call Sign	Wavelength in Metres	Station	Call Sign
24	Chelmsford	5SW	288.5	Edinburgh	2EH	379.7	Stuttgart	—	549.3	Milan	—
30	Bergen	—	289.3	Radio Lyon	—	384.6	Manchester	2ZY	555.8	Budapest	—
30.2	Hilversum	—	294.1	Dundee	2DE	391	Toulouse	—		Hamar	—
36	Lyon (PTT)	—		Hull	6KH	394.7	Hamburg	—	566	Augsburg	—
37	Vitus (Paris)	—		Innsbruck	—	400	Bilbao	—		Cracow	—
45.3	Doeberitz	—		Stoke-on-Trent	5ST		Cadiz	EAJ3		Hamar	—
61	Paris	Radio LL		Swansea	5SX		Cork	6CK	575.8	Freiburg	—
	Doeberitz	—	297	Liverpool	6LV		Mont de Marsan	—	576	Vienna (Wien)	—
158	Beziers	—		Radio Agen	—		Plymouth	5PY	588	Zurich	—
192	Akureyri	—		Hanover	—	401	Aachen	—	680	Lausanne	—
198	Biarritz	—	300	Algiers	—	405	Salamanca	EAJ22	720	Ostersund	—
204.1	Kaisersleutem	—		Bratislava	—	405.4	Glasgow	5SC	760	Geneva	—
217	Radio Luxembourg	—	302	Radio Vitus	—	408	Reval	—	766	Liabach	—
			303	Koenigsberg	—	411	Berne	—	775	Kiev	—
230	Ste. Etienne	—	306.1	Belfast	2BE		Notodden	—	995.5	Leningrad	—
	Schaerbeek	—	309.2	Zagreb	—	416	Grenoble	—	1,000	Leningrad	—
236.2	Stettin	—	310	Oviedo	—	416.7	Goteborg	—		Basle	—
238.1	Bordeaux	—	310.2	Marseilles	—	420	Rabat	—	1,069	Hilversum	HDO
240	Nimes	—	312.5	Newcastle	5NO	422	Kattowitz	—	1,080	Strasbourg	—
246	Juan-les-Pins	—	319.1	Dublin	2RN	428.6	Frankfort	—	1,111	Warsaw	—
241.9	Nurnberg	—	322.6	Breslau	—	434.8	Freidriksstad	—	1,180	Stembol	—
	Muenster	—	326.1	Bournemouth	6BM		Seville	—	1,153	Kalundborg	—
252.1	Bradford	2LS	323.9	Almeria	—	435	Wilno	—	1,180	Stamboul	—
	Cassel	—	329	Gleiwitz	—	441	Brunn	—	1,190	Boden	—
	Montpellier	—	333.3	Naples	—	448	Riuiken	—	1,250	Königswusterhausen-Zeesen	LP
256	Kiel	—		Reikjavik	—	448.4	Rome	—			
259	Toulouse	—	335	San Sebastian	EAJ8	450	Moscow	—	1,380	Motala	—
260.9	Malmo	—		Cartagena	—	453.8	Stockholm	—	1,450	Moscow	RDW
264	Lille (Poste du Nord)	—	337	Copenhagen		458	Paris Ecole Sup.	—	1,525	Lahti	—
			340.9	Paris	Petit Parisien	460	Belgrade	—	1,604	Daventry	5XX
267	Strasbourg	—				461.5	Oslo	—	1,700	Kharkov	—
272.7	Sheffield	6FL		Huizen	—	462	Barcelona	—	1,750	Paris	—
	Bremen	—	344	Posen	—	470	Langenberg	—	1,800	Angora	—
	Danzig	—	344.8	Barcelona	EAJ1	477.7	Lyons	—		Bucharest	—
	Klagenfurt	—	348.9	Prague	—	484.6	Berlin	—		Norddeich	—
273	Limoges	—	353	Cardiff	5WA	491.8	Daventry Experimental	5GB	1,850	Carthage	—
275	Ghent	—	357.1	Graz	—			2BD		Huizen	—
275.2	Dresden	—	361.4	London	2LO	500	Aberdeen		1,870	Kosice	—
	Nottingham	5NG	365.8	Leipzig	—	504	Porsgrund	—		Huizen	—
277.8	Leeds	2LS	370	Paris	Radio LL	508.5	Brussels	—	1,950	Scheveningen	—
278.8	Bordeaux	—	370.4	Bergen	—	517.2	Vienna	—	2,000	Kovno (Kaunas	—
280	Renne	—	375	Helsingfors	—	535.7	Munich	—	2,650	Paris	FL
283	Colognes	—		Madrid	EAJ	545.6	Sundsvall	—	2,800	Temesvar	—

THE GLEE-SINGER THREE



A Pure-tone Gramo-Radio Receiver

Designed, Built & Tested oy the "W.M." Staff

MANY three-valve designs have been published in the pages of the WIRELESS MAGAZINE during the past year to meet the diverse needs of many thousands of readers. The set described in this article is a special gramo-radio outfit—that is, it is intended first and foremost to give reproduction of superlative quality.

Perfect Quality

The idea behind the name of the set is perfect harmony—glee singing is really a combination of soloists, usually unaccompanied, and each voice must be of the best. In the case of the Glee-singer Three only the very best components have been used and the result is absolute purity of reproduction.

No great range is claimed for the receiver, but it should bring in, under all normal conditions, four or five transmissions on the loud-speaker with perfection, and it is really good for reproducing gramophone records by means of a pick-up.

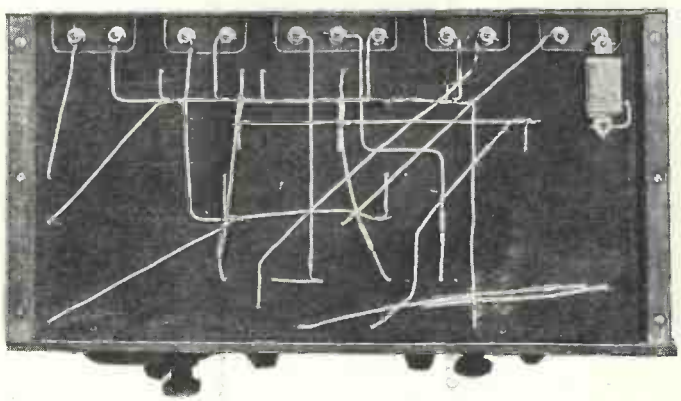
As will be seen from the circuit diagram, the detector works on the anode-bend principle and is followed by two stages of resistance-coupled low-frequency amplification.

Reaction Control

Capacity-controlled reaction is employed and an output choke is provided in the anode circuit of the last valve to prevent the steady direct current from damaging the loud-speaker windings.

By means of a jack the pick-up is inserted in the first grid circuit in such a way that the anode-bend potentiometer can be utilised for making critical biassing adjustments.

The aerial-tuning and reaction condenser are both provided with a vernier dial so that fine adjustments can be made, while a sensitive milliammeter gives a visible check of the quality of the reproduction, as will be explained in detail later



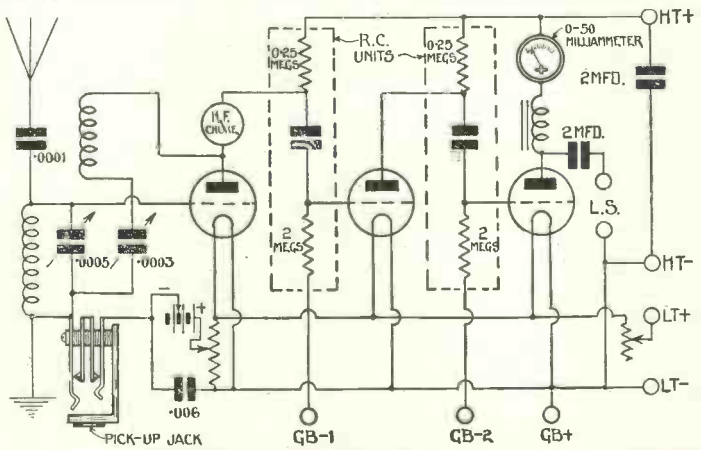
View of sub-baseboard wiring of the Glee-singer Three

Best Components

Particular attention is drawn to the fact that only components of the highest quality are used, and the cost of construction is, therefore, above the average for a three-valver.

But for efficient gramophone work an absolutely pure quality of reproduction is essential and there are many WIRELESS MAGAZINE readers who will not mind the extra cost when they are assured that they are getting something above the average.

For example, the milliammeter incorporated—a Ferranti—is of the D'Arsonval moving-coil type with sapphire bearings and is provided with a fuse which protects the winding from destruction in the event of an excessive overload. A spare fuse is provided with each instrument.



Circuit of the Glee-singer Three, which comprises a detector and two resistance-coupled low-frequency stages

Special Wiring

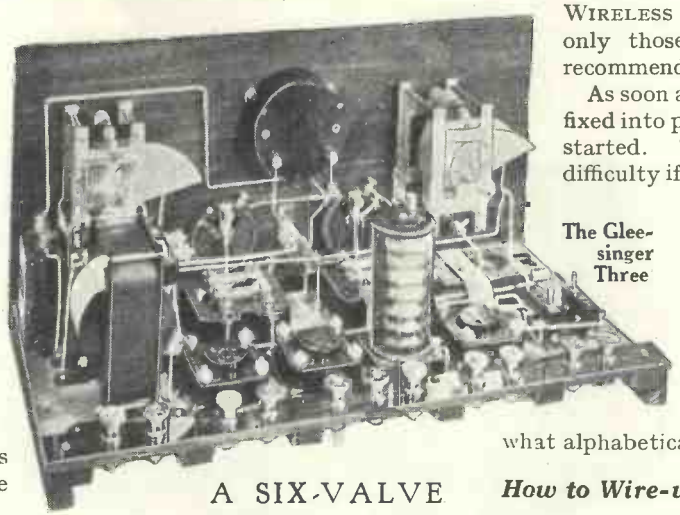
It will be observed that in the construction a combination of surface and sub-baseboard

The Glee-singer Three (*Continued*)

Making final adjustments to the Glee-singer Three, which is a gramo-radio receiver. The loud-speaker in use is a Ferranti exponential horn

wiring has been adapted and special attention should be given to the method of mounting the terminal strip. This is actually placed flat along the edge of the baseboard and recesses are cut out in the latter to accommodate the terminal shanks.

On the front panel are mounted the aerial and reaction condensers, the milliammeter, the anode-bend potentiometer, the master rheostat which serves as an on-off switch, and the pick-up jack.



The Glee-singer Three

A SIX-VALVE GRAMO-RADIO SET—THE CONNOISSEUR'S SIX—IS DESCRIBED IN DETAIL ON PAGE 20

A glance at the photographs will reveal the layout adopted on the baseboard. Along the edge of the baseboard, looking from the back and reading from left to right, are the output filter choke, power-valve holder, first low-frequency valve holder, the high-frequency choke, the detector-valve holder and the holders for the reaction and aerial coils respectively.

Nearer the panel, also from left to right, are the two 2-microfarad fixed condensers, the two resistance-coupling units, and the 4½-volt tapped battery for applying bias to the grid of the detector valve in conjunction with the anode-bend potentiometer.

Positions of Sub-baseboard Wires

Underneath the panel is mounted the small .0001-microfarad fixed condenser in the aerial circuit. It may here be mentioned that the positions of the sub-baseboard wires do not matter in the least; they are simply led from point to point and connected together in the most convenient way.

Constructors will have no difficulty in building the Glee-singer Three. All the essential details are reproduced in these pages, but considerable time and trouble can be saved by using a full-size blueprint, which acts as a panel-drilling template, layout guide and wiring diagram.

Until the end of August copies of the blueprint, which is No. W.M.92, can be obtained for half-price, that is 6d. post free, if the coupon to be found on page iii of the cover is used. Address your inquiry to Blueprint Dept., WIRELESS MAGAZINE, 58/61 Fetter Lane, E.C.4.

Keep to Original Specification

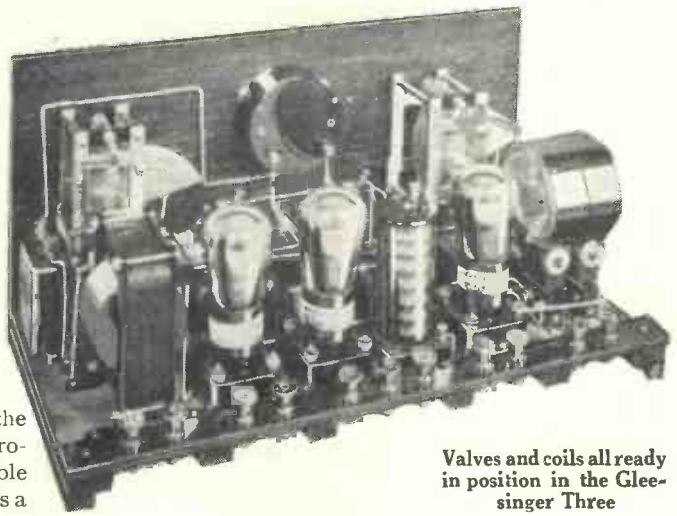
When building the Glee-singer Three keep as closely as possible to the original specification and layout. If it is impossible to use the same parts as employed in the original WIRELESS MAGAZINE design utilise only those alternatives that are recommended.

As soon as all the parts have been fixed into position, wiring-up can be started. This will present no difficulty if reference is made to the blueprint or the wiring diagram reproduced in these pages. On each, every terminal point is marked with a letter of the alphabet; these letters indicate which points should be connected together and in what alphabetical sequence.

How to Wire-up the Set

Thus, all those points marked *a* are first connected in the most convenient way; then all those points marked *b*, and so on throughout the alphabet. It does not matter, as has already been mentioned, how the sub-baseboard wires are arranged.

As regards coils, normally a No. 60 will cover the lower broadcast band (in the



Valves and coils all ready in position in the Glee-singer Three

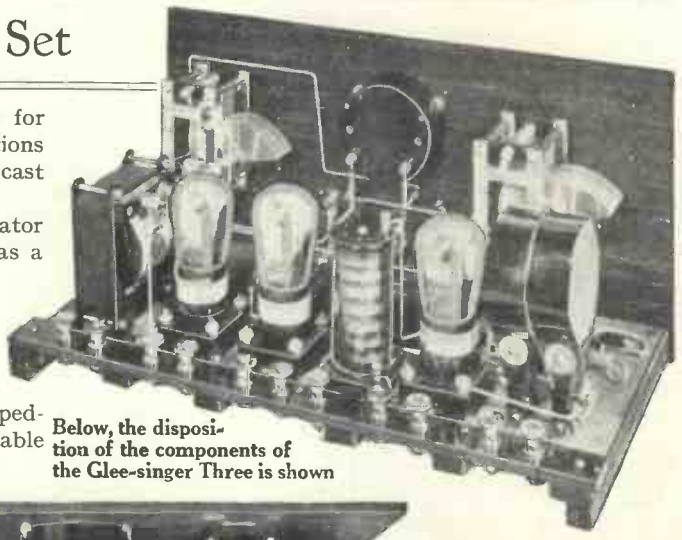
A Fine Gramo-radio Set

aerial circuit), while a No. 50 should be suitable for reaction. A No. 200 and a No. 150 in the same positions should be adequate for reception on the higher broadcast band.

The choice of valves is not difficult if the operator remembers that the impedance of a valve that has a resistance coupling in its anode circuit should be approximately one-third of that resistance.

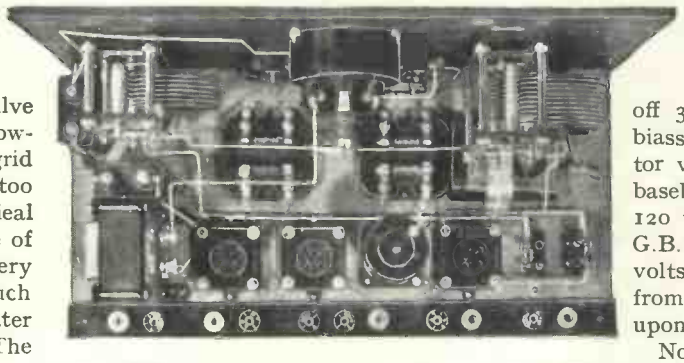
Best Detector Valve

Thus if the anode resistance is 250,000 ohms (.25 megohm) as specified, then a valve with an impedance of the order of 60,000 to 80,000 ohms will be suitable as detector.



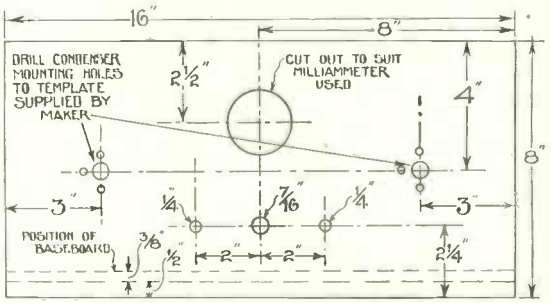
Below, the disposition of the components of the Glee-singer Three is shown

In cases where the set is used some distance from the local station and the strength is not overpowering, a similar valve can be used for the first low-frequency stage : but the grid swing of such a valve is too limited to handle a great deal of energy and in the case of signals that are initially very strong a valve with a much lower impedance and greater grid swing is advisable. The value in this case can be anything between 20,000 and 40,000 ohms.



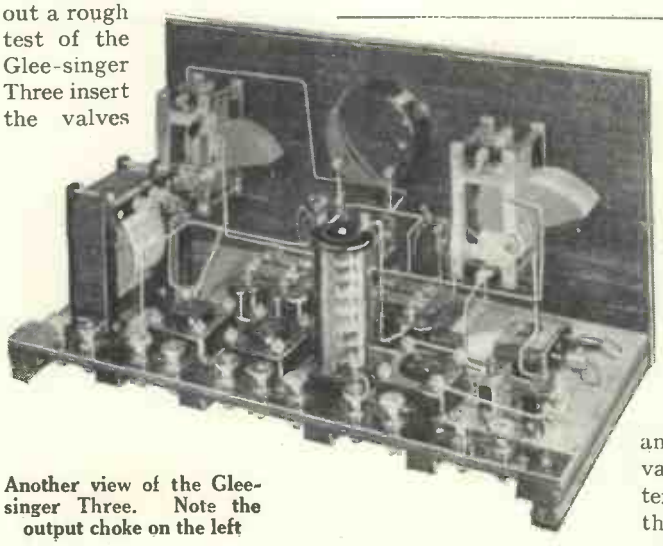
Last-stage Valve

Of course, the last valve should be of the super-power type with an impedance of less than 5,000 ohms. Something about 3,500 ohms will be suitable for most cone and even moving-coil loud-speakers.



Panel layout of the Glee-singer Three

To carry out a rough test of the Glee-singer Three insert the valves and coils and apply the following voltages : Tap off 3 volts negative on the biassing battery for the detector valve (mounted on the baseboard). To H.T.+ apply 120 to 150 volts, while to G.B.—1 apply from 3 to 6 volts and to G.B.—2 anything from 6 to 18 volts, depending upon the type of valve.



Another view of the Glee-singer Three. Note the output choke on the left

Now turn the master rheostat full on and adjust both reaction condenser (right) and anode-bend potentiometer (left) until the slight rustling or hissing sound is heard from the loud-speaker which indicates that the set is on the verge of oscillation.

Greatest Volume

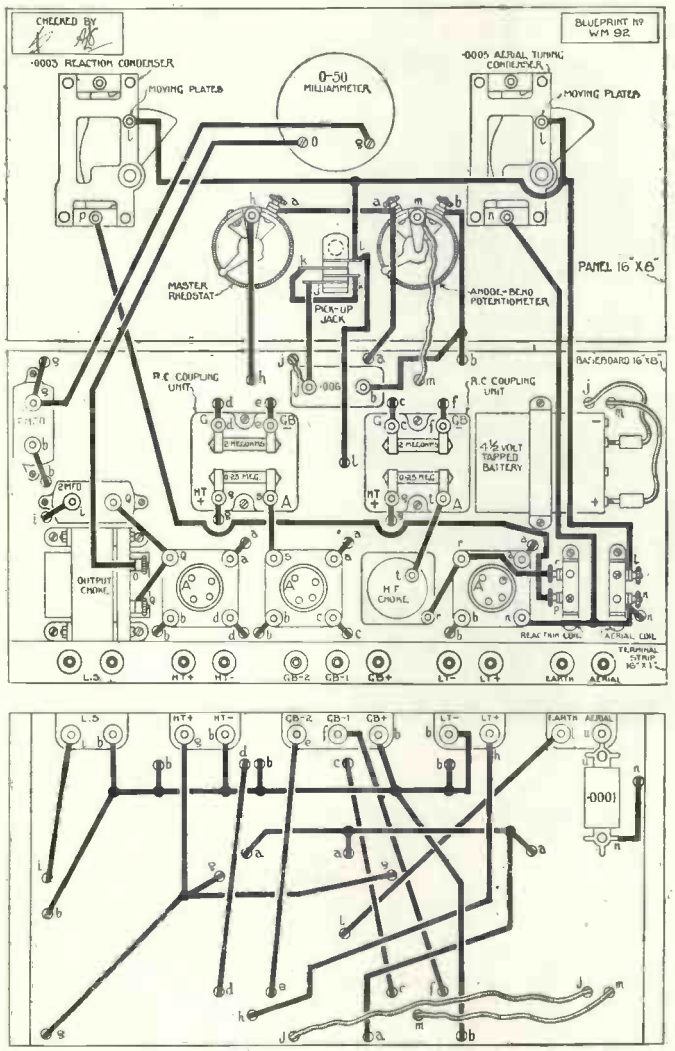
Turn the knob of the aerial-tuning condenser (left) until a transmission is picked up, when the potentiometer (and associated battery) and reaction condenser should be adjusted for the greatest volume.

It is at this stage that the milliammeter begins to play a most useful part. If the reading is not quite steady, distortion is taking place and this should be cured by readjusting the bias applied to the grids of all three valves. The needle will flicker even when distortion is not bad enough to be appreciated by the ear, but nevertheless it is there and should be remedied. Adding more (or applying less in the case of the detector) negative bias will usually produce the desired result—an absolutely steady reading.

Conserving the High Tension Supply

Actually the milliammeter only indicates the amount of current passing in the anode circuit of the last valve. By increasing the amount of grid bias, the high-tension consumption will be reduced and in this way the supply can be conserved. It is a safe rule to apply

The Glee-singer Three (Continued)



This layout and wiring diagram of the Glee-singer Three can be obtained as a full-size blueprint for half-price, that is 6d. post free, up till August 31, if the coupon on page iii of the cover is used. Ask for No. W.M.92

as much grid bias as the valves will stand.

Alteration of the detector bias may be needed when using the set as a gramo-radio amplifier. Connect the magnetic pick-up (special connections are required for electro-static pick-ups) to the plug and insert it in the jack.

Pure Reproduction

In this case, the milliammeter is particularly useful, for one is sure of getting absolutely pure reproduction (provided the correct valves are used). For gramo-radio work with a sensitive pick-up it will be almost essential to use a valve with an impedance of 20,000 to 30,000 ohms in the first low-frequency stage, as any valve with a higher impedance is likely to be overloaded.

An ordinary horn-type loud-speaker is not recommended for use with this receiver, unless it be one of the exponential or logarithmic type, as the bass will not be well reproduced. The best results will be obtained from a modern exponential horn, cone, or moving-coil loud-speaker.

Excellent Quality Assured with This Set

If a really good super-power valve is used in the last stage and the first low-frequency valve is chosen according to particular needs, the Glee-singer Three will be found to give unimpeachable quality.

We have invited Mr. J. Godchaux Abrahams to try out this receiver independently and his tests show that although the Glee-singer Three does not possess great range, the quality of the few stations that can be picked up on the loud-speaker is superb. No doubt many readers will be able to get greater range than we normally claim for this receiver with an average aerial and earth system.

VALVES TO USE IN THE GLEE-SINGER THREE

Voltage	Detector	1st L.F.	2nd L.F.
2-volt	Cossor 210RC Mullard PM1A Six-Sixty 210RC	Cossor 210HF Mullard PM1LF Six-Sixty 210HF	Cossor 220P Mullard PM252 Six-Sixty 215P
4-volt	Cossor 410RC Mullard PM3A Six-Sixty 4075RC	Cossor 410HF Mullard PM3A Six-Sixty 4075HF	Cossor 410P Mullard PM254 Six-Sixty 425SP
6-volt	Cossor 610RC Mullard PM5B Six-Sixty 6075RC	Cossor 610HF Mullard PM5X Six-Sixty 6075HF	Cossor 601P Mullard PM256 Six-Sixty 625SP

COMPONENTS REQUIRED FOR THE GLEE-SINGER THREE

1—Ebonite panel, 16 in. by 8 in. (Radion or Becol).
1—.0005-microfarad variable condenser (Cyldon or Burndept).
1—.0003-microfarad variable condenser (Cyldon or Burndept).
2—Vernier dials (Harlie or Formo).
1—Milliammeter, reading 0—50 (Ferranti type RIP).
1—7-ohm panel rheostat (Lissen, Peerless, or Igranic).
1—400-ohm panel potentiometer (Lissen, Ormond, or Igranic).
1—Plug and jack (Igranic type P63).
2—Resistance-coupling units (Dubilier, R.I. & Varley or Mullard).
1—.006-microfarad fixed condenser (Dubilier, T.C.C., or Lissen).
2—2-microfarad fixed condensers (Dubilier, T.C.C., or Hydra).
3—Anti-microphonic valve holders (Benjamin, Lotus, or W.B.).
2—Single-coil holders (Lotus, Lissen, or Magnum).
1—High-frequency choke (R.I. and Varley, Cosmos, or Igranic).
1—Output filter choke (R.I. and Varley, Igranic, or Ferranti).
1—4½-volt tapped grid-bias battery (Siemens or Ever-Ready).
1—.0001-microfarad fixed condenser (Igranic, Dubilier, or T.C.C.).
1—Terminal strip, 16 in. by 1 in. (Radion or Becol).
11—Terminals, marked: Aerial, Earth, L.T.+, L.T.—, G.B.+, G.B.—1, G.B.—2, H.T.+, H.T.—, L.S.+, L.S.— (Eelex).
6—2-ft. lengths insulated wire (Glazite).
1—Cabinet with 8 in. baseboard (Edwards).

Steps the B.B.C. Is Taking for

Doubling the Number of Licence Holders!

Specially Contributed to the "Wireless Magazine" by Savoy Hill Officials

SOMEWHERE it was suggested recently that in official circles the view was held that broadcasting licences had reached saturation point. This is entirely fallacious. While there is still an enormous number of pirates, users of hidden apparatus who possibly could only be unearthed by a long, tiresome and expensive house to house search, there remains also, incredible as it may sound, a percentage of the population which has not even yet heard of the B.B.C., or what it is here for.


FEE
s. 10/-
RECEIVING LICENCE.
P 236341
WIRELESS TELEGRAPHY ACTS, 1904-1925.
(This Licence expires on the 31st July 1928.) New
Mr. THE DIRECTOR BERNARD JONES PUBLICATIONS LTD
(Name in full to be shown in block letters)
of 58/61 Fetter Lane EC4 is hereby
(Address in full)
authorised (subject in all respects to the conditions set forth on the back hereof) to establish a wireless station for the purpose of receiving messages at above
(address of station)
address for a period ending on the date shown above.
The payment of the fee of ten shillings is hereby acknowledged.
Dated 3rd day of August 1927
Issued on behalf of the Postmaster-General
Postmaster
Signature of Licensee
HATTON GARDEN AUG 3 1927 E.C.

If you own a wireless set and are not familiar with the above licence form you must be a "pirate"! The cost of a licence for any set is 10/- a year—surely a small enough outlay for the entertainment that is available!

Talk of "saturation point" can therefore be dismissed until such time at least as the licence records show a figure of four millions.

What the B.B.C. Is Out to Do

The B.B.C. is definitely out to double the present licence figures. Additions to its salaried personnel, plans for the improvement of its transmissions and the introduction of alternative programmes, the formation of new organisations which shall have their part in the vast national enterprise which functions through Savoy Hill, the contemplated erection of a great new edifice in the heart of London as a home of broadcasting which, like the British service itself, shall be a pattern and example to the world—all these schemes point to the intention of developing the business side as well as the artistic side of the broadcasting machine.

What is being done towards the accomplishment of these aims? The B.B.C. has already made a special study of conditions in the North and has introduced the regional idea to Northerners by means of what might be termed communal programmes. Manchester has, in fact, become already the centre for the distribution of programmes throughout the Northern area and the artistes contributing to its S.B. items are drawn from the studios of Liverpool, Leeds, Bradford, and Sheffield as required.

To enhance the musical side of the Northern programmes a new permanent orchestra has been formed in Cottonopolis, consisting of twenty-seven members, many of whom are members of the Hallé Orchestra, and quite a number of whom are well-known, not only as orchestral performers, but also as solo artistes.

Members of the Orchestra

Mr. T. H. Morrison continues as conductor, while Mr. John Bridge is the leading violinist and deputy conductor. The principals are Don Hyden, deputy-leader; Leonard Hirsch, principal second violin; Frank Park, principal viola; Clyde Twelvetrees, principal 'cello; Alfred Stott, principal double bass; Joseph Lingard, principal flute; Alec Whittaker, principal oboe; Pat Ryan, principal clarinet; Archie Camden, principal bassoon; Otto Paersch, first horn; Charles Birtles, first trumpet; Sam Holt, first trombone; Harry Hoyland, bass trombone, and John Massey, timpanist.

The formation of this permanent orchestra has made it possible for Manchester to put on many more orchestral concerts in the afternoon than hitherto, apart altogether from evening concerts.

While moves were being made in the North with the root object of encouraging a greater use of the broadcasting medium, the B.B.C. was busy also in the West, where it started an experimental scheme, in conjunction with the Welsh National Council of Music, the National Museum of Wales and the Cardiff City Corporation, for a "National Orchestra of Wales," to perform in public and to broadcast nationally.

Six Weeks' Experiment

A six weeks' experiment was so successful that, despite the fact that no further use of the orchestra for broadcasting purposes was projected, pending the opening of a second season of twelve weeks, on October 4 next, weekly concerts will be continued at the request of listeners; and when it is remembered that throughout the world orchestras have had to be heavily subsidised by national and civic authorities, the work which is being done in Wales without any charge on the ratepayers assumes a deep significance.

A third and equally important development in progress is the reorganisation of the National Chorus.

Doubling the Number of Licence Holders! (Continued)

In the past, this chorus was formed as and when required by parties drawn from various amateur choral societies which operate in central London (for example: Lloyds, the Civil Service, the Railway Clearing House, etc.), together with the professional Wireless Chorus.

For Big Choral Works

The B.B.C. considered that past experiments justified the use of a large chorus for important works on a big scale, as distinct from the professional Wireless Chorus which is used regularly for studio performances. Accordingly, plans were laid for a large permanent chorus in addition, which will rehearse regularly once each week during the winter months and will retain its personnel practically unchanged from year to year. This chorus will perform the bigger choral works at certain of the public symphony concerts which are organised from time to time by the B.B.C.

Choral singing by large bodies of choristers is an art in which the competent amateur is pre-eminent. For that reason, the new National Chorus will consist entirely of amateurs. It will be about 250 strong and each member will be carefully chosen. The chorus will, of course, be adequately balanced.

No Need for Fear

There need be no fear on the part of existing amateur societies that this new move of the B.B.C. will interfere with, or hinder, their own work. It should rather help forward the appreciation of choral music, the most democratic of the arts. Hence the B.B.C. insists that no one shall be a member of the National Chorus unless he or she is, and agrees to remain, an active member of some other amateur choral society.

The chorus will be trained by Mr. Stanford Robinson, the B.B.C. Chorus-Master, and will perform under various conductors of international repute next autumn and winter. It will appear in public about three times each season.

The scheme is only in its infancy; but the B.B.C. hopes that it may be possible to produce a chorus of superlative merit, leading to a revival of choral singing, which has sadly declined since the war. Listeners have already been enabled to recapture the pleasures of unison songs through the revival of community singing; the B.B.C. is now aiming to help them to test the happiness which is to be found in vocal harmony.

The next development foreshadowed is in the introduction of a scheme for transmitting illustrations in connection with the broadcasting service. Whether this new facility will take the form of "live" or "still" pictures it is yet too early to say; but progress is undoubtedly being made with the various inventions with which experiments are being carried out. The B.B.C. engineers were, for instance, much impressed recently by a demonstration conducted by Captain Otto Fulton, an inventor, at the Research Department of the Corporation at Clapham.

Transmitting Photographs

Photographs were transmitted on 2LO's wavelength between the Oxford Street station and Clapham and the results were good. The system is not television, but telephotography, and could probably be used for the broadcasting of weather charts, illustrations to talks and stories, facsimile writing, finger-prints and any other purpose where pictorial representation might be of service in elaborating the spoken word.

So far, transmission has successfully been achieved over a distance of 650 miles and the time of each single pictorial broadcast is about three minutes and a half. Various European capitals have adopted the device and it is understood that the regular insertion of pictorial broadcasting in certain foreign programmes will begin next autumn.

Close Watch on Developments

The B.B.C. engineers are closely watching developments in this direction and British listeners will benefit immediately the advantages of adopting any invention are found to be in the interests of the broadcasting service.

[Articles by B.B.C. Officials appear in the "W.M." every month]

Receiving Licence Conditions

1. The Licensee shall not allow the station to be used for any purpose other than that of *receiving* messages in the premises occupied by the Licensee.

2. The station shall not be used in such a manner as to cause interference with the working of other stations. In particular, reaction must not be used to such an extent as to energise any neighbouring aerial. (See Note).

3. The combined height and length of the external aerial (where one is employed) shall not exceed 100 feet. An aerial which crosses above or is liable to fall upon or to be blown on to any overhead power wire (including electric lighting and tramway wires) must be guarded to the reasonable satisfaction of the owner of the power wire concerned.

4. The Licensee shall not divulge or allow to be divulged to any person (other than a duly authorised officer of His Majesty's Government or a competent legal tribunal) or make any use whatsoever of any message received by means of the station other than time signals, musical performances, and messages sent for general reception and messages received from a licensed experimental station in connection with experiments carried out by the licensee.

5. The station and this licence shall be open to inspection at all reasonable times by duly authorised officers of the Post Office, who will produce their cards of identity on request.

6. This Licence may be cancelled by the Postmaster-General at any time either by specific notice in writing, sent by post to the Licensee at the address shown hereon, or by means of the general notice in the London Gazette addressed to all holders of wireless receiving Licences, and will be cancelled on breach of any of the foregoing conditions. In the event of cancellation no part of the fee will be returned.

7. The Licence is not transferable.

NOTE

Interference is taking place if a continuous "note" or "whistle" is heard. If this "note" or "whistle" changes when the wavelength of the receiver is altered the cause of interference is in the receiver and reaction must be reduced until no "note" or "whistle" is audible. If the "note" or "whistle" does not change the interference is due to some external source.

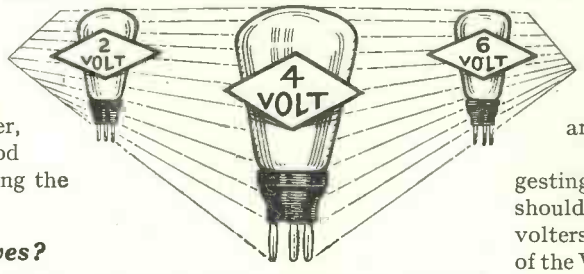
Any permanent change of address must be promptly communicated to the Head Postmaster of the district in which the station is situated. The serial number and date of expiration of the licence should be quoted in all cases. Notice of a temporary change is not required.

Do you remember the conditions under which your licence is issued? Every "Wireless Magazine" reader, of course, makes it a point of honour to observe Clause 2: see that others do, too!

THE VALUE OF FOUR-VOLT VALVES

By D. SISSON RELPH

UNTIL a few weeks ago the four-volter had been so neglected that it showed signs of becoming the Cinderella of the valve family; recent events, however, show that it has dormant good qualities which are at last seeing the light of day.



Abolishing Four-volt Valves?

In some quarters the drastic step of abolishing four-volt valves altogether was advocated with some persistence, but a careful consideration of the position shows that it would be better to retain four-volt valves only, and scrap two-volters and six-volters, than to pursue any other course.

We are quite aware of the value of the two-volt valve as regards utility in practical working and, moreover, we are also aware of the superiority of the six-volter, characteristic for characteristic, when filament wattage is taken into account. But there is every reason for asking the question: "What advantages can the six-volt valve give us that the four-volt valve cannot offer on its own?"

Now it will be readily admitted that the chief argument in favour of the use of two-volt valves is that only a two-volt accumulator is required. But what advantage does this give us in practice?

Better Four-volters

Take two equivalent power valves of the two- and four-volt classes and note their filament consumption. In most cases the consumption of the four-volt valve will be half that required by the two-volter and, moreover, the characteristic of the four-volt valve will be very much better. This is true of valves of almost any make, even in spite of the fact that four-volters have not been developed to anything like the extent that two-volters have during the past year.

Where, then, is the advantage of the two-volt accumulator? For this, as will be readily seen, must be twice the size of a corresponding four-volt battery in order to give the same number of working hours. It will thus be evident that the four-volter has the advantage over the two-volter of reduced filament consumption and greater efficiency.

Now what can we learn from comparing the four-volter with the six-volter? Well, in the first place the six-volter shows no economy of filament current, characteristic for characteristic, over the four-volter and the efficiency of the six-volter is very little, if any, greater than that of the four-volter. In this case, although we save nothing in consumption by using a four-volt valve, yet we do save one cell of an accumulator—which is again an advantage in favour of four-volters over six-volters.

Question of Filament Efficiency

I have discussed this matter at length with several people interested in the manufacture of valves and find they agree that in most cases a valve with a four-volt filament can be made to do everything that a valve with a six-volt filament is capable of, but it is not possible to make a valve with a two-volt filament equivalent to a valve with a four-volt filament, *except by increasing the filament consumption.*

The Position of Portables

Some readers will immediately ask what will happen in regard to portable sets if four-volt valves take the place of two-volt valves. Well, the answer is that although two cells would be needed, each of these could be approximately half the capacity—and, therefore, approximately half the size and weight—of the corresponding two-volt cell that would be necessary with two-volters, because of the lower total of filament consumption.

Already portable-set manufacturers are making a move in this direction, as also are makers of ordinary receivers.

I am not, by any means, suggesting that two- or six-volt valves should be abolished in favour of four-volters, but I would suggest to readers of the WIRELESS MAGAZINE that there are advantages to be obtained by using four-volt valves which, perhaps, they have so far overlooked. This autumn is likely to see a number of interesting developments in the four-volt class.

When We Can Standardise

There is one last point. One might suppose that in the course of time manufacturers will be able to make valves with two-volt filaments as good as those with four-volt filaments, with the same consumption, but the opinion of at least one group of manufacturers is that for many years to come four-volt valves will always be more efficient than two-volters for the same consumption.

Any revolutionary development, however, in the process of making low temperature emission filaments might, at any time, make it possible for manufacturers to standardise on two-volters only. Until that time comes, though, it seems that it will be best to concentrate on the perfection of the four-volt valve.

Continental Notes

(*Continued from page* 54)

from his South American tour and I was present—through my earphones—at the welcome accorded by the United States to Captain Koehl, Baron von Huenefeld and Major Fitzmaurice, after their rescue on Green Island and their subsequent arrival at New York.

Again, more recently, when Captain Wilkins and Lieutenant Eyelson landed on the Tempelhof Aerodrome at Berlin, the German stations broadcast their reception. The return of the crew of the aeroplane *Bremen* and the arrival of the s.s. *Columbus*, were each relayed from Berlin.

The Sunshine Five in the North Country

By J. H. REYNER, B.Sc., A.M.I.E.E.

Constructional details of this receiver were given in the May issue of "W.M."

Near Milnthorpe

At Ullswater

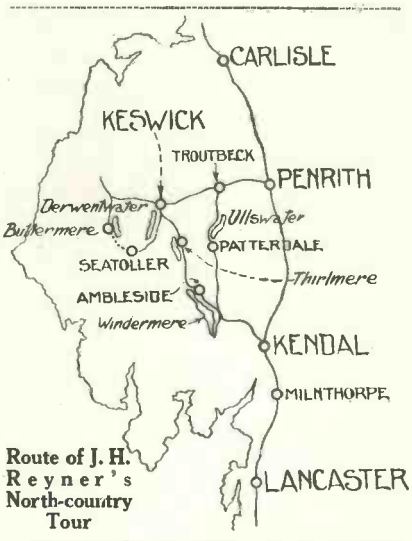
FOLLOWING the tours made at Easter time with the Sunshine Five, I spent a few days recently in touring round the north-west of England with a view to ascertaining what results could be obtained in these districts. There is a large number of very enthusiastic listeners in this area, so that the results are of particular importance.

Route of My Tour

The route of the tour was through the Potteries to Liverpool and thence on to the Lake District. This route, incidentally, took me right past Daventry, which was to be the principal source of entertainment in those parts of the country more remote from civilisation. Those readers who know the countryside around Daventry will appreciate the very fine setting which the masts make against the sunset, which was the inspiring picture I took with me on my road north.

I got as far as Stone, in Staffordshire, the first night, and here the set was brought into commission for the first time. It gave excellent results. On the long waves I obtained Daventry, Radio-Paris, and Berlin (Zeesen) at very good strength, while Hilversum and Ryvang were also audible, although somewhat fainter.

On the short-wave band, 5GB and Langenberg were tuned-in without any difficulty. My geography being a little feeble, it was not until the next morning that I discovered my proximity to Stoke-on-Trent and I did not, therefore, listen for this station which would be tuned in rather towards the bottom of the scale and, consequently, below the general run of stations. I have no doubt, however, that this station could have been received without difficulty, judging by the performance of the set.



Route of J. H. Reyner's North-country Tour

The next time the set was brought into commission was in Liverpool itself. Here again, excellent results were obtainable. Both Daventry's came in at good strength, while Manchester and Liverpool were obtained without any difficulty. These are daylight ranges and, as the time was limited, tests on distant stations were not then conducted.

The route went on through Lancaster and Kendal to the Lakes, the ultimate goal being a small farmhouse at a place called Seatoller, where I had recollections of a previous happy holiday.

This village is at the extreme end of the Borrowdale Valley, the most picturesque of all Lakeland scenery, and here we encountered the first set-back. It was only with considerable difficulty that I was able to tune in Daventry at all, and no other station was audible with the exception, rather to my surprise, of Radio-Paris, which in its lucid moments was quite comfortably intelligible. Daventry undoubtedly was a disappointment and was also subject to fading, the strength at the bottom of a fade being such as to render him very difficult to follow.

Poor Spot for Reception

I cheered up somewhat on the following day, when I made inquiries from others in the village and found that it was a very poor spot for reception. I had, indeed, had suspicions of this, for the village is hemmed in on nearly every side by the mountains rising in height to 1,500, 2,000

and in some cases, 3,000 feet, so that one might expect a certain amount of shielding.

I learned that, although on an outside aerial, a three-valve receiver *would* receive Daventry on the loudspeaker, yet in order to obtain good reception and in order to get distant stations, particularly on the 200 to 500 metre band, a five-valve set was required. Nothing less was, apparently, of any use.

That the poor reception was due to local conditions I was able to confirm later on in other parts of the district. Some photographs were taken at this spot, one showing the farmhouse where we stayed, with myself explaining the mysteries of wireless to the daughter of the house. The photographs reproduced give some indication of the mountainous nature of the country surrounding.

A short trip down the valley towards Keswick was made the next day and the upper route was taken, this winding several hundred feet above the bottom level. The difference in reception was very marked and another photograph shows the set in operation at a particularly beautiful spot overlooking Derwentwater.

The camera was 15 yards away from the set when this photograph was taken and every word was distinctly audible at this and even greater distances when the set was tuned to Daventry. No short-wave stations were obtained in daylight, although Manchester could be heard faintly.

A tour round the remainder of the district was then made, the route being Keswick, Troutbeck, Patterdale, Kirkstone Pass, Ambleside, Keswick. Tests were made at various points, one such test taken on the road just overlooking Ullswater being shown in the second photograph. Throughout the district the same variability in reception was noted.

At some places quite good results could be obtained, while in others the response was disappointing. Daventry was the best station in all cases. The air-line distance from Daventry to Seatoller is 180 miles.

On the return journey, therefore, a test was made as soon as we were clear of the Lake District itself. It so happened that there was no actual transmission until we reached Milnthorpe, which is some sixteen miles north of Lancaster. Here a test was made in a very picturesque spot, as indicated by a photograph, and Daventry was received at excellent strength without any difficulty whatever.

Daventry at 150 Miles

The airline distance here is 150 miles, and the strength indicates that the set is good for the considerably greater distance when troubles due to excessive shielding are not introduced.

On the whole, therefore, the second test may be considered satisfactory, although it was not as good as I had hoped. As far as convenience went the receiver behaved excellently. It was always ready for use without any attention even after the severe bumping that it occasionally received in going over some of the roads.

One point I have discovered in actual operation which may puzzle one or two readers and that is that a nasty threshold howl is sometimes liable to be set up just before going into oscillation. This howl may prevent the reception of stations altogether, for one is apt to mistake it for the actual oscillation itself and, therefore, the carrier wave of the station required is not heard.

Actually this threshold howl occurs a little *before* the oscillation point and if one continues through it, the true oscillation will be found and the station can be pulled out of the carrier in the ordinary way.

I mention this method of achieving results despite the howl only in case it proves obstinate, but in a general case it can be obviated completely by a readjustment of the voltage on the detector. This is supplied with a separate tapping and it should be kept at a fairly low value. Actually, I used about 36 to 42 volts and if the value is increased much above this difficulties may arise due to this cause.

THE ATTENTION OF PROSPECTIVE CONSTRUCTORS OF THE SUNSHINE FIVE (WHICH WAS FULLY DESCRIBED IN THE MAY ISSUE) IS CALLED TO A SPECIAL ARTICLE ON PAGE 77

(Above)—Testing the Sunshine Five at Seatoller, a village surrounded by hills. (Right)—By the side of Derwentwater

Broadcast Music of the Month

Reviewed by Studius

David Wise, Violinist

THERE has been undoubtedly an attempt this month to lighten the programmes, and though over-much syncopated music still prevails, there is obviously a public for that type of thing. Many well-known variety and musical revue stars have figured prominently.

Gwladys Naish, "The Welsh Nightingale"

Some Popular Artistes

Launcelot Quinn, made popular by his success in *Hit the Deck* and known to northern audiences long before he reached London, was heartily welcomed therefore when he returned to Manchester and broadcast some of his successes from that station.

Thornley Dodge, another name of the old Gaiety times, also figured in the same programme with Colleen Clifford and Walter Bayley. The last is a clever bird mimic.

Many favourite broadcasters have been heard, including the two clever partners, Jeane Paule and Leonie Lascelles, both from London and the provincial studios. In every case their songs are different, witty, and well played.

De Groot, with his orchestra; Helena Millais, with her inimitable and really natural "fragments of life" with our "Our Lizzie" to portray them; Helen Gilliland, recently appearing in *Lady Mary* and known to listeners as well for her former broadcast in *The Cousin from Nowhere*; Jack Buchanan, the popular musical comedy star; and Gene Gerrard, who appeared in *Katja the Dancer* and *The Desert Song*, are all artistes who have striven to make a brighter London; while most popular of all are the Charlot Hours.

A special programme is being arranged by Mr. Charlot for July 26, as this date marks his birthday, and most of the original company will be heard.

Last, though by no means least, comes a return of Arthur Prince, the well-known ventriloquist, with his famous companion "Jim."

Even the plays have been a little lighter in texture, a good announcement being the little work, *Something In the Air*, written by Harold Simpson, author of *The Nine o'Clock Revue*, *Dover Street to Dixie*, and other revues. Very tuneful music was written for this by Stanley Holt, who conducted the Revue Chorus and B.B.C. Dance Orchestra for the occasion.

One would like to see the amount of light orchestral items increased still further. The dance bands are well supplied by the performances of Fred Elizalde and his orchestra at the Savoy, as well as by M. Georges Boulanger, who conducts a Tzigane orchestra.

Fred Elizalde and his band at the Savoy

The music heard from the Carlton under the leadership of M. Rene Tapponnier, as well as that from Signor Colombo at the Hotel Victoria, is on a higher plane. Classical as well as the more ordinary popular music is heard, most perfectly played.

Sydney Coltham

Elsie Suddaby

Special Programmes

Special programmes are always popular, though it would be as well sometimes to give us some of the lesser known works of the composers. A special Spanish programme should be noted, when the best-known works of De Falla, Granads and Albeniz, were heard, carried out by the orchestra, with De Brosa and Gertrude Johnson as soloists.

(*Continued on page* 66)

—what Mr. Vincent says about the "Chummy Four"

June 26th, 1928.

"On Friday last, June 22nd, between 9.30 p.m. and 12.30 a.m., I tuned in on the loud-speaker thirty-three stations, including 2 LO and 5 GB, and when I say on the loud-speaker, I mean that the majority of the stations could be heard upstairs when the set was working downstairs.

The only other set that I have had that was as easy to operate as this one was a seven-valve super-het, and that easily lost on the score of noisiness and purity of tone.

Up to the moment I have had nothing to compare with this set in respect of range, simplicity of tuning, or quality of reproduction, and I congratulate you."

Yours truly,

(Signed) FRED VINCENT.

P.S.—This is my first experience with a screened grid valve.

The Cossor 2-volt Screened Grid Valve plays a big part in the success of the "Chummy Four."

Ensure maximum results from your Receiver—use Cossor Valves throughout. Cossor Valves are designed to work together—to help one another in building up weak signals—to reproduce with perfect clarity of tone and ample volume. Ensure complete success—

use Cossor Valves throughout your Set

USE THESE VALVES IN YOUR "CHUMMY FOUR" AND GET MAXIMUM RESULTS :—

1st Valve	2nd Valve	3rd Valve	4th Valve.
Cossor Screened Grid	Cossor 210 R.C.	Cossor 210 L.F.	Cossor 230 P
22/6	**10/6**	**10/6**	**20/6**

COSSOR

The Valves that improve *any* Receiver

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

CA 5277

Broadcast Music of the Month (Continued)

Helena Millais

Georges Boulanger, leader of Tzigane Orchestra at the Savoy

E. Casati

Clifford Collinson

Another concert of interest was that arranged during the lifetime of the late Sir Herbert Brewer, which he had hoped to conduct himself. Under its title, "On Severn's Banks," it comprised works of many of the best known if not the most musical of English musicians, including Sir Edward Elgar, Sir Hubert Parry, Sir Herbert Brewer, Basil Harwood, Gustave Holst, Vaughan Williams, and Herbert Howells.

Apart from the appearances of Lafitte, the famous pianist, and Arnold Trowell, the violoncellist, the month has not been conspicuous for solo performances. But that does not mean that no good playing has been heard; far from it. The B.B.C. have, however, refrained from putting out money merely on big names.

David Wise: Violinist

It would be difficult to find a better player than David Wise, a young violinist who has been heard from halls and in the Children's Hour at 2LO, as well as at several special recitals. His tone is rich and warm, and he has a peculiar facility for broadcasting.

Amongst the 'cellists a welcome re-appearance was made by a very early broadcaster, namely, Miss Beatrice Eveline. Kathleen Moorhouse, of the Hallé Orchestra, and Cedric Sharpe have also been heard to good advantage.

Amongst the singers, many of the B.N.O.C. artistes have been heard, prior to their starting their autumn season in September—Sylvia Nelis, Heddle Nash, Norman Allin, and Kingsley Lark amongst them. Best of all, perhaps, was Miss Gwladys Naish,

Dorothy Kitchen

queen of coloratura singers, who has well earned the title of "The Welsh Nightingale."

Amongst other familiar names, one remembers the performances of Winifred Fisher, Gladys Palmer, Elsie Suddaby, and Dorothy Robson, because they early learnt the art of broadcasting; consequently, we do not have to strain to discover whether they are singing in English or a foreign tongue—a thing not always easy to discover with some of the newer artistes.

Sport, already too well represented, had formed the subject of talks by Mr. Peter Freeman and Mr. F. R. Stainton, also Lieut.-Col. M. F. McTaggart. Probably, however, the most popular "talkers" are members of the Royal Family, and *the* most popular undoubtedly H.R.H. the Prince of Wales.

His address, therefore, on July 1 for the annual "Day of Remembrance" Parade at the Glasgow Cenotaph, and the christening of the new ship, H.M.S. *York*, by the Duke and Duchess of York on July 17 may be considered as two of the most popular broadcasts of the month.

Too Much Gramophone?

The main faults of the programmes of this month appear to be a superabundance of gramophone records and the predominance of religious daily services and music.

Those readers of the WIRELESS MAGAZINE who favour push-pull low-frequency amplification will be glad to know that in the price of Ferranti push-pull transformers is included the royalty payable to the Standard Telephones and Cables Co., Ltd., who hold a patent on this system of coupling. They are therefore fully and automatically licensed by buying these components. Full particulars can be obtained from Ferranti Ltd., of Hollinwood, Lancashire.

A Moving-coil Loud-speaker

PARTICULARLY neat in appearance is the new Zampa moving-coil loud-speaker recently put on the market. Two models are available, one to work from a 6-volt accumulator or trickle charger connected to A.C. mains and the other for D.C. mains working. The former model has a consumption of .5 ampere.

Zampa Loud-speaker

In both cases the resistance of the moving coil is 1,500 ohms, while the diaphragm is supported with oiled silk. The over-all dimensions of the complete instrument are as follows: Height, 9⅞ in.; width, 8½ in.; and depth, 9 in.

These Zampa loud-speakers are manufactured by the Mic Wireless Co., of White Horse Place, Market Street, Wellingborough.

CHINESE TELEGRAMS IN MORSE!

THE transmission and receipt of telegrams in China is not so easy as in most other countries, because the Chinese language lacks an alphabet and expresses itself by characters and signs that represent words.

In consequence, for purposes of telegraphing a list has been made of signs in quantity sufficient for ordinary correspondence, and to each one of the signs a different number is is given, which is transmitted by the Morse telegraphic system.

Nearly Ten Thousand Ciphers

The code consists of 9,800 ciphers, the whole forming a pamphlet of forty-nine pages, each one of which contains ten series of twenty characters with its corresponding number. On receipt of a telegram the operator looks up in his book the characters represented by the numbers transmitted by the apparatus and transcribes them into Chinese. F.P.

The Chummy Four Accumulators

ALTHOUGH it does not appear at first sight to be essential to use unspillable accumulators in the Chummy Four, as the set is carried and operated in an upright position, yet the use of C.A.V. batteries has one very great advantage.

No Acid Fumes

These batteries have an electrolyte of jellied acid, which obviates at once any possibility of acid fumes corroding other components, such as the cone loud-speaker, in the vicinity.

This is a point of some importance, and is the reason why C.A.V. jellied-acid accumulators are essential for the Chummy Four if it is to remain in perfect working order as long as it should.

Remember that for the Chummy Four you need two C.A.V. 2NS9 accumulators and for the Sidecar Portable a 2NS13 battery.

Full constructional details of the Chummy Four were published in the June WIRELESS MAGAZINE; further notes appear on page 13.

"W.M." Tests of New Apparatus

Conducted by J. H. REYNER, B.Sc., A.M.I.E.E.

PHILIPS' L.F. TRANSFORMER

Philips' Low-frequency Transformer

A SMALL and reasonably light low-frequency transformer has been the desire of many set constructors, particularly those who have made portable or transportable receivers.

Hitherto, we have usually associated the ultra small and compact transformer with the second-class apparatus, since it is difficult to visualise a high inductance primary winding, which means a large number of turns and an iron core of ample dimensions, in anything but a bulky component. Recent research, however, has shown that instruments can be produced having good performance with small dimensions.

The new Philips' low-frequency transformer which we recently tested has over-all dimensions of 3½ in. by 1¾ in. by 2 in., and is, therefore, considerably smaller than the majority of transformers on the market.

Measurements taken in our laboratories indicate that the inductance, with a small polarising current through the primary winding, lies between 45 and 50 henries, although the step-up ratio is 3 to 1. The makers claim that such figures are obtained by the use of special materials both in the windings and iron core.

The base consists of a well-finished insulated moulding on which four terminals and soldering tags are mounted. The transformer is enclosed in an iron shroud having a crystalline black finish. Philips Lamps, Ltd., of 145 Charing Cross Road, W.C. 2, are the makers.

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EDISWAN LOUD-SPEAKER

THE Ediswan One-der loud-speaker, which has been submitted for test and report, has a striking appearance, owing to the large size flare and brown finish given to the model. The importance of a large-size diameter horn is not always realised, yet reproduction is governed to a great extent by the design of the horn. A large flare such as fitted to the One-der loud-speaker helps in obtaining a better reproduction of the low notes and also assists by reducing horn reflection and preventing resonance.

Another quality of this loud-speaker is its sensitivity to weak signals. It will reproduce at comfortable strength an electrical output, which would, with many

(*Continued on page 72*)

Ediswan One-der Loud-speaker

"W.M." Tests of New Apparatus (Continued)

speakers, be insufficiently audible.

As an approximate test on the performance of this speaker, we connected it to the output terminal of an electrical oscillator capable of producing audible frequencies from a few cycles per second up to 6,000 cycles at constant amplitude. At certain frequencies there was evidence of slight resonance in the speaker and a slight falling-off in volume at frequencies below 300 cycles per second. On the whole, however, the speaker performed well and gave quite pleasing reproduction of speech and music when tested in a broadcast receiver.

As regards mechanical details, the high-resistance windings are placed on two bobbins, fitted over a substantial steel magnet, over which a large diameter diaphragm rests. The position of the magnets relative to the diaphragm may be adjusted by means of a small grub screw operated from the side of the base. The speaker can be recommended.

The manufacturers are The Edison Swan Electric Co., Ltd., of Ponders End, Middlesex.

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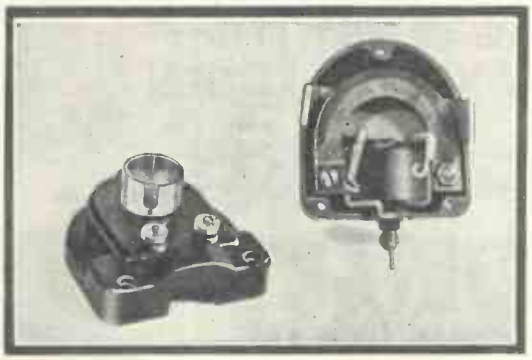
BURNDEPT PICK-UP

THE gramophone pick-up has added a new interest to wireless since it has enabled gramophone records to be reproduced with remarkably good tonal quality in conjunction with a properly designed low-frequency amplifier and loud-speaker. In addition, the volume of reproduction may be readily controlled by means of a variable resistance placed across the pick-up.

It is only natural that first-class reproduction should depend on the type of pick-up amplifier and loud-speaker employed; disappointing results will often occur if one of these items is incorrectly designed.



Burndept Magnetic Pick-up

We have received for test a Burndept electric pick-up. This component bears evidence of careful workmanship and design. The magnetic unit consists of a vibrating armature held centrally in an electrically balanced position between the poles of an electro-magnet. Actual contact between the armature and the pole pieces is prevented by means of a substantial rubber washer fitting over the armature, which is clamped to give the correct degree of damping.

With all types of gramophone pick-up, it is of extreme importance to allow appreciable lateral movement of the armature in order that the needle may follow the vibration ridges set up in the record. If the armature is too stiff, rapid wear of the record will ensue: on the other hand, should the damping be too light, forced vibrations may be set up with consequent distortion.

In the Burndept pick-up, a happy medium seems to have been reached with respect to armature damping and the results obtained on test in our laboratories, indicated that the makers have produced an instrument which gives good reproduction, is sensitive and free from chatter.

Comments on the Five-pounder Four

Full Constructional Details on Pages 5-9 of This Issue

THE Five-pounder Four was not the outcome of a bet, although when I first heard of the intention expressed by the WIRELESS MAGAZINE Staff of producing a four-valve receiver at that price I doubted very much whether the set would be capable of doing what was asked of it. I tender my apologies; I have had the receiver on test for several days and have been surprised at the results obtained.

Value for Your Money

There appears to be little doubt that at the cost of some five pounds sterling for components you can connect up almost nightly with from fifteen to twenty stations without encountering any difficulty; for the outlay of five "Fishers" you may visit in turn England, Austria, Belgium, Denmark, France, Germany, Holland, Hungary, Italy, Poland, Spain and Sweden, with a sporting chance of hearing transmissions from other countries even more distant.

The tone and volume on a cone loud-speaker were very satisfactory; in fact, for the more powerful stations slight detuning was found necessary. Its selectivity is particularly good, but to facilitate tuning it would be wise to equip the anode condenser with a slow-motion dial.

Coils to Use

For the broadcasting waveband, a No. 60 tapped coil was used, but the range would be extended if for lower wavelengths than 300 metres a smaller aerial coil were adopted. For the long waveband both a No. 100 or a No. 150 and No. 200 tapped coils will be found necessary.

The log of stations given on page 9 was compiled on three separate evenings and as an instance of the Five-pounder's reliability I need only mention that in each instance Budapest, Milan, Vienna, Kattowitz, and Copenhagen were received on the loud-speaker.

Stuttgart was obtainable when 2LO was working and so soon as the latter station closed down—my house is within 1 ¼ miles of the London aerial—loud signals from Leipzig were picked up. Some little difficulty was experienced in separating Brussels from Vienna but this was overcome by more careful adjustment of the neutralising condenser and a consequent improvement in reaction.

How to Adjust Reaction

To permit of the reception of distant stations it is essential that the reaction condenser should be adjusted just under oscillation point; any kind of harsh reaction will prevent good tuning apart from the production of distorted howls, whistles, and other unpleasant noises which worry both your neighbours and you. As an all-round four-valve receiver capable of being built at a low cost and possessing the advantages of many more expensive sets, the Five-pounder Four can be strongly recommended.

I have handled many receivers which could not compare with it, although, in most instances the price asked for them was at least double its primary cost.

J. GODCHAUX ABRAHAMS.

A Show(room) Worth Seeing

READERS of the WIRELESS MAGAZINE who have walked down Kingsway recently will have noticed the very striking window display in connection with the new R. I. and Varley showrooms at Kingsway House, 103 Kingsway, W.C.1.

For the benefit of those readers who have not yet visited these showrooms we may say that this is a display of all the products marketed by R. I. and Varley, Ltd., and is arranged to interest wireless enthusiasts and not for the direct sale of components.

Readers who have the opportunity should certainly visit these rooms, where they will not be pressed or even asked to buy, but will be given any technical information they may require about the use of R. I. & Varley components in their receivers.

Those who are unable to visit the showrooms will find it well worth while to apply for the handsome 24-page catalogue for amateurs issued by this firm. Mention the WIRELESS MAGAZINE and address your inquiry to Sales Department, R. I. & Varley, Ltd., Kingsway House, 103 Kingsway, W.C.1.

Taking the "Ive" Out of Wireless!

By John Simple

This is the second of a number of elementary articles by a "low-brow" amateur writing in the "Wireless Magazine" under the name of John Simple. From time to time he will tell readers of his practical experiences with different types of sets and special pieces of apparatus in an informative yet chatty way; this month he writes about tracking troubles in receivers.

Beginners and other amateurs who have not had much practical experience in radio will find John Simple's "confessions" both interesting and helpful, for he writes with the understanding of one who has just passed out of the novice stage himself.

If there is any special point about the operation of a set that is at present obscure to you, just drop a line to John Simple. He will try to answer any practical questions in his articles, but he cannot undertake to do so by post individually.

WHEN I suggested to the Editor of the WIRELESS MAGAZINE that I should be pleased to have an opportunity of unravelling some of his readers' knotty problems at greater length than the Technical Staff probably have time to give to individual questions, I hardly expected to be at once confronted with so difficult a problem as that set by an amateur in North Ferrily, Yorks.

Trouble with the 1927 Five

After explaining that he had built up the Music Charmer with very excellent results and that it is admired by everyone who sees it, this reader says that he built some time previously a 1927 Five receiver, on which he has been able to receive only 5GB, 5XX, Hull (local), Manchester, and about two other stations. Can I tell him what is wrong?

Well, at once let me say quite frankly that I cannot, but I can make a few comments which I hope will be of value to other amateurs as well as to this particular inquirer.

From his letter I gather that he has already written to the WIRELESS MAGAZINE Technical Staff on several occasions regarding this set and received advice. He complains that the same reply is given almost every time and that even when he has applied the suggested remedies no better results are obtained. Altogether I gather that he is pretty fed up!

Now the point that strikes me at once is that the information contained in the letter is far too indefinite for even the most experienced technician to say at once what is wrong. Failing exact details of all the symptoms, it is only possible to generalise very widely, as there are such a number of things which might be causing trouble.

The Case in Detail

Let us examine the case of this 1927 Five in more detail. In the first place the aerial is of the twin type, the wires being spaced 6 ft. apart, while it is 40 ft. long. Two-volt Marconi valves are used, and the high-tension supply is obtained from a Clark's Atlas eliminator. The wiring has been checked and found correct, all the connections are good, and the constructor has been told that

"it is a beautifully built set."

A rheostat is provided for each valve, while the condensers are Jackson's, with slow-motion dials. The windings of the anode coils have been changed several times.

Excellent Quality

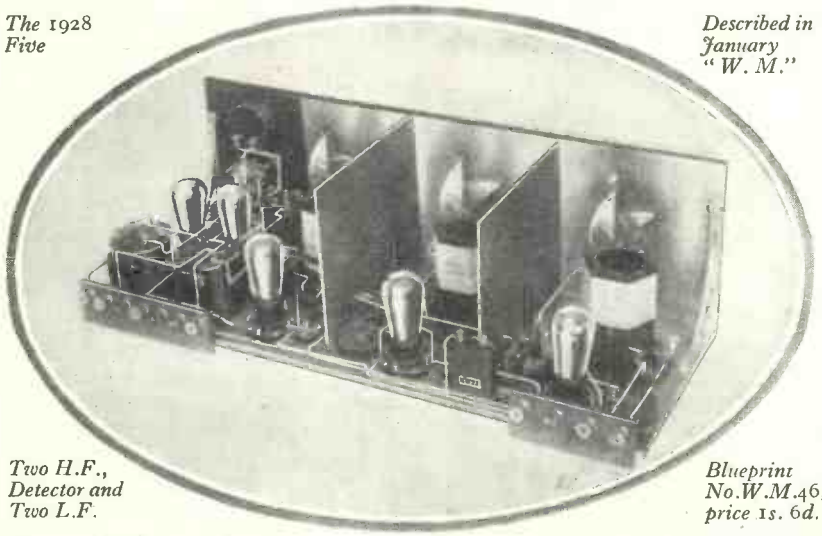
One might suppose that after all this trouble the constructor would feel like scrapping the set, but he does not wish to discard it because of its good appearance and the excellent quality of the few transmissions that he can receive.

Before attempting to suggest any remedy for the state of affairs that exists, one would like to have much more definite details of the symptoms. For instance, there is no indication as to whether the set oscillates violently, or not at all; whether neutralisation can be carried out; and, further (a thing that is of the utmost importance to the would-be adviser), no mention is made of the actual types of valves used.

With such limited knowledge of the actual conditions it is extremely difficult to attempt a satisfactory diagnosis of the real trouble.

The 1928 Five

Described in January "W. M."



Two H.F., Detector and Two L.F.

Blueprint No.W.M.46, price 1s. 6d.

In the first place I should like to suggest, however, that the aerial would be much better if it consisted of only a single wire, 40 ft. length, instead of the twin arrangement. As it is at present, the aerial is likely to have quite a large capacity, and this is always undesirable. Better results in all probability would be obtained by inserting a small fixed condenser of the order of .0001 microfarad directly in the aerial lead.

Having made that addition, if I were testing the set, I would take a lead from the grid of the first high-frequency valve to the grid of the detector valve and switch out both the high-frequency amplifiers.

Then I should try out the set to make quite sure that both low-frequency stages were doing their proper share of amplification. This is made easy by the fact that a jack is provided for cutting out the last stage. A point I should give special consideration to is that no reaction is incorporated, and therefore I should not expect to get results such as would be obtained from a normal three-valve set with a reaction control.

H.F. Stages in Turn

Having satisfied myself that the low-frequency stages were O.K., I should next remove the temporary lead from the grid of the detector valve and place it on the grid of the second high-frequency amplifying valve, replacing the second valve and switching it in circuit.

I should now try the neutralising arrangement to see that it was operating properly and, if it were not, I should then make the recommended alterations to the coils until I was certain that the high-frequency stage was doing all that it ought. This would have got four valves working properly, and I should then altogether remove the temporary grid lead referred to and put the first high-frequency valve into operation, again making sure that its neutralising was perfectly O.K.

Inspecting Coil Contacts

In going over the high-frequency coupling coils I should carefully inspect the pins and sockets to make

(*Continued on next page*)

Taking the "Ire" Out of Wireless (*Cont.*)

sure that they were making perfect contact. I should also try various values of grid leaks and—this being as important as anything—a critical variation of the high-tension voltages applied to the various stages.

A systematic test of the set on these lines is certain to result in the trouble being found. In some cases, of course, it is due to a faulty component, and troubles in this direction are sometimes not at all easy to track down.

These remarks will, I hope, be beneficial to many WIRELESS MAGAZINE readers, but in particular to this querist regarding the 1927 Five. There is one thing I should like to point out to him about this set, and that is that it is now rather out of date. As long ago as last January the WIRELESS MAZAZINE published details of a revision of this receiver under the name, "The 1928 Five." The chief difference between this and the old 1927 Five is that reaction is incorporated.

If all else fails, I would recommend to this reader that he should convert his set into the 1928 Five, when I am sure he will be able to get the stations he desires.

When You Want Advice

Whenever they are asking queries on paper about elaborate sets of this type readers should always give the following information to those whose advice they are asking:

1. General characteristic of aerial system.
2. Details of types of valves used.
3. Actual anode and grid-bias voltages applied to the various stages and, in the case of the former, whether obtained from an eliminator or batteries.
4. In the case of high-frequency amplifiers, whether there is trouble with oscillation and whether or not the stages can be satisfactorily neutralised.
5. Where reaction is incorporated, whether no oscillation is obtained at all or whether oscillation is too fierce.
6. Whether the components used are exactly the same as employed in the original receiver and, if not, what parts have been substituted, with details of the manufacture and values.

Usually there are so many things that might be wrong with a wireless receiver when it is not giving the results that are expected from it that it is almost impossible to give a satisfactory reply on paper unless all these details are available.

Value of Experience

It is a fact, though, that when one has had a little experience in handling different types of receivers one seems instinctively to know what is wrong when one can operate the set oneself for a short time without going through the whole process of *reductio ad absurdum* which I have outlined.

If these hints enable the reader at North Ferrily to overcome the trouble I shall be glad to hear from him, while if he still cannot get results and can give more definite symptoms of the difficulty, I have no doubt that the WIRELESS MAGAZINE Technical Staff will be able to give him a satisfactory reply by post, but that I am unable to do myself.

THE SAME OLD SONGS

SINGING being one of those things which all of us can do, more or less, we take a great interest in the vocal items put on by the B.B.C.

When it comes to the songs of Schumann (which are some of the best ever written), the low-brows will be out of their element; but they—perhaps I should say "we"—are not always satisfied with the more popular efforts sometimes broadcast. Possibly because there really are not many popular songs suitable for broadcasting we hear the same old items over and over again.

This is not a complaint, but a register of fact.

How often within the last month have you heard, "Come to the fair," or various settings of the Londonderry Air? These are only two of the many examples which might be cited.

Unfortunately, there is no proper remedy. The B.B.C. can't produce new songs and song-writers by waving a magic wand. And the broadcasting hours must be filled with music and song of some kind.

Oh, that another mass-production composer like Schubert would arise and give the announcers something fresh to announce! P. B.

Modified H.F. Coupling Unit

for the Sunshine Five and Sidecar Portable

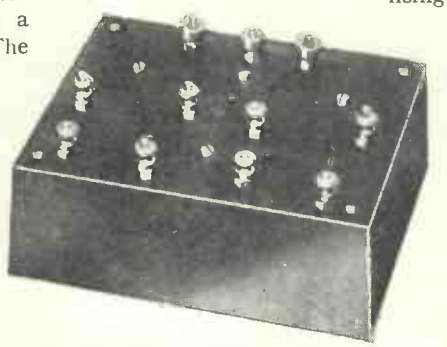
EXPERIENCE has shown that the Polar two-stage aperiodic high-frequency coupling unit could be altered with advantage, and we learn from the manufacturers that the old type of unit is now withdrawn and is replaced by that illustrated below.

This new component is supplied in a moulded case and does not include valve holders. There are four terminals in place of each of the existing valve holders, to which the filament, grid, and anode sockets of any suitable valve holder may be connected.

Suitable Valve Holder to Use

An Ashley valve holder is recommended; this holder consists of a centre portion carrying the four valve sockets, this being floated in a circular base. The two parts are held together by four screws, which also serve as terminal connections.

On removing these screws, the centre portion, with four spring connections attached to it, comes away completely and can be placed over the four terminal screws of the unit, which will be found to fit the valve holder exactly. Replacing the nuts and terminal screws completes the assembly.



Modified Polar H.F. Coupling Unit

Valve holders assembled in this way are vibratory, so that tendency to microphonic noise is lessened.

Positioning Stops

Underneath the anode and grid terminals of the valve holder will be found two small metal stops, which lap over a rim moulded round the base of the centre portion of the valve holder. The function of these is to prevent the holder from being pulled out of position when the valves are removed. These stops should be replaced in their appropriate positions when the holders are fitted to the unit.

The terminals G1 and A2 which were on the original unit are now omitted, the connections going direct to the grid terminal of the first valve and the anode terminal of the second valve. In addition, there is a slight modification in the arrangement for stabilising the unit, which has been made possible by the fact that the second grid is now provided with a terminal, and is, therefore, available for external connection.

Neutralising Condenser

In the original unit, a stabilising condenser was provided between the grid of the second valve and the grid of the first valve. Experience has shown that this stabilising connection is only necessary on the long waves and that it is desirable to cut it out on the short waves. A small neutralising condenser—any standard type will do, although a small size is more convenient in a portable receiver—should be connected between G1 and G2 externally to the unit, and connections to this should be taken through the ordinary switch employed for changing over the connections on the frame, in such a manner that the neutralising condenser is cut out of circuit in the short-wave position.

Complete instructions as to how this may be accomplished are given with a leaflet accompanying the unit and a full diagram of connections is provided.

The neutralising condenser should be adjusted to give adequate stability on the long-wave position. It will then be found that the short-wave position is inherently stable and the reaction demand on both wavelength bands will be found approximately the same.

The new unit, therefore, possesses important advantages, and the modifications required to existing diagrams and receivers which incorporate the old unit is only quite small. The new "All-wave Coupler" sells at £1 19s. 6d., instead of £2 2s., as formerly.

"Wireless Magazine" REFERENCE SHEETS

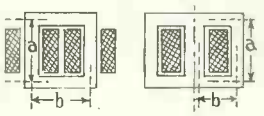
Compiled by J. H. REYNER, B.Sc., A.M.I.E.E.

Month by month these sheets can be cut out and filed—either in a loose-leaf folder or on cards—for reference. The sequence of filing is a matter for personal choice. In a short time the amateur will be able to compile for himself a valuable reference book.

WIRELESS MAGAZINE Reference Sheet — *No. 76*

Inductances, Iron-cored

THE design of an iron-cored inductance differs somewhat from that of an air-cored coil owing to the fact that the magnetic field is almost entirely confined within the iron circuit. In this case, it is possible to determine the exact value of the magnetic flux with considerable accuracy, whereas in the case of an air-cored coil the lines of force stray by various routes and only a small proportion thereof is actually linked with the turns of the coil. It is only such magnetic field as do link with the turns themselves which is useful in producing inductance.



Core type (left) and shell type (right) iron-cored chokes. Length of magnetic circuit = 2 (a + b), in each case

The inductance of an iron-cored coil depends upon the square of the number of turns, and upon the actual area of the iron core and is inversely proportional to the length of the iron circuit. Two typical iron-cored choke coils are shown in the diagram. One is known as the "core" type and the other as the "shell" type. In the latter case, the thickness of the centre leg should be twice that of all the other portions of the core.

The actual length of the iron circuit is marked in the two cases and this must be evaluated for the particular type of stamping used.

The inductance is also proportional to the permeability of the iron which is really interlinked with the other properties of the circuit. The expression for inductance is

$$L = \frac{1.257\ An^2\mu}{100{,}000{,}000\ l}$$

where L is the inductance in henries,
n is the number of turns;
A is the area of the core in square centimetres;
l is the length of the magnetic circuit in centimetres, and
μ is the differential permeability for the particular working conditions.

WIRELESS MAGAZINE Reference Sheet — *No. 77*

Voltmeters, Increasing Range of

IT is often desired to increase the working range of a voltmeter so that the full-scale deflection shall be higher than the normal. This can quite easily be carried out by the addition of a suitable value of resistance in series with the meter.

A voltmeter consists essentially of a milliameter in series with a high resistance. (See Sheet No. 47.) The current flowing through the circuit, and hence the indication of the meter, clearly depends upon the voltage across the whole and the actual resistance of the circuit.

In order to increase the range of the instrument, therefore, it is necessary to add resistance, so that for a given voltage the current will be less and the indication on the meter smaller. Consequently, in order to obtain the full-scale deflection a greater voltage must be applied across the terminals, which is what we require.

The voltage for full-scale deflection is directly proportional to the resistance. If, for example, we wish to halve the sensitivity of the instrument so that instead of giving a full-scale deflection with 150 volts, it requires 300 volts, we must double the resistance of the circuit.

Most voltmeters are labelled either with the total resistance or with the resistance per volt, this being a convenient way of expressing the relative sensitivity of different types of voltmeter. In either case it is easily practicable to obtain the actual total resistance of the instrument and to add an external series resistance of such a value that the sensitivity will be of the required order. Two examples will serve to make the matter clear:

Example 1.—Voltmeter reading 250 volts. Resistance, 1,000 ohms per volt. Hence total resistance = 250 × 1,1000 = 250,000. Meter is required to read 500 volts for full-scale deflection. Hence resistance must be doubled, that is, extra resistance of 250,000 ohms must be inserted in series.

Example 2.—Meter reads 10 volts full-scale deflection and has a resistance of 2,000 ohms. What will be the full-scale deflection if 20,000 ohms is placed in series?

The total resistance is now 22,000 ohms, which is eleven times the original figure. Thus 110 volts will be required to produce full-scale deflection and the readings on the meter at any point on the scale will require to be multiplied by eleven to give the actual voltage across the whole circuit.

WIRELESS MAGAZINE Reference Sheet — *No. 78*

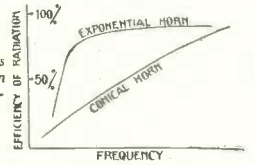
Loud-speaker Horns, Effect of

THE horn type of loud-speaker can be made to reproduce faithfully over a wide frequency band if the rate at which the area increases is determined according to an exponential law. Then, provided suitable precautions are taken to avoid second resonance effects, a uniform response can be obtained from a very high frequency down to quite a low value.

The lowest frequency which can be reproduced satisfactorily is determined by what is known as the cut-off of the horn. In order to radiate sound satisfactorily, it is necessary for the pressure on the air inside the horn to be in phase with the velocity of the air. That is to say, the maximum air pressure and the maximum movement of the air must take place together.

With the ordinary horn this is the case only at the higher frequencies and the two effects become more and more out of phase as the frequency is reduced, exactly as shown in the diagram. This means that, although the sound is reproduced, it is not radiated to its correct extent and the lower tones suffer.

Using an exponential horn, the pressure and velocity remain in phase for a considerably longer period, giving a more or less uniform radiation, until a sudden cut-off point occurs.



Relative efficiencies of exponential horn and cone loud-speakers

This cut-off depends entirely upon the design of the horn, and the longer the horn can be made the lower it occurs. Thus exponential horns can be designed at which the cut-off point is below 50 cycles per second, and such horns will give reproduction comparable with the best-known methods of reproduction.

In designing an exponential horn, an initial area should be made only a small fraction of the actual area of the diaphragm of the speaker movement itself. This serves to concentrate the air column on the diaphragm, so that small diaphragm movements produce relatively large pressures at the neck of the horn. In this way a distinct increase in the volume of sound is obtained.

WIRELESS MAGAZINE Reference Sheet — *No. 79*

Exponential Horns

AN exponential horn gives a substantially uniform radiation over a wide range of frequency. An exponential horn is designed in such a manner that the area increases at an exponential or logarithmic rate. The law connecting the area at any point with the distance from the commencement of the horn is as follows:

Log $A = .435\ Bx + \log A_o$.

Where A_o = initial area.

A = area at distance x from start.

x = distance from start.

B is a constant the value of which must be chosen to suit the particular requirements.

Common logarithms (to base 10) are employed.

The larger B is made, the more rapid is the expansion of the horn, but the higher will the cut-off point occur. Thus we can have a rather rapidly expanding horn, in which case it will only be comparatively short. Alternatively, we can have a very slowly expanding horn, which will be very long and which may have to be designed to coil up in order to obtain a reasonably compact arrangement. The latter horn would be the better from the point of view of reproduction, since it would have a very low cut-off.

The actual cut-off point is determined entirely by the value of B and the frequency at which cut-off begins to be serious, that is, at which pressure and velocity begin to fall out of phase, so that the radiation is not efficient (see Sheet No. 78) is given by the expression:

$$f = 4{,}000\ B.$$

f being the cut-off frequency in cycles per second.

From this data, therefore, it is possible to design an exponential horn to suit any requirement: the final area of the horn should be about 18 in. to 2 ft. square in order to give adequate radiation of sound, although satisfactory results can be obtained with somewhat smaller diameters than this.

In general, the design will be worked out in the following manner:

1. Decide the value of cut-off required.
2. Define B from the expression given.
3. Decide the initial area (this is usually obtainable from the unit employed).
4. Work out the area of the horn at increasing distances, until the final diameter has become of the order of 18 in. or 2 ft.

WIRELESS MAGAZINE Reference Sheet — *No. 80*

Reaction Control

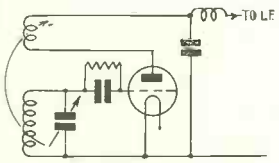


Fig. a.—Moving-coil reaction circuit

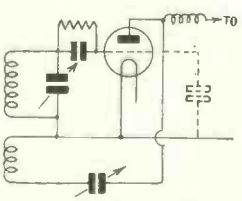


Fig. b.—Capacity-controlled reaction circuit

THE detector valve in a receiver carries a mixture of high- and low-frequency currents, and it is essential to separate the two at this point.

It is necessary to provide a ready path of adequately low impedance for the high-frequency currents, as otherwise they must, of necessity, force their way through into the L.F. stages.

The simplest way of doing this is to use a high-frequency choke and condenser filter.

In the case where smooth reaction is employed the reaction coil should be inserted between the anode and the high-frequency choke, as indicated in Fig. *a* accompanying this sheet. The value of the by-pass condenser should be at least .001 microfarad. It should not be made too large, or it may distort the characteristics of the coupling device following, causing a loss in high notes, but up to .001 microfarad this effect is prevented to a large extent by the presence of the H.F. choke following. For this reason alone, the H.F. choke should have a high inductance of at least 100,000 microhenries.

In the case of capacity-controlled reaction, such as that shown in Fig. *b*, the arrangements are similar. Here the two separate paths are provided as before, the one for the L.F. through the L.F. coupling device, H.F. being kept out of this circuit by means of a high-frequency choke. The reaction coil should be small, so that a large value of reaction condenser is required.

Useful Accumulator Connector

ILLUSTRATED below is a new Clix product that will appeal to everybody who has an accumulator. It takes the form of a robust terminal "top" provided with a hole into which a plug can be inserted.

This device, as can be seen, is particularly neat and has many advantages in use.

It is made by Lectro Linx, Ltd., of 254 Vauxhall Bridge Road, S.W.1.

The Gramo-Radio Four

THOSE who are thinking of building one of these sets, described on page 337 of the May issue of the WIRELESS MAGAZINE, should note that a printer's error occurs in the list of components reproduced on page 340.

The jack should be an Igranic No. 68 or No. 65 and *not* a No. 63. Wiring up is easiest when a No. 68 jack is used, although a No. 65 is suitable.

Index to Advertisers

AMATEUR SET-CONSTRUCTOR'S FULL-SIZE BLUEPRINTS

Full-size blueprints are available of the following sets. Copies of the "Wireless Magazine" and of "Amateur Wireless" containing descriptions of all these sets can be obtained at 1s. 3d. and 4d. respectively post free.

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All these 6d. each, post free.

For the R.C. Enthusiast	WM13
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Super Set	AW 64
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ONE-VALVE SETS

All these 1s. each, post free.

One-valver for a Frame Aerial	WM47
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Reinartz Plug-in One	AW 46
Constant-coupled	AW 65
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Loud-speaker Special	AW 78
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Fan's Short-wave One	AW119

TWO-VALVE SETS

All these 1s. each, post free.

Loftin-White 2 (D, Trans) *Price 1s. 3d., with copy of "W.M."*	WM20
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Q-coil 2 (D, Trans)	WM62
Crusader (D, Trans)	WM69
Flat-dweller's 2 (HF, D)	WM76
KL1 2-valver (D, Trans)	AW 5
One-control 2 (D, Trans)	AW 6
Wide-world Short-wave (D, Trans)	AW 11
Reinartz 2 (D, Trans)	AW 21
Empire Short-wave	AW 28
Next Step 2 (D, Trans)	AW 34
Centre-tap 2 (D, Trans)	AW 42
Three-option 2 (D, Trans)	AW 51
Rover 2 (HF, D)	AW 53
General-purpose 2 (D, Trans)	AW 55
All-wave (D, Choke)	AW 57
Yule (D, Trans)	A W59
30/- 2 (D, Trans)	AW 61
Economical 2 (D, RC)	AW 66
Britain's Favourite (D, Trans) *Price 7d., with copy of "A.W."*	AW 74
Home-and-Abroad 2 (D, Trans)	AW 77
Two-wave (D, Trans)	AW 83
Ultra-selective Hartley (D, Trans)	AW 90
Oceanic Short-wave (D, Trans)	AW 91
Trapped Reinartz (D, Trans)	AW 92
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THREE-VALVE SETS

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Continental (HF, D, RC)	WM 7
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Screened-grid Short-waver (HF, D, Trans)	WM51
Metropolitan (D, 2 LF)	WM48
Everyday (D, 2 Trans)	WM52
Music Charmer (D, RC, Trans)	WM60
Britannia (D, RC, Trans)	WM67
Home and Garden 3 (D, 2 RC)	WM78
★Glee-singer Three (D, 2 RC)	**WM92**
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Astral (HF, D, 2 RC)	WM53
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Station-finder (HF, D, 2RC)	WM68
Gramo-Radio 4 (D, RC, 2 Trans Push-pull)	WM70
Q-coil 4 (HF, D, Trans, RC)	WM71
Screened grid 4 (HF, D, 2RC,)	WM77
All-from-the-Mains Four (HF, D, LF)	WM86
★Five-pounder Four (HF, D, RC, Trans)	**WM91**
All-purpose 4 (HF, D, RC, Trans)	AW 43
Tuned-anode 3–4 (HF, D, 2 Trans)	AW 49
C.T.4 (HF, D, RC, Trans)	AW 58
Special 4 (HF, D, 2LF)	AW 70
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"Q" 4 (HF, D, RC)	AW 98
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★Connoisseur's Six (2HF, D, RC, Push-pull)	**WM88**
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Adaptor for above (see miscellaneous list)	AW67a

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	Price	Post Free
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Countryside 4 (HF, D, 2 Trans)	WM17	1/6
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★Pilgrim Portable (D, Trans)	**WM94**	1/6
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One-valve LF Unit	AW 79
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Super-power Push-pull	AW 86
Hook on Short-waver	AW104
Purity Amplifier	AW108
Add-on Distance-getter	AW117
Two-valve L.F. Amplifier (RC, Trans)	AW121

MISCELLANEOUS

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Moving-coil Loud-speaker	WM58 1/-
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H.T. Eliminator for A.C. (200 v. output)	AW102 1/-
Moving-coil Output Unit	AW 115 1/-

A blueprint of any one set described in the current issue of the "Wireless Magazine" can be obtained for half-price up to the date indicated on the coupon (which is always to be found on page iii of the cover) if this is sent when application is made. These blueprints are marked with an asterisk (★) in the above list and are printed in bold type. An extension of time will be made in the case of overseas readers.

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