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No. 564. Vol. XXIII.

March 25th, 1933.

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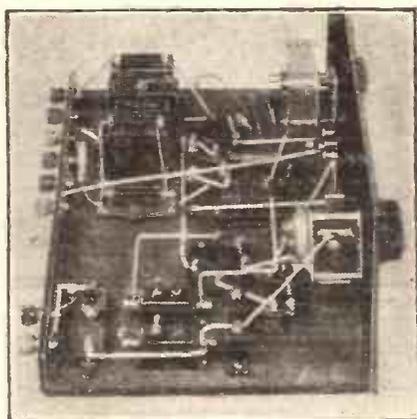
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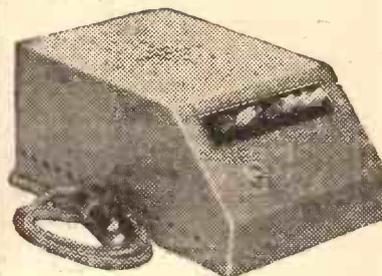
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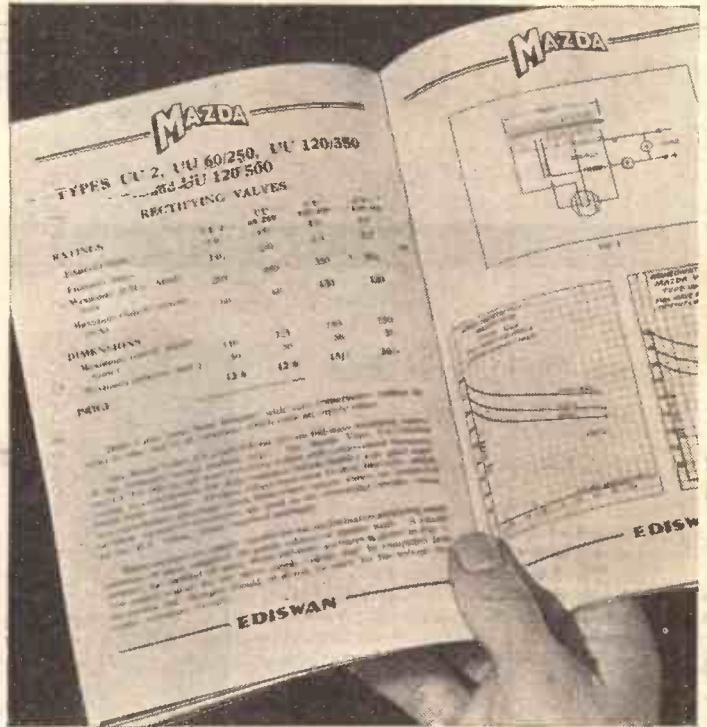
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RECOMMENDED BY ALL GOOD RADIO DEALERS



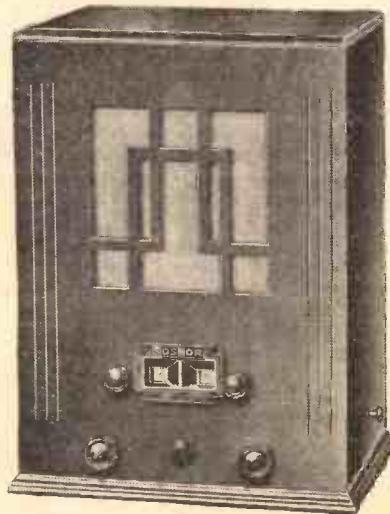
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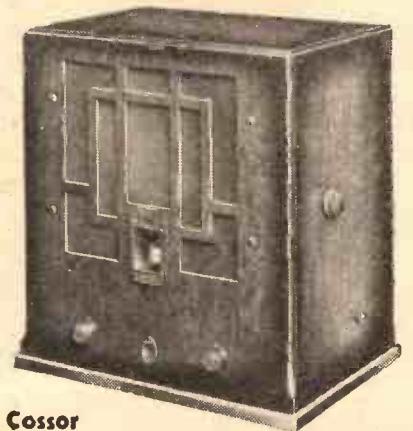
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The Paper that Made Wireless Popular



**GOOD BUSINESS
 A TEST CASE
 EMPIRE RADIO
 ZEEBRUGGE**

RADIO NOTES & NEWS

**RADIOCRACY
 H.T. AT WILL
 THE "LOUNGER"
 RADIO EXILES**

This Secular Age.

I HOPE that the following anecdote does not indicate that the present generation has a tendency to think of everything in terms of "hot" music or Twentieth Century Blues. A friend tells me that he recently gave a party at which he propounded some amusing competitions, one being to write down the names of the twenty musical works of which he played portions on the piano.

One piece was "The Messiah," from which he played some well-known bars of the Hallelujah Chorus. One sweet young creature declared in her answer that he had played "Crazy People"! A certain similarity of rhythm, perhaps

Good for Gracie.

THAT charming person and artiste, Miss Gracie Fields, recently had the unique pleasure of visiting the H.M.V. works and pressing the four millionth record of her voice. And very sweet she looked as she did that.

What is equally gratifying is the fact that the production of her four million records involves work for a hundred and twenty people for four and a half years. Hence it takes one person on a forty-four hour week one hour to make 324 G.F. records. Am I right?

Test Case Decision.

THE first test case, according to the Electricity Commission, to determine if an electricity supply undertaking is responsible for altering a consumer's apparatus when the supply is changed from D.C. to A.C., has been decided in the affirmative. A certain corporation on making such a change offered to pay a claimant the "scrap value" of his battery-charging plant, as against his claim for £41 17s. 4d. for new plant to meet the altered conditions.

Mr. Justice Goddard found for the claimant. This decision may affect hundreds of thousands of listeners—favourably.

Brum Looks Into It.

DURING the past twelve months 1,425 instances of interference with radio in the Birmingham district have been investigated, and of these 1,066 were traced

to electrical apparatus such as dental mechanic's equipment, heat-ray gear, flashing signs, etc. Oscillation accounted for 852 cases.

Miscellaneous cases to the number of 150 were dealt with, including the investigation of amateur sending stations, alleged tramway interference, and illicit transmitters.

Extension of Empire Broadcasting.

FROM April 2nd the hours of Empire broadcasting to the Indian, African, and West African zones will be extended. The Indian programmes will begin in London at 1.30 p.m. and will continue till 5.30 p.m. G.M.T.

vision" instead of television, "radome" for studio, "radovia" for a street where radio is exhibited, and "radiopole" for a "radio city" such as the great Rockefeller centre in New York. I should think that "radiopole" would be more likely to suggest a wireless mast.

The I.S.W. Club.

A "CHAPTER" of the International Short-Wave Club has been formed in Leicester, and its meetings, which are open to non-members, will be held in the Foresters' Institute. The county representative of the club (Radio 2 B H A, 27, March Street, Forest Road, Leicester) has been elected president of the Chapter.

For particulars of the next meeting, etc., please address: Mr. C. L. Wright at that address.

Straining After Effect.

ONE of the most puerile "effects" ever presented by the B.B.C. was the big bang which was supposed to add verisimilitude to the recent talk about the Leicestershire granite quarrying. The microphone and the loudspeaker are not instruments which are well adapted to deal with explosions; moreover, everyone has heard a big bang, especially those of us who were alive in 1914. Bless me, even a modern child of five would not be impressed by a radio bang.

Zeebrugge—and All That.

EARLY in April, 1918, I put a red ink ring on my calendar round the 23rd of that month, though the figures were somewhat bleached by poison gas. Some of us knew that St. George's Day was to become Zeebrugge Day. On April 23rd next those two "days" will be celebrated by a relay from St. Mary's Church, Dover, and eight bells will be struck at mid-day on the Zeebrugge Bell.

Very appropriate! For we certainly rang the bell that first time!

Apart from some of Drake's and Ansons' little whoopees, Zeebrugge was the most audacious exploit ever accomplished by our sea-dogs. Listen, and be proud of ourselves!

(Continued on next page.)



FIRST AGAIN!

This week "P.W." gives full details for making a magnificent set employing the new

Class "B" Amplification

The other two zones will be served with a programme from 6 p.m. to 10.30 p.m. G.M.T. The Indian extension will, incidentally, benefit listeners in Western Australia and Malaya. These improvements are due to information supplied by Empire listeners, so write to the B.B.C., ye exiles, and tell it exactly how the programmes get through.

Will They Become Current Coin?

MAJOR-GENERAL SQUIER, who used to be—and still may be—very prominent in American Army radio matters, has coined a number of new words. For example, he uses "radio-

ARIEL CONTINUES HIS RUNNING COMMENTARY ON RADIO

Radiocracy.

HARD on the heels of the funeral procession of that American ogre, "Technocracy," comes the British "Radiocracy" or dictatorship of thought by radio.



The fear is expressed that a monopolist and dictatorial B.B.C. will be able to mould the mental life of our people according to the pet designs of the various specialists

who draw up the programmes and courses. Apart from the broadcasts to schools, which I have always opposed, I have little fear.

The Briton is an obstinate, independently-minded cuss, and is not likely to take the B.B.C.'s young and old men too seriously.

English and B.B.C.-ish.

THE Central Council for School Broadcasting (and Time-Wasting) felt itself bound to "experiment with broadcasting as a definite medium of speech instruction in view of various Board of Education reports urging that standard English should be taught in the schools, so that the children should be bi-lingual."

I find it hard to refrain from sarcasm, but with almost super-human self-control I will confine myself to propounding the question whether the B.B.C. is to be allowed to teach our youngsters that there are two kinds of English, namely, Mr. A. Lloyd James & Co.'s kind and the "also rans." There is a danger in this so-called standard-English ramp which is worthy of the Government's attention.

H.T. at Will.

ONE wonders what freak of Nature caused certain eels to develop within themselves electrical generators.

Scientists have been studying some electric eels which live in the Paris Aquarium and report that these fish are capable of handing out no less than 300 volts.



They can knock a horse or mule clean into next Thursday! The

uncanny thing is, however, that these eels seem to know the rules of electricity, and will deliberately send a charge through a fish by touching the victim with the body and completing the circuit by touching with the tail.

As a Candid Friend.

DEAR W. S., of Binfield, Berks. We liked your letter. The things which it says about "P.W." and Ariel are too sweet. We reciprocate your kindly wishes for our good luck—though we prefer

to rely on good management. But—and a big "but"—how can you expect us to ask our snappy readers in general if they have had the "luck" to get New York, etc., on a 1927 non-"P.W." set brought up-to-date? You say that yours is "not an iron bedstead story." It certainly is not an "Airsprite" story and that's the story for up-to-date radio men. Well, no doubt you have to do your best with the means available and there is evidence that you are pretty hot stuff at radio—so accept our fraternal blessing.

Why Do Wires Hum?

A CONVERSATION about transformer "hum" led someone to ask me what causes telegraph wires to hum, a question which I was unable to answer. Can anybody give the true explanation of that steady drone, as that of a tireless, giant harpstring, which dominates the country road even on windless days?

SHORT WAVES

AN IMPENDING APOLOGY.

"Jack Hulbert's Follies broadcast."—Daily Paper. "Punch."

Britain has one radio set to every thirteen people. So it is an unlucky number, you see.—"Pictorial Weekly."

A contemporary thinks something should be done with the people in the studios who laugh at the jokes made by the comedians who broadcast.

What about giving them medals?

Statistics show that women are not using the transatlantic telephone to any extent.

This will not come as a surprise to anyone who has waited outside a telephone call-box occupied by a lady.

ABBREVIATION'S ARTFUL AID.

"The abbreviation 'arr.' which appears so often in the programme is, of course, for 'arranged by.'"—Wireless Paper.

And not, as many may have thought, an exclamation denoting anger or disgust.

"An innovation will be a broadcast description of the face."—Grand National article in newspaper.

The favourite's, or the winner of the Irish Sweep?

I once asked an ex-Chief Engineer of the Post Office to tell me what made his wires do that, but he didn't pass the exam.

Wireless News.

ALL Chinese Consulates have been instructed by their Ministry of Foreign Affairs to instal receivers for the direct reception of news from the 75 kilowatt broadcasting station at Nanking.

Turning to Japan I note that listeners are not allowed to use short-wave sets. Nearer home, namely, Egypt, the radio-telephone service from London has been extended to Assouan and Luxor; tariff, £1 4s. Od. per minute.

Talking of radiotelephony, I had better mention here that a scheme for linking Macao with Hongkong by that means is being considered.

The "Lounger" Four.

AT last it has come, the lazy man's set. One of the exhibits at the B.I.F. (White City) was an arm-chair which incorporates a four-valve receiver, the controls being under the arms, which lift up, and the loudspeaker at the side, covered by the chair's fabric.

Fancy sitting-on "1812" or the "Hallelujah Chorus"! But how tiring it must be to lift up the arms to tune in! And there is no automatic switch-off in case one falls asleep? I thought that this was a labour-saving age.

Proof of Popularity.

WHEN the King broadcast his Christmas message to the Empire on Christmas Day it was between 6 a.m. and 7 a.m. in Vancouver—not a time when as a rule people listen in.

Nevertheless, a striking proof of the interest which the good people of that city took in receiving this broadcast is given by the President



of the British Columbia Power Corporation who states that during the hour mentioned the load on the generating stations supplying Vancouver increased by 5,000 horsepower.

Penalties for Interference.

IN many countries, with the notorious exception of our own, the law is piling up heavily against interference with radio reception. In France, the owner of an offending dynamo has been ordered to abate the nuisance within a month and to pay ten shillings a day until the order has been complied with.

In Rumania, a recently made law gives offenders two years, but lays down the imposition of a heavy fine failing compliance. Listeners may also claim damages.

Meanwhile British trams, etc., continue to pulverise our radio in many places, scot free.

The Radio Exile.

RP. (Lahore), whose full address runs into seven lines, and who is good enough to approve of my two pages, tells me in a beautifully written

letter a sad story of the exiled British soldier in India whose spiritual home is Britain and whose harp is really the knobs of a radio set.

As a private on two bob a day practical radio is outside his budget, but by the help of "P.W." he keeps in touch with the progress of radio and when he returns to Belaiti (or "Blighty") he intends to wallow.

He pays a tribute to the "Magic" Four owned by a fellow soldier who has now withdrawn—leaving him radio-less. All the best, R. P. It's you and the likes of you who let the Empire sleep sound.



ARIEL.



The "CLASS B" FOUR

IN America there are three main forms of low-frequency amplification. These are divided into three classes, of which two are "Class A," the normal straight type, and "Class B" which is divided into what we know as Quiescent Push-Pull, and a second method based on Q.P.P. to some extent but quite unlike it from a practical point of view, and which we are calling "Class B" in this country. Finally, there is "Class C" a more specialised method of getting colossal output power from special pentodes:

First in the Field.

"Class B" (as we call it) is a form that is even more economical than Q.P.P., both in primary cost and in running, and so we have decided to use it in conjunction with

Closely associated with Q.P.P. is another form of low-frequency amplification in which the output stage is power—instead of voltage—driven. Foremost in the field with new designs, "P.W." is now able to place before its readers exclusive constructional details of the first receiver utilising the "Class B" method.

stages of low-frequency amplification. At first sight the set looks perfectly ordinary, but the theoretical diagram shows that the low-frequency side is by no means normal.

The output valve, though seemingly an ordinary amplifier is a push-pull triode, being two valves in one bottle. This is

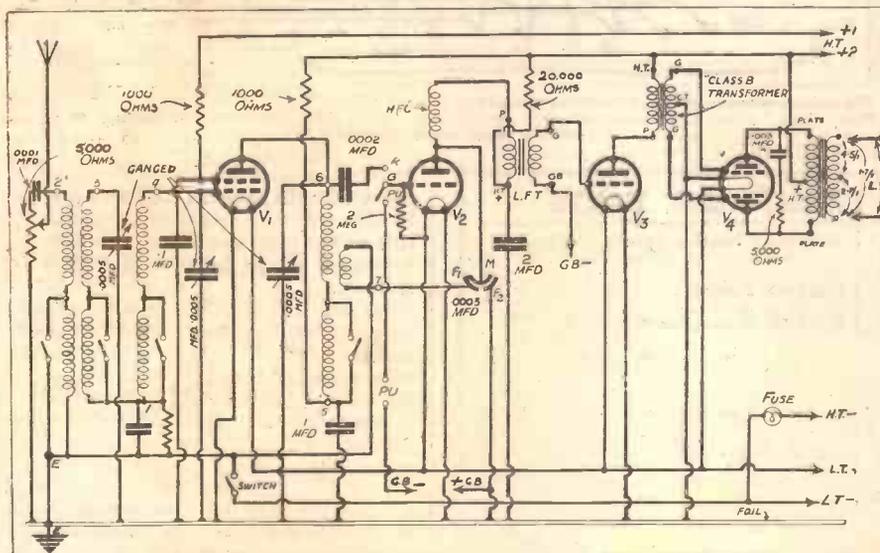
the "Class B" valve, and is essential to the operation of the circuit. Preceding this valve is an L.F. valve and coupling transformer, which also appears to be quite normal, but though the valve is not out of the ordinary, the transformer is.

To understand why normal components cannot be used it is necessary to have some idea of the operation of "Class B" amplification, but this we will discuss later, meanwhile let us get on with the practical side of the receiver.

The "Class B" Four will be the forerunner of a large number of home constructor and commercial set designs, which will follow during the next few months.

With the "Ferro-Q" and the "Westector Super" readers have this week a trio of receivers representing all that is latest in modern reception technique. Never before has such a feast of up-to-the-minute designs been placed before the home constructor.

INCORPORATING TWO OUTPUT VALVES IN ONE BULB



The second L.F. transformer employed in this circuit is of the step-down type, thus, contrary to usual practice, there are more turns on the primary than on the secondary. This is because the first L.F. valve, or the "drive," as it is called in "Class B," has to supply power.

our latest design, the first set to use the new system of power amplification.

This set is put before you as the very latest thing in four-valvers; so "hot from the oven" is it, in fact, that at the time of writing the final release of the special "Class B" valve has not been made. But POPULAR WIRELESS has always been first in the field and has determined to place this latest and really important battery set advance before you as soon as possible.

Leading the Way.

The set itself consists, as the theoretical diagram shows, of a band-pass screen-grid amplifier followed by a detector and two

Constructional Details.

But we must get down to the actual constructional details, for space is precious, and we have much to say.

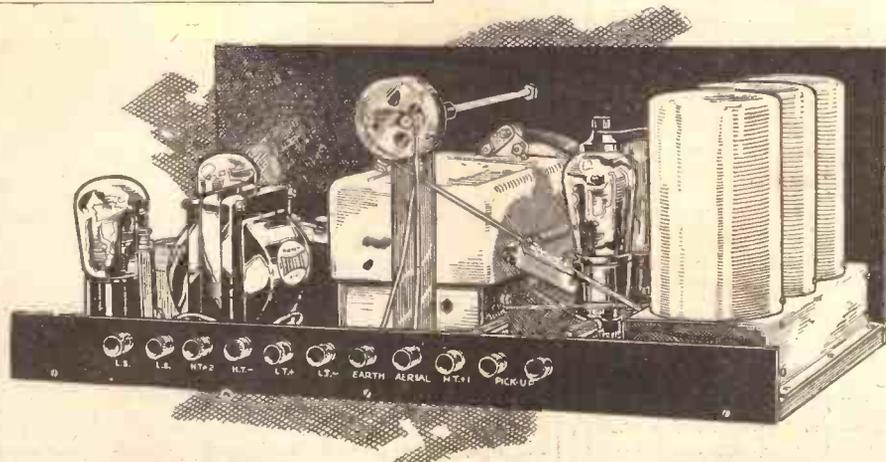
These details are simple in the extreme, for with the easy mounting of the band-pass unit, which incorporates not only its wave-change switch but with the same knob controls radiogram and filament circuits, and its associated three-gang condenser, there is little to be done, except to lay out a few parts and connect them up.

The use of copper foil on the baseboard makes the wiring very easy, for it automatically earths the screen and chassis of the tuning unit, and the moving vanes of the gang condenser, while it also acts as a useful L.T. negative feed to the four valve holders.

Care should be taken in the drilling of the panel for the escutcheon of the Telsen gang

(Continued on next page.)

PRE-H.F. VOLUME CONTROL



The volume control seen immediately above the "ganged" condenser prevents valve overloading and enables the strength of the incoming programmes to be adjusted to a nicety.

THE "CLASS B" FOUR

(Continued from previous page.)

condenser, for we found the template supplied by the makers was not quite accurate, and though probably it has been corrected in other later models (ours was one of the first to leave the works) we advise you to check the dimensions carefully before actually drilling the panel, in case you have one of the faulty drilling diagrams.

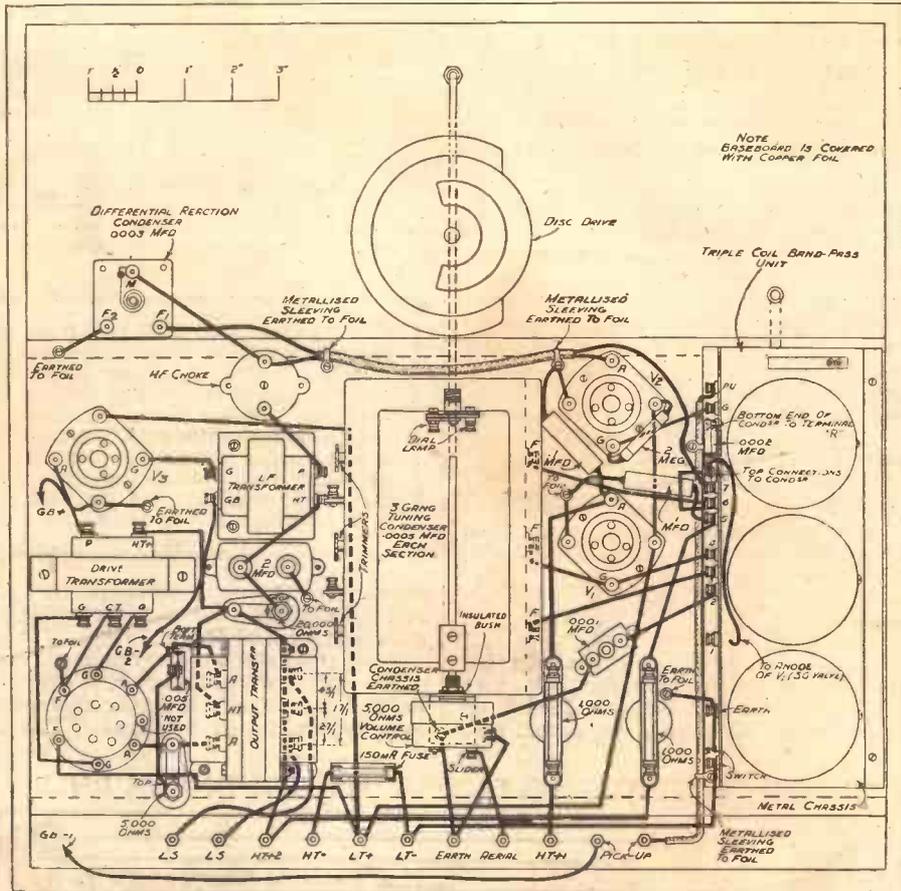
The condenser is fixed to the baseboard by the tapped sockets in the base, the positions of these being easily marked by means of the wooden template-base on which the condenser is mounted when you buy it.

Preventing Interaction.

Care must be taken over the mounting of the volume-control potentiometer, which is held in position on a strip of stiff brass bent to form a bracket, and situated to the rear of the variable condenser. The length of the brass is given in the list of components, and the height of the centre of the hole for the potentiometer above a 3/8-in. thick baseboard should be 5 1/2 inches.

Note that an insulating washer is used for mounting the spindle through the brass bracket, otherwise the aerial (connected to the spindle terminal) will be earthed through the bracket and foil. Also, it is advisable to use an insulated coupling link between the spindle and the extension rods to prevent the latter being in contact with the aerial, with possible inter-feed trouble, in the H.F. section of the set.

The reaction lead is passed through



The metal-covered baseboard, screened band-pass coil unit and shielded "ganged" control eliminate undesirable "feed-back" effects and ensure very high amplification. Note, also, that two of the leads have shielding which is joined to the baseboard foil.

CONSTRUCT YOUR SET FROM THESE PARTS

Component.	Make used by designer.	Alternative makes of suitable specification recommended by the designer.
1 Panel, 18 in. x 7 in.	Goltone	Peto-Scott, Permcol
1 Baseboard and foil, 18 in. x 10 in.	Camco	Peto-Scott, Osborn, Gilbert
1 Cabinet to suit above	Lotus	—
1 Three-gang coil assembly	Telsen	—
1 Three-gang .0005-mfd. variable condenser	Polar	—
1 .0003-mfd. differential reaction condenser	Goltone	Dubilier, Telsen, T.C.C.
1 .0002-mfd. fixed condenser	Dubilier 670	—
1 .005-mfd. fixed condenser	Dubilier 670	Goltone, Telsen, T.C.C.
2 1-mfd. fixed condensers	T.C.C. type O.F.	T.C.C., Telsen, Igranic
1 2-mfd. fixed condenser	Dubilier B.B.	—
1 5,000-ohms potentiometer	Lewcos Standard	—
2 1,000-ohms resistances with holders	Graham Farish "Ohmite"	—
1 5,000-ohm resistance and vertical holder	Graham Farish "Ohmite"	—
1 20,000-ohms resistance and vertical holder	Graham Farish "Ohmite"	—
1 2-meg. grid leak with wire ends	Goltone	Tunewell, Igranic, Ready Radio
1 H.F. choke	Bulgin H.F.9	W.B., Telsen, Ready Radio
3 four-pin valve holders	Benjamin	—
1 Class B valve holder	Benjamin	—
1 L.F. transformer	Lissen Hypernik	—
1 Class "B" transformer	Benjamin	Multitone, R.I. type B
1 Output transformer	Ferranti O.P.M. 13 (c)	—
1 Fuseholder	Belling & Lee 1034	Telsen, Bulgin, Goltone
1 Terminal strip, 18 in. x 1 1/2 in.	Peto-Scott	Goltone
11 Indicating terminals	Goltone	Bulgin, Belling & Lee, Igranic, Clix
6 Battery plugs	Bulgin	Belling & Lee, Goltone, Clix
2 Accumulator tags	Clix	Belling & Lee, etc.
4 yds. insulated sleeving and 6 yds. of 18-gauge tinned copper wire	Goltone	Wearite
1 Fuse	Belling & Lee Type 1056	Telsen, Goltone, Bulgin
1 Brass strip for vol. control bracket, 7 in. x 1 in. x 1/8 in.	Lewcos	—
1 Insulating bush for vol. control	Wearite	—
1 1-in. insulating coupling link to suit spindle (3/8 in. holes)	Wearite	—
1 Extension spindle 3/8 in. diameter, 7 in. long	Wearite	—
1 Panel bush for above	Wearite	—
1 ft. each double and single screened wire sleeving	Goltone	—

screened sleeving to obviate any stray feed effects, for the reaction condenser and leads are the only H.F. parts of the set on that side of the gang condenser, which usefully acts as a screen between H.F. and L.F. sections.

On the L.F. side we have transformer-coupling between the detector and the first L.F. (or "drive") valve, which as explained later is a small power type of valve and not the usual L.210 variety.

Next comes the special step-down transformer, with its low-resistance secondary, followed by the double output, or "Class B" valve. This is one glass envelope enclosing two triodes of matched characteristics, and these are connected to the transformer in push-pull.

An output transformer similar to that used for quiescent push-pull completes the parts necessary for the "Class B" Four,

(Continued on next page.)

WE RECOMMEND—

- LOUDSPEAKERS.—Standard Types : Amplion, Celestion, H.M.V., Marconiphone, Epoch, R & A, Clarke's Atlas, Baker's Selhurst, Igranic, B.T.-E., G.E.C., Blue Spot, Lancheater, Ormond, Ferranti.
- CLASS B TYPES : Amplion, Magnavox.
- H.T. BATTERY.—120-volt super capacity : Ediswan, Siemens, Ever Ready, "Silver Knight" Pertrix, Drydex, Marconiphone, Lissen, Oldham, Magnet.
- G.B. BATTERY.—16 volt : Ever Ready, or see above.
- L.T. BATTERY.—Exide, G.E.C., Ediswan, Block, Pertrix, Lissen, Oldham.
- AERIAL AND EARTH EQUIPMENT.—Electron "Superial," Goltone "Akrite," Graham Farish "Filt" earthing device.

THE "CLASS B" FOUR

(Continued from previous page.)

with the exception of minor items, such as resistances, condensers, and so on.

The circuit is not tricky to wire, and no soldering is required, but in order to meet with slight variations in valve design the valve holder shown may be slightly modified before it is finally placed on the market. We have used one of the earliest samples, in conjunction with an early but authentic model of the new Class B valve.

Special Valve Holder.

This latter has a six-pin base, fitting into six of the seven sockets provided on the valve holder. The seventh socket is to accommodate any further valve connection such as might be desirable in some of the mains valves that are coming along in the near future.

It can be safely assumed that you will have no trouble with either layout or wiring, and that a very few hours after commencing construction you will be ready to test the set.

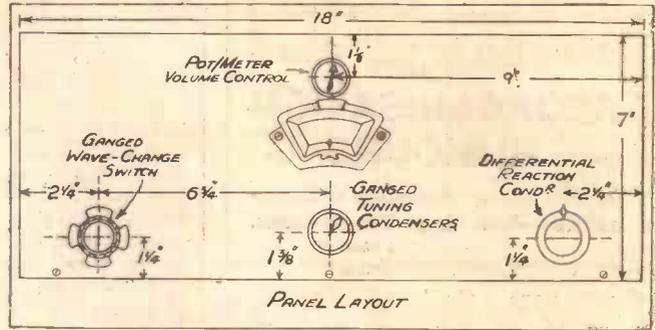
H.T. Volts.

The valves are inserted in the holders, a metallised S.G. being used for preference in V1, H.L. or Det. type for V2, a small power valve of similar characteristics for V3 and the special "Class B" valve in V4.

For H.T. an ordinary 100 or 120-volt battery is ample, the maximum voltage being applied to H.T.+2 and about 75 volts to H.T.+1. Owing to the fact that well over 1,200 milliwatts can be obtained from

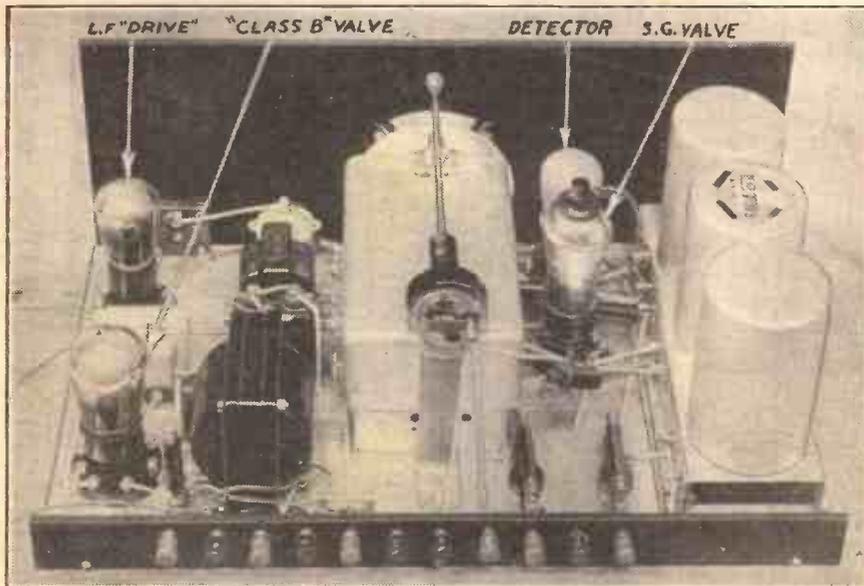
battery. For 100-volt working the "small" type only will be required.

Grid bias of $-1\frac{1}{2}$ volts should be applied to the pick-up terminal, and about $4\frac{1}{2}$ to the 1st L.F. (the "drive" valve). No bias is used for the output, "Class B" valve. In practice the bias to the L.F. "drive" valve should be as high as is consistent with good results, and it thus can be set by experiment, the idea being to keep the H.T. consumption down as far as possible.



The switch knob on the extreme left controls the wave-changing, L.T. "on-off," and radio to gramophone change-over.

A "P.W." UP-TO-THE-MINUTE DESIGN



The volume control is mounted upon a bracket which is easily made from brass strip. The use of an extension-rod enables volume to be controlled by the usual panel knob. Intending constructors will be attracted by the "clean" baseboard lay-out and the small number of separate components which require to be mounted and wired.

There is no matching of the output valve to be done, as in Q.P.P., but careful matching of the output transformer to speaker is required. The various combinations between speaker and output transformer (or choke) should be tried, and as a safeguard it is advisable to get into touch with the transformer maker and ask for the required ratio to suit your particular speaker.

Incidentally special "Class B" speakers are coming along, so if you so desire you can do away with the output transformer in the set, and, using one of these speakers, connect the anodes and H.T.+ for the last stage direct to the centre-tapped loudspeaker transformer.

All that remains to do now is to trim the gang condenser. This is quite easy, and should be done on a weak station round

about 220-250 metres in wavelength. "Undo" the trimmer on the back section of the gang condenser to its fullest

extent (about 3 turns anti-clockwise) and slack the other two off by 1 turn. Tune in the station with the volume control fully turned to the right, and then proceed to increase its strength by adjustment of one trimmer at a time, leaving the one on the back section of the condenser till last.

Sharp Tuning.

If you find that the station becomes quite loud before trimming is complete, tune again below 250 metres until you find a weaker transmission and carry on the trimming with that. The maximum volume position of the first two trimmers, especially the centre one, will be

found to be quite sharp, a fraction of a turn either way of the trimming wheel making a big change in strength of reception.

Finally the back trimmer is gradually screwed up till strongest results are obtained.

It will be found that the trimming will hold over medium and long wavebands very well indeed, and the sensitivity of the set is surprising. Many stations will require volume controlling to prevent the detector and other valves being overloaded.

Connecting a Pick-up.

For pick-up work a volume control across the pick-up should be used in the normal way, the control being situated on the gramophone motor-board. The connections are these. One side of volume-control potentiometer to one pick-up lead and to the pick-up terminal that goes to bias on the set. Slider (centre terminal as a rule) of the volume control to the remaining pick-up terminal on the set, and the remaining volume-control terminal to the free side of the pick-up.

(Continued on page 81.)

VALVES FOR THE BEST RESULTS

Make.	S.G. Stage	Detector.	Drive (1st. L.F.)	Class "B."
Mullard	P.M.12A	P.M.2D.X	P.M.2	—
Mazda	S.G.215	H.L.210	P.220	—
Marconi	S.22	H.L.2	P.215	—
Osram	S.22	H.L.2	P.215	—
Cossor	220S.G.	210Det.	215P.	240B
Micromesh	—	H.L.B.1	P.B.1	—

the set working with the ordinary type of H.T. battery of the 100-volt variety, there is no need to get greater voltage, and in fact it will not be economic to do so, for the increase in power thus obtained is only gained at the expense of greater milliamp consumption, and one then has to go into the realms of the super-capacity type of

THE MIRROR OF THE B.B.C. By O. H. M.

REORGANISATION RUMOURS

A New Chief—Plymouth's Transmitters—Boat Race Preparations.

I WONDER what really is happening behind the scenes at Broadcasting House? The official spokesmen are in their customary oyster mood about the internal affairs of the business; but the news which does emanate from Portland Place leaves little doubt that important changes are imminent.

From what little I can gather, I expect the Programme branch to be changed considerably, and several fresh outside appointments to be made. Also some members of Provincial staff may come to London soon, causing an equivalent exodus in the other direction.

I hope the latter move is made because the B.B.C. has been too much inclined to follow the path of least resistance by leaving the Provincial staffs too long away from London.

The New Chief.

So Eric Maschwitz's appointment to the new Entertainment Department has been finally confirmed, and he will be on the air in his new job early in June. This change will mean more high spots and high lights in the programmes of widest public currency.

Plymouth's Transmitters.

Since December two transmitters have been working at Plymouth—one on 288.5 metres, and the other on 218.5 metres. In future the service will be carried on 218.5 metres only.

Trouble in Scotland?

There are indications of another packet of trouble for the B.B.C. in Scotland. The Glasgow crowd are on the warpath about Mr. Cleghorn Thomson, the Regional Director, while the cohorts of the brighter young set of Edinburgh are mobilising in defence of their idol. Meanwhile the flank is being harassed by Provost Murray, whose clansmen are on the move on behalf of a transmitter for the Highlands.

Altogether the situation north of the Tweed has quite a lot of possibilities which might add to the gaiety of other nations.

Too Many!

A grand total of nearly ten thousand and thirty poems, sent in by three thousand five hundred people was the result of the B.B.C.'s invitation to poets to submit original efforts for the microphone. Readers will remember that each poet was restricted to three entries, but some sent more.

The competition closed on February 28th, and the real work of choosing the best from this huge batch is now in full swing. We have already enumerated some of the subjects dealt with and the personalities to whom the poems are addressed, but we did not mention that Henry Hall, who has just completed his first year as director of the B.B.C. Dance Band, has inspired over a hundred of the authors, while E. Paynter,

hero of the vital Test Match game in Australia, received a credit of eighty.

Stars in Their Courses.

We have already referred to the series of talks to be given by Mr. James Agate, the first at 9.20 p.m. on Saturday, April 8th, entitled "Stars in their Courses," in which he will speak about distinguished actors and actresses and give illustrative extracts from some of their greatest and most representative stage successes.

Dame Madge Kendal, Sir Frank Benson, Matheson Lang, Seymour Hicks, Hilda Trevelyan, Irene Vanbrugh, Marie Tempest, Fay Compton, Sir John Martin Harvey, Julia Neilson and Fred Terry are all taking part in this interesting series of broadcasts, and they are visiting Broadcasting House

PREVENTING THOSE HETERODYNES



Great pains are taken at the radio transmitter to keep the carrier-wave frequency constant. This engineer is examining a quartz crystal oscillator, which is the means now employed in many foreign stations to keep the wavelength steady.

to record their extracts by the Blattner-Phone-Stillé method.

Famous players of the past, whose voices will also be heard, from gramophone records, are Sir Herbert Tree, Arthur Boucher, and Lewis Waller. Dame Sibyl Thorndyke and Sir Johnstone Forbes-Robertson will also speak from gramophone records. We hear that Mr. Agate has many personal notes for this series of talks, which will run for twelve weeks.

Boat Race Preparations.

The commentary on this year's Boat Race on Saturday, April 1st, will break into the normal afternoon's programme, which does not matter so much as the fact that if the weather be at all spring-like many listeners will be out of doors, and may therefore miss hearing one of the most popular and exciting broadcasts of the whole year.

(Continued on page 80.)

THE LISTENER'S NOTEBOOK

A rapid review of some of the recent radio fare provided by the B.B.C.

SUCH events as the broadcasting of the points of view of Mr. Matsuoka and Mr. Quo Tai-Chi on the Sino-Japanese question illustrate to a marked degree the increasing significance of broadcasting in world affairs.

I think this fact impressed me even more than the points of view themselves; for didn't this Saturday evening item hint to a future possibility (or certainty) when all doctored information—consisting mainly of impressions gained by outsiders through conversations, etc.—will be thoroughly out of date. In future, thanks to broadcasting, the public will be informed directly of the contents of a situation by the representatives of the participants themselves.

Broadcasting then will contribute immeasurably to the propagation of fact in place of partial fact, which is—perhaps inevitably—one of the achievements of the vehicle now in use.

I read as follows: "Everything (in broadcasting) must be entertainment, whether it be a sermon or a course in Spanish, or it will not be listened to." I agree with every word of this! But does the B.B.C.?

I don't believe it can. Otherwise, it wouldn't have wasted one minute over the production of "The Fall of the House of Usher," to mention a recent cruel infliction. This was really a ghastly affair. I refuse to call it a play.

In this particular case, the dialogue seemed to be only of secondary importance. The "effects" were paramount, and everything else was delayed or held up so as not to interfere with the diabolical din with which the producer thought it to fill the air.

What can be the object of such productions? Even assuming they are successful, what good purpose do they serve? I can't see why such things are ever written in the first place. Are they meant to console? To terrify? No? What then? They must have some motive! I confess I am baffled.

Wouldn't we appreciate better something we can understand—and enjoy? Of course we would! Let's have some comedy, something that makes us laugh!

It is all the more vexing when we find that "foreigners" are broadcasting translations of good English plays—which, alas! we cannot understand—or musical plays, only parts of which we can understand. It is good to hear the apparent enjoyment of foreign audiences, but even this isn't adequate compensation for being deprived of similar fare at home in our own tongue.

I venture to suggest that the mid-week service from Chester Square was more appreciated than ever, following, as it did, "The Fall of the House of Usher." Besides its usual attractiveness, it was an admirable toning corrective: It steadied nerves, delayed irritability and imparted an atmosphere of quiet calm.

I also read that Christopher Stone seldom attempts to be humorous. I think I agree with this, on the whole, but it is patent that it was pre-arranged to put on as a *last* record "Rolling-Stone, Roll Home," the other Friday night. If it wasn't, then it was a strange coincidence.

The fact, however, that Christopher faded out the last but one record before it was finished, apparently to give him time for the "Rolling-Stone" one seemed to confirm the impression. No! Christopher, I think, was determined to have his little joke. And why shouldn't he?

The Percy Pitt Memorial Concert was just as beautiful as the pseudo-play was ugly. It was a typical Percy Pitt programme, achieving everything its organisers hoped it would achieve.

It would be difficult to place those taking part in any order of merit, but if I were forced to award the palm, my choice would be Walter Widdow for his beautiful rendering of Handel's Air, "Waft Her Angels." At the other end of the scale I would place Delius' "Air and Dance." I cannot get on with Delius, but that is my misfortune.

ECKERSLEY EXPLAINS-



Week by week on this page, Captain Eckersley will write on wireless topics. Inspired mainly by readers' own problems, he will discourse in his characteristically provocative manner on the wider aspects of radio. Definitely a feature you will enjoy!

I HAVE been very busy in my laboratory (or 'atories) lately, designing, or trying to design, filters.

Although I have been working with very low "high" frequencies, and although my problem to prevent them interfering with very high "low" frequencies is more difficult than yours when you deal with high "low" but not high "high" frequencies, I have been struck with the complexity of filter design.

In broadcast receivers there is certainly a detector somewhere in the circuit. I always like to think of a leaky grid triode detector—and why use any other type?—as a diode plus a low-frequency amplifier in one "bottle." (Hither bring in one content, anode, grid, and filament!)

Feeding the Detector.

It pays in overall sensitivity to use a high impedance detector. If a low-impedance detector is used one must, to get efficiency, have an output from the stage feeding the detector probably beyond the capabilities of that stage. (Unless one is clever, but that's another story—we are talking of common practice!)

Necessarily, high frequency gets on to the anode of the detector. Unless precautions are taken this will get on to the grid of the first audio-frequency magnifier.

This is not good because, particularly with resistance-capacity magnification, the audio magnifier may amplify the radio frequencies and give distortion.

An easy way to stop this happening, to any serious extent, is to use transformer coupling, because the high frequency doesn't get amplified by, and won't jump easily between, the windings of the transformer.

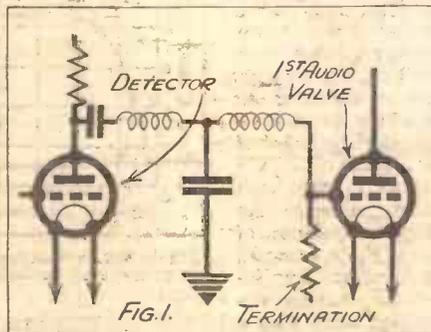
But there are some, like myself, who on the whole, abhor reactances of all kinds and, where possible, like to use resistance-capacity magnification. So it is required to design a filter which, inserted between anode of detector and grid of the first audio magnifier, lets through the low frequencies but stops the high.

Some think all will be well if they arrange for a capacity between anode of detector and earth. This has a much

lower impedance to high than to low frequencies.

But the highest audio may be of the order 8,000 cycles per second and the lowest radio of the order 150,000 cycles per second (say) twenty times as high. If the detector is of high impedance and

PASSES L.F.—STOPS H.F.



A filter of this type acts as a barrier to any H.F. currents which might otherwise pass into the L.F. stages and cause distortion. The values of the chokes and condenser have to be carefully chosen with due consideration to the musical frequency range.

requires (say) an effective constant anode impedance of 50,000 ohms, then the condenser, at 8,000 cycles per second, must be, say, 150,000 ohms so as not to change greatly the effective anode impedance at the high audio frequencies.

But the impedance in the grid circuit of the first audio valve is in parallel with the anode impedance of the detector. So the

My diagram (Fig. 1) shows a low-pass filter which should be a much better arrangement. The inductances resist, so to speak, high, and let through the low, while the condenser to earth accepts high frequencies—shunts them away—but is so high a reactance as to leave the audio frequencies undisturbed.

Moreover, at a low low-frequency the reactance of the inductance is low and that of the condenser high. And, vice versa, at high low-frequencies the reactance of the inductance is high but that of the condenser is low, and so the general idea is that, provided valves are properly chosen, the filter passes all the low frequencies.

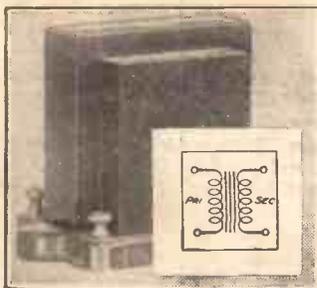
The Low-Pass Filter.

But this process cannot be indefinitely continued. There comes a frequency when the inductance really stops the high, and any which gets through finds an easy path to earth through the condenser. The filter is called a low-pass filter, because it passes all frequencies below a certain frequency, and then stops all those above this frequency. Not quite, but practically so.

It isn't all so simple as all that—it's a question of values and more particularly still of terminations (see my diagram, which explains what this means).

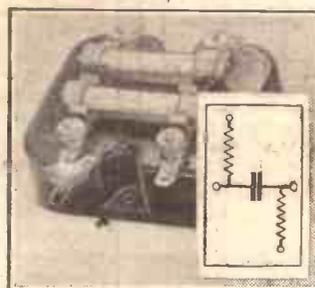
The sort of values I should play about with—you see my attitude—involve something of the order 0.1 henries and a shunting condenser of the order 0.005 mfd.

TRANSFORMER COUPLING



With transformer coupling there is little danger of high-frequency currents being amplified by the low frequency stages. Resistance-capacity coupling, on the other hand, will magnify both H.F. and L.F. The H.F. is undesirable, and must be filtered out.

RESISTANCE CAPACITY



grid impedance must be of the order of hundreds of thousands, and the high-frequency voltage will therefore not be shorted, so don't think that a condenser between anode and earth stops the high frequency from getting into the audio stages.

valve voltmeter would go a long way to setting up the foundations of a laboratory.

And for the benefit of those who have ambitions in this direction, I hope, in a future article, to return to the subject of simple laboratory apparatus.

I wonder how many amateurs try things empirically and how many actually measure things. It's a question, I well know, of £-s.-d., but even with reasonable economy one can have a very amusing time measuring things.

I suppose a source of A.C. varying between 50 and 10,000 cycles per second—I call it a "squeak"—and a

Exclusive News for "P.W." Readers—

SOME WONDERFUL VALVE DEVELOPMENTS

H.F. PENTODES ● NOVEL DETECTORS ● CLASS 'B' VALVES ● DOUBLE-DIODE TRIODES

By JEREMY GREY

AFTER a season during which, if we except the development and commercialisation of the multi-mu valve, there has been little by way of novelty in valve technique, we are now on the eve of important and far-reaching advances. It is not too much to say that practically every stage of radio reception—high-frequency amplification, detection and power output—will be profoundly affected by new valve types. For example, in the Mullard laboratories high-frequency pentodes, detector valves of novel and ingenious design, and output valves operating on the "Class B" principle have long since passed the initial stages of development, and will all, in due course, be available to the public.

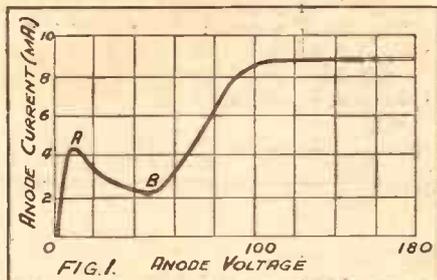
High-Frequency Improvements.

Considering first the high-frequency side of the receiver, signs are not wanting that the set of the future will employ, not the four-electrode screened-grid valve having either normal or multi-mu characteristics, but a five-electrode valve—the high-frequency pentode.

This valve, while similar in construction and application to the familiar screened-grid valve, resembles, also, in some respects, the low-frequency pentode, in that it possesses a third grid situated between the anode and screen, and maintained at zero potential.

The effect of the "earth" grid, as in the low-frequency pentode is to eliminate

THE S.G.'s SWITCHBACK



This curve of an S.G. valve shows that it does not rise smoothly, but actually falls between the points marked A and B.

the kink which occurs in the anode volts—anode current characteristic of the four-electrode valve.

Fig. 1 shows the curve for a typical screened-grid valve, the unstable portion being marked AB. Over this part of the characteristic an increase in anode voltage produces a decrease in anode current or, vice versa, a decrease in anode voltage produces an increase in anode current.

In other words, the valve shows negative resistance characteristics.

It is obvious that this "negative resistance" part of the characteristic corresponds to a condition of instability, so that, in order to obtain satisfactory operation with a screened-grid valve, the relation between anode and screen voltages must be more or less critically adjusted.

With the high-frequency pentode, on the other hand, the characteristic, as indicated in Fig. 2, shows no negative resistance effect, so that stable operation is obtained over a wider range of working conditions, such as the value of the screen voltage. In addition to this, the amplification factor of the valve is much greater than that of a screened-grid valve. It is true that, owing to the high impedance of the H.F. pentode, maximum amplification is only obtained when very efficient tuned couplings are employed, but even with ordinarily efficient coils the stage gain with a high-frequency pentode is greater than that with a screened-grid valve using similar coils.

The grid swing of the high-frequency pentode will be substantially the same as that of the corresponding screened-grid types. To avoid overloading when receiving powerful transmissions, therefore, and also to permit the application of manual and automatic volume-control devices, the Mullard company will produce high-frequency pentodes in both normal and multi-mu form.

Novel Methods of Detection.

Every listener knows that the process of detection is essentially one of rectification. Both the crystal detector and the diode valve detector operate as simple half-wave rectifiers, while in the three-electrode detector a certain measure of amplification is so obtained. Thus the leaky grid detector acts as a half-wave rectifier plus a low-frequency amplifier, while the anode bend detector is, in effect, a high-frequency amplifier followed by a half-wave rectifier.

With the diode, rectification is practically perfect, but so far this system has not achieved any great measure of popularity, because it necessitates an additional valve, and thus adds to the cost of the receiver.

Two diodes, operating in push-pull to give full-wave rectification, form an almost ideal system of detection, but there

is still the feeling that a certain amount of voltage amplification should be provided in the detector stage.

The solution of the problem will be in special valves in which one or more diode rectifying elements will be combined with an amplifying electrode system. Several variants are possible—single diode combined with either triode or tetrode, and double diode combined with a triode or tetrode.

Dual-Purpose Types.

In the double-diode-triode, which represents possibly the most useful combination, a single cathode is employed. Two small anodes serve for the full-wave rectifying portion, and the rectified output is then passed to the control grid of the triode portion, which has its own anode and operates as an audio-frequency amplifier. Thus, detection and amplification are kept entirely separate within the one bulb, the triode portion of the valve being electrically screened from the rectifying element to prevent unwanted coupling.

The same type of valve can be employed in other ways. For example, one of the diode anodes can be used for half-wave rectification, while the other serves for introducing an automatic volume control.

Class "B" Amplifiers.

One of the most urgent needs in present-day radio is

economy in high-tension supply, and the new Class B valves have been designed to provide it.

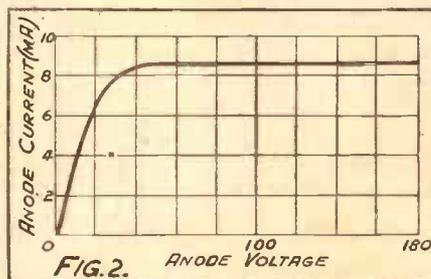
The now familiar Quiescent Push-Pull system is one special form of Class "B" amplification, a low value of "rest" current being obtained by increasing the grid bias of each of the two normal output valves to approximately twice the normal value.

In Class "B" proper, the output valves are of special design in that they operate without bias. The anode current at zero grid volts is extremely small, and the grid-volts/anode-current curve for positive variations of grid voltage is substantially straight, so that the variations of anode current are strictly proportional to the variations of grid voltage, giving substantially undistorted output.

The new Class "B" valves can be made either as single triodes—when a pair of valves must be used in push-pull—or as double valves with two electrode systems in one bulb. The latter arrangement will probably be adopted.

Class "B" valves are of the high-impedance, high-amplification type, and are extremely sensitive, so that their full output is obtainable for a comparatively small grid input. On the other hand, due to grid current damping, the input circuit must be specially designed and of low impedance. This may mean, in some cases, the use of a fairly low impedance "drive" valve, and of a special type of inter-valve step-down transformer.

PENTODE PROGRESS



In the H.F. Pentode there is a long, straight, steep portion, ideal for distortionless amplification.

The "WESTECTOR SUPER"



Incorporating The New Cold Valve—Single-Control Band-Pass Tuning—Wavelength Calibrated Dial—and Tone Compensation, this remarkable receiver sets an entirely new standard in superheterodyne design.

THERE are three main bugbears that confront the designer of a battery-operated superheterodyne receiver— anode-current consumption, detector over-

frequency input transformer, it really does the job well.

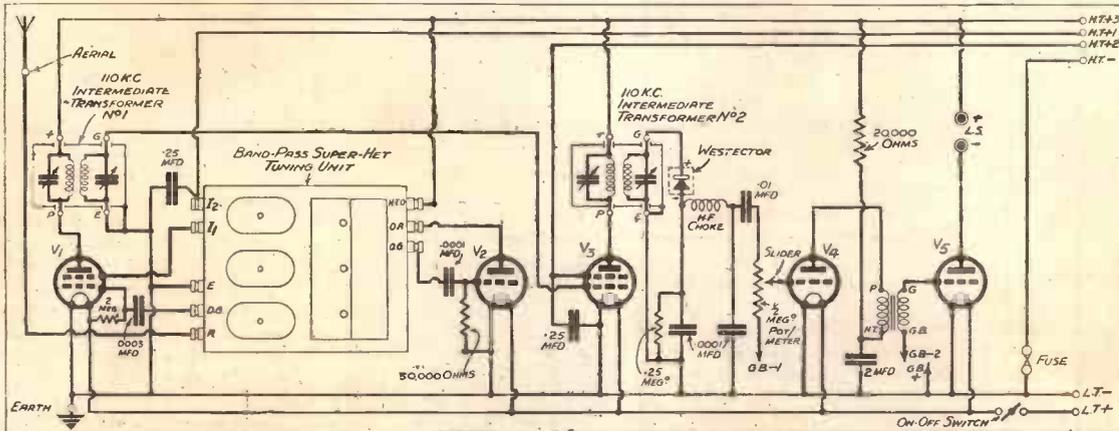
It takes no anode or filament current, and as it cannot be overloaded at all

easily (it will take either 24- or 36-volts input, according to type) there is no need to use pre-rectifier volume control. That is, we need not use variable-mu valves, with their need for not only heavier H.T. current than the normal S.G. valve, but their requirement of a small grid battery current due to the bias potentiometer.

At one blow, then, we have removed points one and two, and, due to the excellent characteristics of the Westector, we find that point number three solves itself, for the danger of H.F. getting into the L.F. side of the set is greatly decreased.

(Continued on next page.)

HIGH SELECTIVITY—GREAT RANGE—SIMPLE CONTROL



Here is the circuit of the first cold valve superheterodyne receiver. In order to simplify the diagram the oscillator and tuning unit is shown in plan form.

loading and the likelihood of H.F. impulses getting into the L.F. side. Incidentally, they all wrap up together and form a fourth snag—volume controlling.

Let us start unwrapping. In the first place, how are we to volume-control a super? We mean effectively. Given ordinary valves throughout, there is only one way—by using variable-mu valves. L.F. schemes cannot be used, as they do not protect the detector from overloading, and aerial-resistance schemes are not very satisfactory in supers.

That is quite O.K., except that variable-mu valves are likely to take more anode current than ordinary screened-grid valves when they are operated in their most sensitive condition, so that the running costs are higher than they should be.

Removing "Snags."

However, they protect the detector and thus remove one of the three snags. The other two this system does not touch, while the use of ordinary S.G. valves, while helping to remove number one, does not attack the other two.

There is a scheme, however, which tackles all three points, and, because it does so automatically, solves the problem of volume control. I refer to diode rectification, and to one particular form of diode, the new cold valve—the "Westector."

This can be used in either half-wave or full-wave rectifier form, and though it needs a special step-down intermediate-

FEATURING THE VERY LATEST DEVELOPMENTS

THE PARTS—THE MAKES—THE ALTERNATIVES.

Component.	Make used by the designer.	Alternative makes of similar specification recommended by the designer.
1 Panel, 16 in. x 8 in.	Goltone	Peto-Scott, Lissen, Permcold, Wearite, Becol
1 Baseboard, 16 in. x 10 in.	—	—
1 Cabinet to suit above	—	Camco, Pickett, Osborn, Lock
1 Band-pass superhet tuning unit	Goltone Radiophone type B.P. super 110 K.C.	—
2 .0001-mfd. fixed condensers	Dubilier type 620	T.C.C., Ferranti, Telsen, Goltone, Graham Farish
1 .0001-mfd. fixed condenser	Dubilier type 670	Ferranti, Telsen, Goltone, T.C.C., Graham Farish
1 .01-mfd. fixed condenser	T.C.C. type 34	Graham Farish, T.C.C., Dubilier
1 .0003-mfd. fixed condenser	Telsen W.242	Graham Farish, Dubilier, T.C.C., Ferranti
2 .25-mfd. fixed condensers	Telsen	T.C.C.
1 2-mfd. fixed condenser	T.C.C. type 50	T.C.C., Telsen, Dubilier
1 1-meg. potentiometer	Igranic "Megha"	Ready Radio, Wearite, Varley
1 20,000-ohms resistance with vertical holder	Graham Farish "Ohmite"	—
1 30,000-ohms resistance with wire ends or terminals	Dubilier 1-watt type	Graham Farish
1 1-meg. resistance with wire ends or terminals	Dubilier 1-watt type	Graham Farish, Goltone, Igranic, Ready Radio
1 2-meg. grid leak with wire ends or terminals	Goltone	As above
1 Intermediate transformer	Colvern 110 K.C.	—
1 do. 1.5:1 ratio	Colvern 110 K.C.	—
1 H.F. choke	Goltone Super	Slektun, Lewcos, Peto-Scott
1 2-point push-pull switch	Ready Radio	Tunewell, Telsen, Bulgin
5 4-pin valve holders	W.B. small type	Telsen, Bulgin
1 Compensating L.F. transformer	Telsen "Audio-former"	Varley, Lewcos, R.I.
1 Fuseholder	Belling & Lee type 1034	Goltone, Telsen
1 Terminal strip, 16 in. x 1 1/2 in.	Goltone	—
10 Terminals	Belling & Lee, type "R"	Bulgin, Igranic, Clix
7 Wander plugs	Clix	Goltone, Belling & Lee
2 Spade terminals	Goltone	Belling & Lee
4 yds. insulated sleeving	Goltone	Wearite
6 yds. 18-gauge tinned copper wire	Goltone	Wearite
1 150-m.a. fuse	Belling & Lee type 1056	Goltone, Telsen
1 ft. twin copper screened sleeving	Goltone	—
2 Anode connectors	Belling & Lee	—
1 1-megohm resistance	Graham Farish "Ohmite"	For optional local-distance control (see text)

THE "WESTECTOR SUPER"

(Continued from previous page.)

By removing these snags we also find it a simple matter to volume-control the set where we really prefer to do so—at the L.F. end, where it is economically and efficiently applied by the simple potentiometer, taking no current and causing no complications of design or need for decoupling.

Borne Out in Practice.

Thus it would seem that the best all-round rectifier for battery superhets is one or other of the four models of the new "Westector." This certainly seems to be borne out in practice, and we have completed the design of a really hot-stuff super using one of these units and single-dial tuning.

As you will see from the heading, the appearance of the panel is particularly attractive, containing only the tuning control, wave-change switch and volume control. The on-off switch is at the back of the set in accordance with fast-growing practice.

The most tricky part of a superhet as regards construction is that concerning the tuning and oscillator coils, and in this receiver all this has been done for you by the makers of the superhet, ganged chassis.

Thus a completely wired unit consisting of band-pass tuning and oscillator, with the requisite three-gang condenser for single-dial tuning, is dropped straight into the set, all that remains being the intermediates, valve holders and L.F. end, and these present no difficulties of layout or wiring.

Compensated L.F.

We have, therefore, so far, two very great refinements in super design incorporated in the "Westector Super." But there is yet another important item that has a direct bearing on the remarkably good quality the set provides.

The "Westector" is an efficient rectifier, and provides a rectified output of excellent quality. But it cannot compensate for the loss of high notes that is bound to occur in all high selectivity sets, especially supers.

This compensation is carried out in the "Westector Super" by a special compensating L.F. transformer which, having

a specially designed rising characteristic, "puts back" those high notes in their proper proportions which would otherwise have been all but lost. Thus the reproduction has the brilliance and true musical balance of a straight-three valver, but with the selectivity and sensitivity of the really first-class superhet. That it is.

Single-dial band-pass tuning, calibrated in wavelengths; cold valve diode detector, giving undistorted rectification; and tone compensation in the L.F. side. Such are the three great features of this latest advance in supers, a receiver that will set all constructors talking.

There is not space here to go fully into the construction of the set; that will be done next week. But we give the list of components so that you can see what is required, and the theoretical circuit to show how the various circuits and valves are arranged.

At the foot of the list you will see an additional resistance which is used in connection with a local-distance input reducer which will be explained fully next week.

Absolutely New.

So new is this super in conception, as a matter of fact, that three of the main

TESTED AND RECOMMENDED

LOUDSPEAKER.—Ferranti, Lanchester, Ormond, Igranio, B.T.H., Blue Spot, G.E.C., Marconiphone, Epoch, Clarke's Atlas, R & A. Celestion, Ampion, H.M.V.

H.T. BATTERY.—120-150-volt super-capacity: Siemens, Ediswan, Ever Ready, Drydex, Pertrix, Marconiphone, Lissen, Magnet, Oldham, "Silver Knight."

G.B. BATTERY.—16 volts: Magnet or see above.

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

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

fact that the super is so "stop press" in character need not deter you in getting or ordering your components.

Next week we shall give you further details of this remarkable receiver, with full wiring diagram and photographs.

H.T. VOLTS FOR Q.P.P.

THOSE readers who have changed over the output stage of their receivers to Quietest Push-pull and are using the standard type of high-tension battery, may be rather disappointed with the results obtained by the system. The trouble, of course, is that the battery is tapped only at every 9 volts or so, and such wide intervals will not permit that fineness of graduation necessary for the correct adjustment of "screen" voltages:

A special "Q.P.P." battery with tapings at 3-volt stages at the positive end would solve the problem, but the scrapping of the existing battery, which may still have a long life ahead of it, would seem rather a sacrifice. There is, however, a simple and cheap way out.

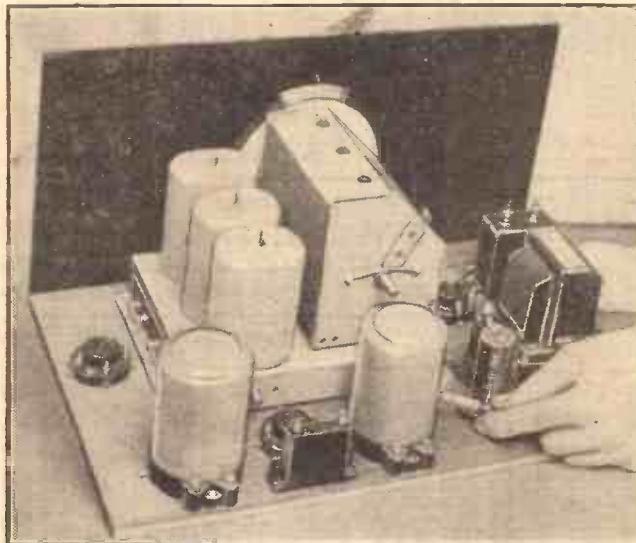
We will assume that the battery is one of 120 volts with the last tapping taken at 108 volts. Now the anode voltage is common to both valves, so therefore one lead taken to 120 suffices. The grid bias is also the same for each valve.

This leaves us with the varying factors of "screen" voltages, and to obtain the excellent quality and output of which the Q.P.P. system is capable, fine adjustment of these voltages is essential.

Something in the neighbourhood of 112 or 115 volts will probably be required to bring the valves to their correct working points, and this is impossible with the battery in use. But if we connect the negative end of a 9-volt grid-bias battery to the 108 tapping of the H.T.B., we provide 1½-volt stages between 108 and 117 volts, and so close adjustment of "screen" voltage can be carried out by plugging into the grid-bias battery.

R. S.

WITH CHASSIS-BUILT TUNING UNIT



The above photograph shows the "Westector" being placed into position. It will be observed that this component is comparable in size with the conventional grid leak.

parts used in it are not at the moment of writing available on the market. They are early production models, and will be released shortly; but, at the moment, if you were to try and get a Radiophone superhet, band-pass such as we have used, and which has been specially designed for this set, a "Westector," or a special Colvern top-down ratio intermediate trans-

former, you would be met with blank inquiry from your dealer as to what you were talking about.

Production is in hand, of course, and ere you read this, probably all three features will be ready; so the

These are the CORRECT VALVES

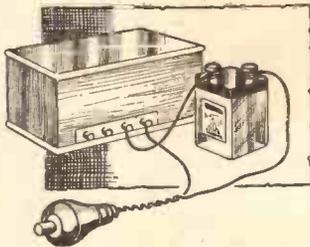
Make	1st Det.	Oscillator	Inter-mediate	1st L.F.	Output	Output Mains Unit
Mullard	P.M.12A	P.M.1L.F.	P.M.12A	P.M.1L.F.	P.M.2A	P.M.202
Cossor	220S.G.	210 Det.	220S.G.	210 Det.	320P.A.	230X.P.
Marconi	S.22	L.210	S.22	L.210	L.P.2	P.2
Osram	S.22	L.210	S.22	L.210	L.P.2	P.2
Mazda	S.G.215	L.2	S.G.215	L.2	P.220	P.220A

"COLD VALVE"—1 "Westector" Model W6 Rectifier.



SLEEP CONTROLS THE SET.

HOW many people have taken their portable wireless receiver up to their bedroom, have switched on the dance music thinking they would listen to same in bed, and have dropped off to sleep without switching the set off?



You cannot forget to switch off with this control.

This difficulty can easily be overcome at the cost of a shilling or so.

All that is required is a pear-shaped bell-push, a few yards of flexible wire and two connectors that can always be found in the junk box.

Disconnect the wire from one of the accumulator terminals and connect this wire to one end of the flexible wire that goes to the bell-push, and connect the other wire from the bell-push to the accumulator terminal from where you removed the wire in the first place.

The set must now be switched on in the usual way, and the programme can only be heard as long as the bell-push is being pressed.

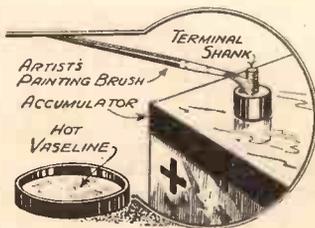
Take the bell-push in bed with you, and you will find that directly you fall asleep the set will be switched off.

PAINTING ACCUMULATOR TERMINALS.

I WONDER how many readers are worried about their accumulator terminals becoming corroded through the creeping of the sulphuric acid? A good many, I expect.

Well, here is a tip for more efficiently smearing the accumulator terminals with vaseline.

Procure an artist's painting brush and a half-full tin of vaseline. Melt the vaseline into a liquid by placing the tin over a gas-ring. Unscrew the



Paint your vaseline on in liquid form for best results.

terminals of your accumulators, dip your brush into the hot, liquefied vaseline, and proceed to paint same round the terminal shanks, base and screw top.

You will find that the hot vaseline,

painted on, will do the job much better than daubing it on solid and cold with your finger; the vaseline, being hot, tends to soak into every niche and crevice in the terminal, and, besides, you don't run the risk of getting green corrosion into a cut or chapped finger.

The same procedure can be adopted with the terminals and tapping points of H.T. accumulators. Your accumulator will last years longer, and you will get cleaner and more efficient contacts.

H.T. BATTERY SOCKETS.

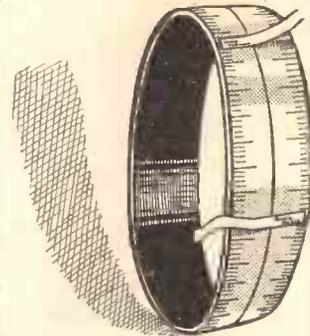
DO not throw away worn-out H.T. batteries. Dismantle them and take out the small brass sockets. The latter can be used for building up a terminal strip.

I find such a strip far more convenient than ordinary terminals. (They also save one a few pence.)

The leads from aerial, earth, etc., are fitted with wander plugs. See that the holes drilled in the ebonite strip are a shade smaller than the brass sockets.

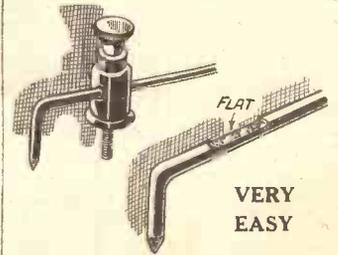
Mark the positions of the principal stations in pencil on the dial, and stick the name of the appropriate station, cut from the station list, in position.

A little hint on the neat fixing of the label will not be amiss. The label



Paste the station names on the dial.

When a circular hole, say, for a meter, is required in the ebonite, the bit is opened to the correct diameter and firmly fixed. The terminal is held in the chuck of a brace, or in the fingers, and a hole is bored in the exact centre of the circle to take the shank.



Here is an easily made expanding bit which will enable you to cut large holes.

Slowly cut half-way through. Reverse and finish by cutting from the other side, and a clean hole will result. By using a stout needle, 5 or 7-ply wood can be cut for loudspeakers.

DON'T MISS YOUR CHANCE OF £1:1s.

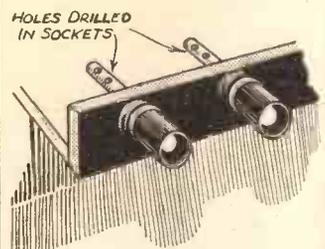
Readers are invited to send a short description, with sketch, of any original and practical radio idea. Each week £1 1s. will be paid for the best Wrinkle from a reader, and others will be paid for at our usual rates.

Each hint must be on a separate sheet of paper, written on one side of the page only. Address your hints to the Technical Editor, "Popular Wireless," Tallis House, Tallis Street, E.C.4, marking the envelope "Recommended Wrinkles."

Will readers please note that the Editor cannot, in any circumstances, guarantee to return rejected Wrinkles, and that payment for published hints is not made until ten days after they appear.

Our guinea last week was awarded to Mr. L. Haddock, of 29, Hill Street, Leeds, 11.

Hold the socket in a pair of pliers and apply a little heat to it; then twist the socket in the hole in ebonite. This ensures a tight fit.



Battery sockets make fine substitutes for terminals.

The closed end of the socket can be cut off and holes drilled in socket (or the socket can be opened) to take wires of the circuit and then soldered, which makes an excellent electrical contact.

TUNING BY NAME.

PROBABLY there are many readers who have envied the station calibration of commercial sets. With the aid of a station list such as that published recently in POPULAR WIRELESS, they can easily add this refinement to their own sets.

should be cut out with a strip of paper over at one end for holding it and preventing sticky fingers.

When the label is in position the superfluous paper is cut off.

On drum dials the tabs can be arranged neatly to the right for the medium waves and to the left for long waves. On disc drives the long-wave stations should be on the inside nearer the spindle, since their positions are not so critical as for medium waves.

If the aperture is insufficiently wide the two wave-bands should be distinguished by some sort of mark, such as an ink spot.

For open dials (like the Ormond) the labels can either be stuck to the dial directly or to a semi-circular piece of thin card which can be stuck to the dial.

With regard to illuminated dials, see that there is no heavy type on the opposite side of the tabs which would show through. Ordinary type on the reverse side is hardly noticeable.

For sets with more than one dial the dial least subject to variation due to other controls should be chosen for calibration.

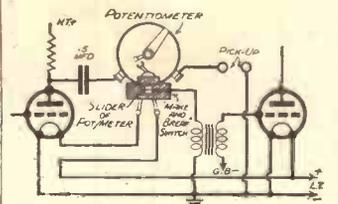
AN IMPROVED BIT.

FEW constructors possess an expanding bit, but one can be made from a knitting needle and a strong telephone terminal.

The knitting needle is bent at right angles at one end and the point is carefully filed down to a cutting edge and a flat is filed on the horizontal part. This is slipped in the terminal and the terminal screwed down.

FADE-IN SWITCHING.

MANY constructors must have envied the "fade-in" type of switching used by the B.B.C. for changing from one record to another. The idea may be tried in radiogram receivers if the first L.F. stage is parallel-feed transformer-coupled.



A make-and-break switch is used on the potentiometer.

A potentiometer with a make-and-break switch mechanically coupled to it is the only component required.

One side of the potentiometer is connected to one pick-up terminal, and the other to the anode-coupling condenser of the detector. The slider is joined to the transformer, and the switch is connected so that when the slider is turned to the pick-up side the filament circuit of the detector and preceding valves is broken. The other pick-up terminal is connected to earth.

A potentiometer of about 1 meg. resistance is suitable.

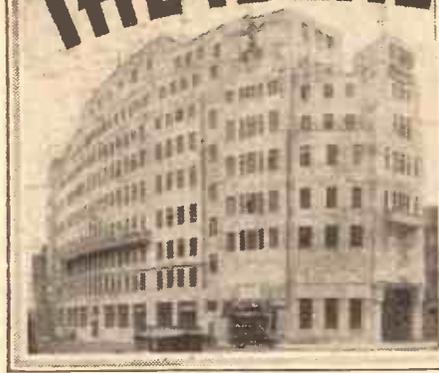
STARTING AWKWARD SCREWS.

PLACE a little jewellers wax, cobblers wax, or any similar wax on the end of your screwdriver. The screw will stick firmly enough to enable it to be introduced into the hole, and your other hand is free to manipulate, if required. Moreover, the screw can be stuck on straight and there is less difficulty in getting the screw to start the thread.

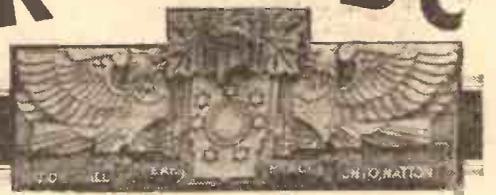
For very small screws it is the best method.

Alternatively a little soap on the screwdriver can be used.

THE IDEAL GOVERNOR OF THE B.B.C.



BY THE
VISCOUNTESS SNOWDEN



READERS may smile when they read this title. They will think I intend to paint a portrait of myself; but they will be wrong.

My own governorship of the B.B.C. was far from ideal, and I have no quarrel with anyone who would so describe it. I wish simply to set forth what I think some of the essential qualifications to be for a directorship in one of the biggest and most responsible businesses in the world.

Certain conditions in its Charter over which the B.B.C. has no control make the ideal impossible of realisation at present.

A Heavy Responsibility.

The fact that there is no fixity of tenure and that the salary is small when compared with the responsibility carried would fail to attract the kind of ability which ordinary big business could command were it not for the inborn devotion to the public service of the typical British citizen.

The statutory meetings of the Board are held twice a month. At these meetings the report of the Director-General is discussed and the finance examined. Departmental matters are handled and new departures in policy debated. Add to this the carrying of the responsibility for anything that may happen and the whole duty of a Governor would seem to be defined.

But when I accepted the appointment I imagined it meant something more than this and I still think so. My colleagues also must have been of the same opinion since they did much more.

Whole-Time Job.

When in 1927 Mr. Baldwin, then Prime Minister, asked me to become a Governor of the new British Broadcasting Corporation, I hesitated a while before accepting. Broadcasting was a new thing on the earth and I was doubtful of my gifts for the task. I knew nothing about it. Moreover it meant giving up much useful work on which I was engaged.

I finally decided that as it was new, I was as well or as little qualified as any other woman for the job. Work would convert my ignorance into knowledge and common-sense would save me from bad mistakes.

To become a Governor I cancelled my political connections and gave up the many interesting pursuits which had become a part of my life. I wanted to devote myself wholly to the work of the B.B.C.

Six years of activity within the Corporation have confirmed me in the view that the work of a Governor should be a whole-

Five and a quarter million "shareholders" and an annual income of more than £1,000,000 gross—that is the great business which we call the B.B.C. Its control is obviously a matter of great importance to every listener, and our contributor—herself a Governor until recently—brilliantly outlines the qualifications required.

time job. At present it is as much or as little as he chooses to make it.

In the best-managed businesses the directors are few and well-paid, and each is made responsible for a department. Their names come up at regular intervals for the scrutiny of the shareholders; but it is a thing unheard of that a director should be superseded whose efforts have helped to create and sustain a flourishing concern.

So it should be with the B.B.C., which is not a Government Department, but a business whose independent management is secured to it by Charter.

Think what is involved in the control and guidance of a business of this magnitude with five and a quarter million share-

THE PRESENT CHAIRMAN



At one time Speaker of the House of Commons, the Rt. Hon. J. H. Whitley was appointed Chairman of the B.B.C. about two years ago.

holders and an annual income of more than a million pounds gross!

In outlining what I conceive to be the duties of a Governor I visualise no conflict between Governors and officials. The wisest thing any board can do is to buy the best brains in the market for its detailed management and leave them free to work. But as the two sets of people must cooperate they should be equally informed about their jobs.

The popular notion that Governors select the programmes must be dismissed. Experts of all kinds—in talks, education, music, drama, sport, journalism, entertainment, etc.—do the actual programme-building.

Questions of Policy.

The Board exercises its veto when offences against taste, judgment, and discretion are threatened; but the chief business of the Board is policy.

It has to decide questions of policy arising not only out of the work of the various departments, but out of the Corporation's relation with outside organisations, such as the Newspaper Proprietors' Association, the Performers' Rights Society and the Council for Adult Education.

This constant adjudication requires of a Governor that he should be of strictly judicial mind, able to sift and weigh evidence, and willing to show neither fear nor favour.

I am happy to say that I have never had colleagues so sound in this matter as those with whom I served on the B.B.C.

There is much ill-informed criticism abroad just now, but it is not deserved. When it is realised that every criticism of one sort is balanced by an equal weight of criticism of the exactly opposite kind, the fair-mindedness of the old Board seems to me to be established.

The First Requirement.

I place this quality at the very head of the list of those which a good Governor of the B.B.C. should possess—absolute, unswerving impartiality. Whether it is exercised over the vexed question of political broadcasting, or in the selection of artistes, or in criticism of its own services, there should be no movement by so much as the breadth of a hair from the path of strictest probity.

A Governor should make himself conversant with the work of the department at first-hand. He should visit the officials in their own quarters. He should meet them socially from time to time, and so learn the better what manner of men they are. He should interest himself in the outside activities of the staff, and attend on occasion their sports events and their dramatic performances.

(Continued on page 82.)



Graham Farish says:

My NEW OHMITES are PILLARS OF STRENGTH

Reliability, safety, consistency, accuracy characterise my NEW OHMITES. Put them in your set, and whatever else may go wrong, depend upon it, you will find the OHMITES standing up to their job—veritable pillars of strength, dependable to a degree. That's why the Technical Editor of "POPULAR WIRELESS" so frequently specifies them.

- The "FERR-O-Q" requires Ohmites as follows:
- 1 10,000 ohms resistance with vertical holder.
 - 1 150,000 " " " " " "
 - 1 50,000 " " " " " "
 - 1 30,000 " " " " " "
 - 1 100 " " " " " "
 - 1 1,000 " " " " " "
- The "WESTECTOR" Super-Net. requires Ohmites as follows:
- 1 20,000 ohms resistance with vertical holder.
 - 1 25,000 " " " " " "
- The "CLASS B" FOUR requires Ohmites as follows:
- 2 1,000 ohms resistances with holders.
 - 1 5,000 ohms resistance with vertical holder.
 - 1 20,000 " " " " " "

1'6

Graham Farish OHMITE RESISTANCES

SAFE MAXIMUM CURRENT CARRYING CAPACITY OF "OHMITES." 100° F. Temperature rise.

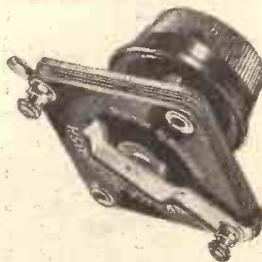
Ohms	Milliamps	Ohms	Milliamps	Ohms	Milliamps
1,000	40	5,000	20.25	40,000	6
2,000	35	10,000	12	50,000	5.5
3,000	29	20,000	8	60,000	5.24
4,000	24	30,000	6.75	80,000	4.24
				100,000	3.5

Heavy Duty type approximately double the above ratings. Price 2/3. Every wireless enthusiast should have a copy of the Graham Farish "Component Book" and also a free copy of the "Instant Station Tuning Chart." Send a Postcard request for these by return.

BETTER THAN WIRE WOUND

A very carefully constructed instrument, compact in size and efficient in design, with accurately gauged bakelite dielectrics and solid brass pigtail connection to moving vanes. Made in all capacities up to .0005-mfd. in Tuning, Reaction and Differential types. Used by many leading manufacturers and specified in sets by famous designers. One-hole fixing; supplied complete with terminals.

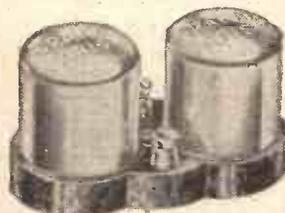
2!



L.M.S. H.F. CHOKE.

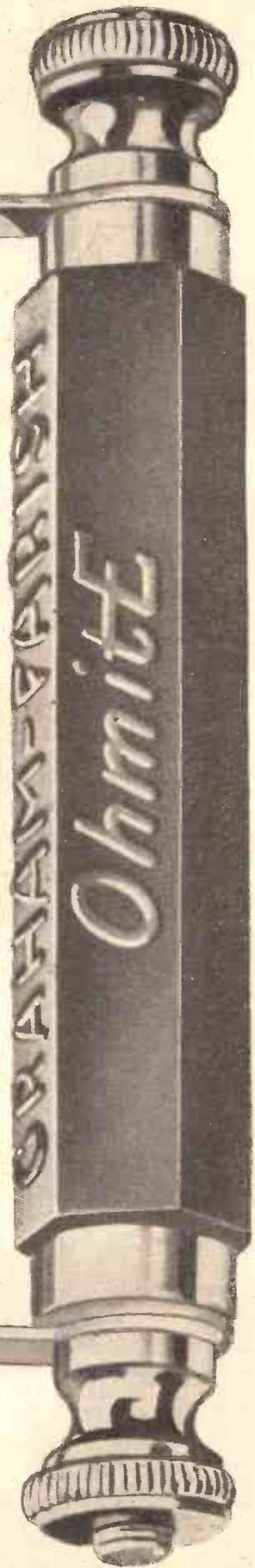
The L.M.S. is silk wound and has a consistent high inductance on all wavelengths, whilst its capacity is negligible. Particularly suitable for H.F. Circuit where high efficiency is the first consideration.

4'6



GRAHAM FARISH COMPONENTS

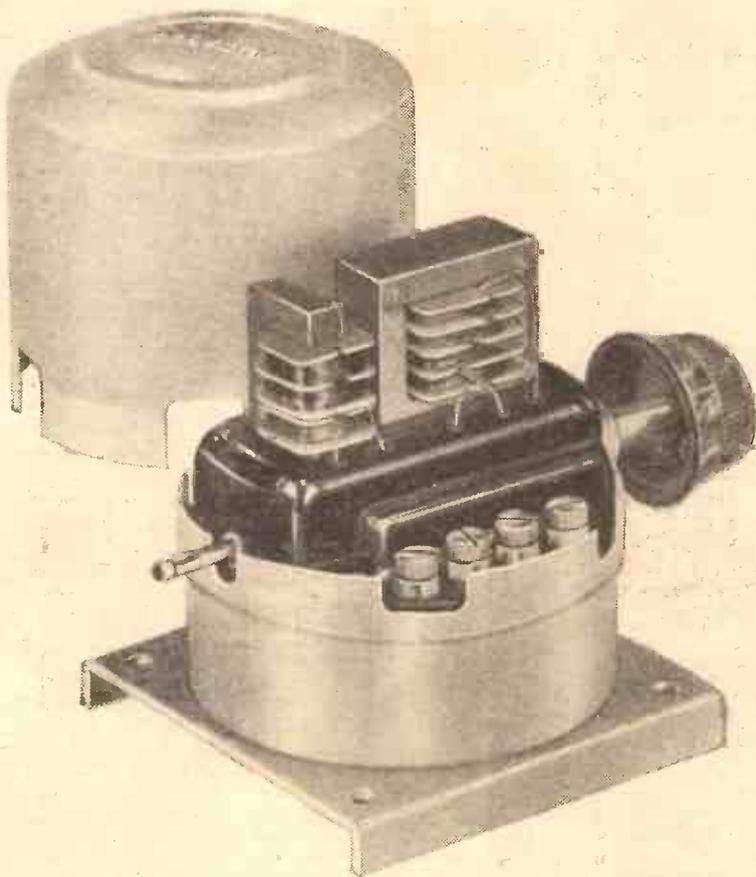
GRAHAM FARISH, LTD., MASONS HILL, BROMLEY, KENT.
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PROGRESS! COLVERN FERROCART COILS OPEN A NEW ERA IN RADIO RECEPTION

It has long been recognised that tuning coils of maximum efficiency are of paramount importance in the attainment of selectivity and sensitivity in a receiver. The design of tuning coils has made large strides in the past few years, but space considerations and the realisation of effective screening for band-pass filters and between the various stages of a receiver has involved the use of relatively small winding diameters for the coils. Thus, although actual progress has been made, this self-same progress has involved a reduction in the efficiency of the coils themselves.

Colvern Ferrocart coils have, however, changed all this at one fell swoop. These coils, though of considerably smaller dimensions than the relatively inefficient screened air-cored coils to which we have become accustomed, are actually more efficient than the unscreened Litz wound large diameter coils which have always been regarded as the last word in efficiency but which could never be put to practical use in a receiver, owing to their bulk and the impossibility of screening without very serious loss of efficiency.



The first types to be available are:—

TYPE F1-F2.

Input band-pass filter. Constant selectivity, ganging unaffected by variations in aerial reactance, symmetrical resonance curve.

TYPE F3.

Autotransformer intervalve coupling with reaction, ganging perfectly maintained on both wave-ranges by transfer of tapping point in correct turns ratio, practically constant reaction.

SPECIFIED FOR THE "FERRO-Q"

One set F1, F2, F3 Coils ganged on sub base plate with wave-change switch Set

50/-

MADE UNDER LICENCE FROM THE PATENTEE, HANS VOGT.

COLVERN LTD., MAWNEYS RD., ROMFORD, ESSEX

London Wholesale Dept., 150, Kings Cross Road, W.C.1.



Choosing Your Q.P.P. COMPONENTS

IT is well realised by now that the use of quiescent push-pull method of output valve coupling requires specially designed components, but it may not be so generally known how many various makes and types are available.

There are two definite needs for the operation of Q.P.P.—the input transformer to couple the push-pull stage to the preceding valve, and the output transformer or auto-choke for matching the stage to the loudspeaker.

In the first-mentioned component there are two vital requirements, a high step-up ratio (the usual 1 : 3½ will not do, for we require some 1 : 8 or 1 : 10), and as high a primary impedance as possible.



Readers are familiar with the Multitone tone-control transformers. Here are the Q.P.P. components of the same make to one of which tone-control principle is applied.

Naturally the design of a transformer of high step-up ratio normally necessitates the reduction of primary impedance if the dimensions of the component are to remain substantially the same as the usual 1 : 3½ inter-valve transformer, but as the figures we shall give show, the primary impedance has been kept well up in most cases, in spite of the difficulty of design, and high impedance means good bass amplification.

What Poor Design Would Do.

Also, it must be remembered that there is a danger in using a high ratio of seriously increasing the self capacity of the transformer, with a resultant loss of high notes. Thus, it is possible with poor design to lose both high- and low-note amplification, and it speaks well for the manufacturers who have so far tackled the problem that these troubles have been so successfully avoided.

Though they all make both the input transformer and the output choke, we will take the various firms in two sections, dealing first with the transformer, and later with the output arrangements, and to be perfectly fair we will discuss the makes in the



An inexpensive input transformer of Ferranti make.

A review of the components available to constructors for use in quiescent push-pull amplifiers and receivers, and an explanation of the technical requirements necessary for efficient operation.
By K. D. ROGERS.

order in which they were sent to us for test on the arrival of Q.P.P.

The first firm to come along with the required components was Radio Instruments, who brought their "Q" type transformer and an output transformer. This was later altered to the present choke, of which we will have something to say later.

Finished Appearance.

The transformer is built in the well-known "Hypermu" case, and has a most finished appearance. It employs a nickel-iron alloy for the core, and has a primary inductance of 16 henries with a current of 2 milliamps passing through it. With no D.C. the inductance rises to 30 henries, while saturation does not occur below 3 milliamps.

As most cases of Q.P.P. will be those in which the detector is fed into the transformer it can be taken that the average working inductance of the primary will be a little above 16 henries, for few battery detectors take anode currents quite as high as 2 milliamps.

The ratio of the transformer is 1 : 8 and the price, including royalty, is 16s. 6d.

Following R.I. came, a mere few hours later, Sound Sales Ltd., with a transformer and output choke. The transformer is in a particularly neat brown moulding and has excellent characteristics. The ratio is 1 : 9, which enables the output valves to be fully loaded quite easily, and the price is 15s.

FROM RADIO INSTRUMENTS



The core is of special alloy, and the transformer primary will carry 3 or more milliamps without core saturation. The inductance is commendably high, being as much as 30 henries at 2 milliamps, thus ensuring good bass amplification, while the self-capacity of the component has been kept low, reducing the possibility of high note loss by means of a special type of sectionalised winding. The transformer is known officially as type SS/P.P.9.

For Controlling Tone.

Next we come to Multitone, Ltd., who have turned out three quiescent push-pull transformers—one for tone controlling, at 17s. 6d., another, a straight type, retailing for 15s., and a special one at 17s. 6d.

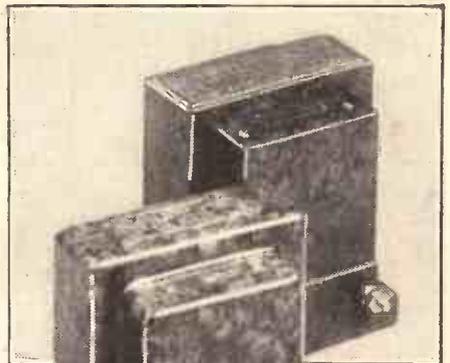
The former will probably be the most popular, for it is a distinct advantage to be able to control the proportion of high and low notes, especially for broadcast talks and the playing of gramophone records.

It has an inductance of about 30 henries with 2 milliamps passing, and the step-up ratio is 1 : 8. The second transformer in the Multitone quiescent push-pull range is the PU/1 : 8, which is the same as the former mentioned (the PUCO 1 : 8) except that it has no provision for tone control. The price is 15s. in this case.

The third in the range costs the same as the tone control model (17s. 6d.) and is

(Continued on next page.)

HIGH RATIO



Two Sound Sales quiescent components, the one in the foreground being for input.

CHOOSING YOUR "Q.P.P." COMPONENTS

(Continued from previous page.)

called the D4. It has a particularly high primary inductance, being of the order of 40 henries at 2 milliamps, which is a very good figure indeed. The ratio is 1:9 in this transformer.

Ferranti have long been in the push-pull transformer line, and so when their quiescent models arrived we expected great things of them. And we were not disappointed, for they are very fine indeed, especially the more expensive model of the two input transformers, the AF11c, which has a ratio of 1:10, and a primary inductance of 50 henries at no D.C., dropping to 25 with 10 milliamps.

This obviously gives a very high figure for a current of under 2 milliamps (the usual figure), and the general design is such that the minimum of self-capacity is allowed, giving results that are good all over the musical scale.

Less Expensive Model.

This transformer costs 34s. 0d., including royalty, but there is a less expensive model, the AF12c, which retails at 15s. 0d., and which has a ratio of 1:9. The primary inductance in this case is less, being of the order of 30/15 henries with currents of 0 to 6 milliamps. Obviously it pays to use the more expensive of the two if you are out for the very best from your quiescent receiver or amplifier.

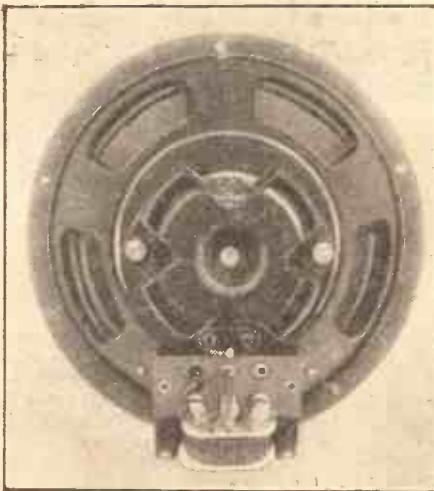
Finally we received samples of the Varley range, which includes several chokes, but only one input transformer. This has a high inductance, being round about 27 henries with 2 milliamps, and has a ratio of 1:9. It is sold for 17s. 6d. and is called the D.P.36.

This concludes the various transformers we have tested, and readers will be able to choose the particular one they fancy from the details given. It must be remembered that while the ratio of 1:8 satisfactorily

types of output chokes and transformers that have been designed, and we will take them in the same order as the input transformers.

The R.F. output choke allows a number of different ratios to be obtained so that it can be used for any type of high impedance speaker and for either pentode or triode valves. It is known as the DY35, and the ratios provide 1:1, 1.4:1, 2:1, and 2.8:1. This is quite sufficient for any ordinary operation with either conc or moving-coil speakers, provided the latter have normal speaker transformers on board. The price of the component is 12s. 6d.

FOR DIRECT CONNECTION



By using a loudspeaker with special input transformer as on this Celestion instrument, an output transformer in the set is obviated.

The Sound Sales output choke is also a tapped type giving a number of ratios. It costs 10s. 0d. and is called the OPQ model. The ratios again look after the ordinary high impedance loudspeaker, and those obtainable are ratios of 1:1, 2:1, and 3:1.

On the output side Multitone have one choke, the Puchoke, which provides matching ratios of 1:1, 1.5:1, and 3:1. Here again it is intended for use with high resistance speakers, as is the choke previously mentioned. The price is 9s. 6d.

"Tranchoke" Details.

Ferranti and Varley have brought out a large range of output coupling devices, the former being transformers, and the latter chokes, "Tranchokes" as they are called.

There are three Ferranti transformers, the OPM11c, OPM13c, and OPM12c.

The first of these covers ratios of 35, 56 and 100:1. The price is 26s. 6d. The second transformer covers ratios of 1.7, 2.7 and 4.5:1; while the price is the same. Finally, the third covers 1.7 and 40:1, being for use with either high- or low-resistance speakers without built-in transformers, or with low-resistance speakers with transformers. It will carry up to 75 milliamps, though this is hardly necessary with Q.P.P., and the price is only 15s. 0d.

Varley have three chokes, the DP37, DP38, and DP39. They give ratios of 3 and 42:1; 3 and 50:1; and 3 and 75:1. The price is 18s. 6d. in the case of



40:1 AND 1.7:1

These are the alternative ratios on this inexpensive Ferranti Q.P.P. output transformer.

the former, and 16s. 6d. in the latter two, and as will be seen the various ratios allow very close matching to be obtained.

Finally we should like to draw attention to the fact that a number of speaker manufacturers are making special transformers to suit their speaker models so that they can be used with Q.P.P. without the need for the output choke or transformer in the set. Among those who can supply suitable speakers, or transformers for their existing speakers, are Celestion, Rola, B.T.H., and Amplion. But no doubt before this appears in print we shall have yet more Q.P.P. components both in the speaker and the set component section. We already have heard that British Radiophone are busy with a range of such components.

In addition to these, Ormond are busy getting out a particularly cheap transformer, which rumour says will be available for round about eight shillings; but so far we have had no details of this. Further, Lissen have a range of components that at the time of writing is nearly ready for the market; and these, too, we hope to discuss at an early date, after tests have been carried out.

The popularity of quiescent push-pull has certainly justified the energy and expense that have been expended by the pioneers of the system, for the sales of the various transformers have more than fulfilled the expectations of at least two of the "early birds."

In concluding this description of the various Q.P.P. components it is fitting that we draw attention to the special H.T. batteries that have been developed for use with this type of circuit. They have been designed to provide not only a suitable voltage and capacity, but also much closer tapping points at the top end of the battery to facilitate the adjustment of screen voltages.

INPUT AND OUTPUT

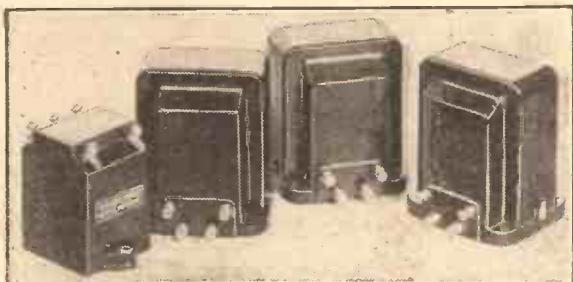
Messrs. Ferranti have a large range of transformers for the new push-pull, with varying ratios and prices.



Above is the 1:10 ratio transformer for input, and to the right an output transformer with a choice of three ratios.



HERE IS THE VARLEY RANGE



On the left is the input component, the other three being output types with different ratios, each giving two to choose from.

loads the output stage when the detector is fully loaded, the higher ratios give more scope in this respect, though the possibility of overloading the output valves becomes greater.

Primary inductance is a big consideration, for on this the amount of low-note amplification depends, while, of course, the matching of the output is of vital importance.

This brings us on to the various makes and

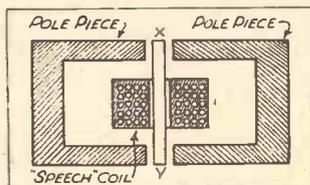
RADIO SIMPLIFIED

A PRACTICAL OUTLINE FOR BEGINNERS

WHEN broadcasting first started, the loudspeaker was a most inefficient piece of apparatus. It was, in fact, simply a telephone ear-piece—sometimes of bigger dimensions than the normal headphone, but nevertheless identical as to its working parts. To this glorified “ear-piece” was attached a horn, which served to focus and magnify the effect of the sound impulses, derived from the “ear-piece” diaphragm.

In recent years vast improvements have taken place both in

BALANCED ARMATURE



In the case of the balanced-armature type the armature X Y is pivoted, and moves to and fro in sympathy with the voltage variations in the “speech” coil.

the design of L.F. amplifying equipment and in loudspeakers. The horn type has virtually disappeared, and its place has been taken by other forms of speaker which can be divided into three main classes, viz., moving-iron cone, inductor, and moving-coil.

The moving-iron cone speaker is probably the most sensitive of the three types, and usually works on the balanced-armature principle. If you refer to the figure, you will notice that there is a “speech” coil which is

THE FINAL ADJUSTMENT



Many cone loudspeakers have an adjusting knob, which is rotated to give the best results.

The LOUDSPEAKER - HOW IT WORKS -

simply a coil consisting of a number of turns of fine copper wire. This coil surrounds the soft iron armature X and Y, which is pivoted between the pole pieces (usually laminated) of a powerful permanent magnet.

The two ends of the “speech” coil are connected either directly, or indirectly, to the loudspeaker terminals of the set. The armature X Y remains in a central position all the while there are no varying currents due to speech or music passing through the coil.

Directly varying currents—caused by the broadcasting programmes—commence to flow through the coil, the armature X Y becomes a magnet and is therefore attracted by one pole of the permanent magnet and repelled by the other, depending upon the direction of the current passing through the coil.

Attached to one end of the armature is a light metal coupling, which imparts every movement of the armature to the driving rod of the cone. The driving rod is secured by means of nuts and washers to the apex of a cone constructed either of paper or some other material, and arranged so that it is moved to and fro in sympathy with movements of the armature.

There is also an adjusting knob with which it is possible to adjust the armature to its most sensitive condition, and loudspeakers of this type are particularly suitable for small sets, or in cases where the utmost

sound output is required from a small input.

Inductor type speakers give good quality reproduction and are fully comparable with moving coils in the same price class.

Referring to the figure, there are two steel pieces X and Y joined together by a rod, one end of which is attached to the cone. The rod is held so that it can only move horizontally and parallel with the magnet pole pieces. The speech coils are connected in series, and when the current flows through the windings from the end nearer the cone, that is the top coils, the steel piece Y tends to move, so that it is disposed centrally in

relation to the magnet pole pieces in its immediate vicinity.

When the current is reversed, X moves in exactly the same way, and so there is a to and fro motion of the cone driving rod, the extent of the movement depending upon the strength of the impulses passing through the coils.

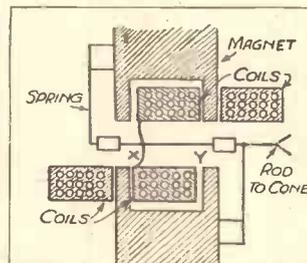
In order to take advantage of the reproductive properties of any loudspeaker in

which a cone forms the diaphragm, it is essential that some sort of baffle should be used. A baffle is a flat wooden surface having a hole of approximately the same diameter as the cone. Often this hole is of ornamental pattern. The baffle can be either a plain flat board, or the cabinet in which the loudspeaker unit itself is fitted.

If a speaker unit is tried first

with a baffle and then with no baffle, a very marked difference will be observed in the reproduction; without the baffle the tone will be high-pitched, owing to a complete loss of lower musical frequencies; with the baffle the tone will be normal, containing the proper proportion of the lower frequencies, and within limits the bigger the baffle area, the better is the bass response—the limits, of course, being the speaker itself and the amplifier,

INDUCTOR TYPE

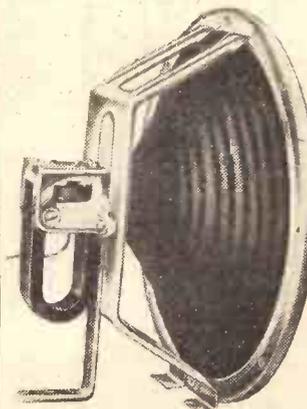


With the inductor loudspeaker the movement of the armature is parallel with the magnet poles.

It is a mistake to have a solid back to the cabinet because this aggravates box resonance. The back can consist of a gauze-covered frame, which will serve to keep out dust, and the wood from which the cabinet is made should be as thick as possible. Box resonance tends to spoil the reproduction, and it definitely gives lack of crispness.

Next week we shall deal further with loudspeakers and the principles upon which they work.

COMPLETE WITH CHASSIS



A sensitive model—the Blue Spot 100 U. When mounted on a baffle or placed in a suitable cabinet it is ready for use.

Special Beginners' Supplement—Page 3.

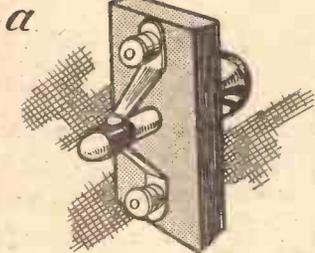
WHAT should the owner do when a set suddenly develops a fault?

If he happens to have built the set for himself, the probability is that he will feel fully competent to overhaul it, testing for a faulty component on the lines indicated in our March 4th supplement. But if the set was purchased complete its owner often rightly hesitates to interfere with its internals.

In a number of cases the advice of the makers is not obtainable, and the owner is then in a quandary. Though he may call on a friend for assistance, this may prove disappointing.

Despite inexperience, his best plan is to try and find the fault for himself, as indicated below.

CAUSING CRACKLES?



If you get scratchy noises and crackles when you operate a switch of this kind, look at the sketch opposite. It shows how the knob can be unscrewed and the switch dismantled and tightened.

(Once it is located the actual putting it right is usually an easy matter.)

The most disconcerting symptom of all is to switch on and to wait in vain for any sign of the programme to appear. If the set was working perfectly only a few hours before, try the wave-change switch, to see if the fault lies only on one waveband.

If the latter is the case and the set seems altogether dead, the next line of investigation should be the external connections.

Reversed H.T.

Has a new battery been connected, or has either the loud-speaker or the set been moved, and its leads disturbed, for spring cleaning or other domestic reasons? Any such interference with the set, with its aerial, earth, or switches may easily put it temporarily out of action.

Perhaps one of the battery connectors has been accidentally removed. The reversal of the high-tension plugs will result in dead silence from the loud-speaker.

An exactly similar "reversal" fault can occur with a D.C. (Direct Current) mains set, if the



SETS WHICH WON'T WORK

plug that fits into the wall-socket is placed the wrong way round.

Probably the valves will light and everything will appear to be in order, but there will be no H.T. on the valves, and consequently no sound from the loudspeaker.

A reversal of the mains plug will put this matter right. But generally it is not advisable to change it instantly, as this will sometimes cause big surges of current.

It is wiser to remove the mains plug, and before putting the plug back the right way into the wall socket, to allow the set to stand idle for a while. (Shorting the large smoothing condensers would serve the same purpose, but this is usually not a task for the unskilled.)

If an H.T. battery is employed, and if all the leads, etc., appear to be O.K., notice what is the effect of taking out the H.T. negative plug and putting it back in the socket. There may be no loud clicks from the loudspeaker when this is done, in which case the loudspeaker (or its wiring) may be at fault, or the set's fuse may have "blown."

Not all sets are fitted with fuses, but if there is one it is almost certain to be found wired between the H.T. negative and L.T. negative terminals, inside the set, and can easily be changed.

If a new fuse is not immediately available it is sometimes recommended that the old fuse be "shorted" by connecting a short length of wire across its terminals, to restore the programme; but this is seldom advisable, and in any case it must on no account be tried unless the fault which caused the first fuse to blow is known.

If the fuse is not at fault and the leads are O.K., the probable effect of moving the H.T. negative lead from the battery will be corresponding loud clicks from the loudspeaker.

These would indicate that the

(Left) Moving contacts of this kind can be lifted and a "cleaner" inserted as shown.

last valve is working, so the next test is to turn the reaction control to see if the set will oscillate. If this happens—with the usual "phut" in the loud-speaker, accompanied by a rushing sound, which increases, perhaps to a "hiss" as the reaction is further increased, it will prove that the detector, too, is O.K.

This narrows the field down considerably, for it indicates that the trouble must be that the detector is getting nothing to detect. Near a local station it will be found possible to remedy this state of affairs by "finding a carrier," which is done as follows:

Turn the tuning dial to zero, and increase the reaction till the set sounds really "lively." If reaction is turned too far you will get the characteristic "plop" and rushing noise of oscillation, and reaction must be slackened a little till the set is nearly oscillating—not quite.

Now if tuning is slowly advanced and reaction increased a little at intervals, to keep the set "lively," it is almost certain that at some point on the tuning dial there will be a little whistle, or chirp, as a station's carrier-wave is tuned in. And often careful tuning and reaction adjustments will enable a faint tune or speech to be heard.

Such a weak programme is of great assistance in testing a hitherto dumb set, because if left tuned in, the effect of other adjustments, etc., upon it will give clear indications of improvement or otherwise.

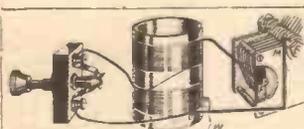
By proceeding methodically thus we have exonerated the detector and low-frequency end of the set, so now attention can be given to the high-frequency section (which precedes the detector). If an S.G. valve is used a close inspection of its flex lead which goes to the terminal on the cap of the valve and of its other wiring should be made.

TESTING A COIL



If a coil winding is broken there will be no click in the loudspeaker when its terminals have the loudspeaker and battery connected in series between them.

A wavechange switch cuts out the long-wave coil by joining its two ends, as depicted here. If the spring gets weak, and does not "bite" long-wave stations may be heard when the switch is pulled out for medium waves.



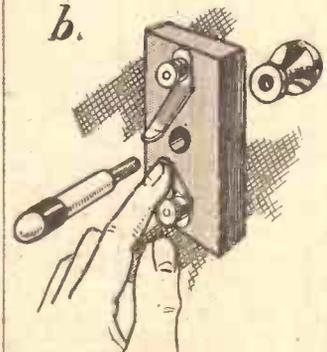
(Right) Open out grid bias and H.T. plugs with a penknife so as to ensure a good contact.

Pay particular attention to any wire passing through a coil "can" or other sharp metal screen, and to flexible wires, for these are specially liable to breakage.

Examine the switches, volume control if used, and flex leads to coils, a wooden prod being very cautiously employed to move or press any suspected component while listening to the effect on the weak reception.

If the faulty spot is located the set will immediately jump to life again, but if this does not happen there is still a good chance of the set-owner finding the fault, especially if he can borrow a few parts, similar to his own, for test purposes.

THE REMEDY



When the centre piece is withdrawn the springs can be tightened by pressure with the finger.

An H.F. choke, for instance, can generally be cut out of circuit easily, and another substituted, by running flex leads from the new choke to the points formerly connected to the old one.

In the same way, resistances can be tested by substitution quite quickly, and it is worth remembering that for purposes of locating a breakdown there is no need for resistance values to match closely—almost any resistance value will do to ascertain if the one in the set is faulty.

The Valve's Contacts.

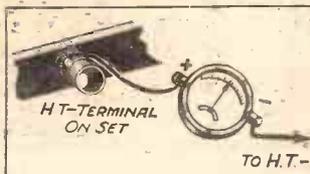
Remember, that if a valve does not make excellent contact in its holder a slight accidental sideways push is often sufficient to disconnect, say, its grid pin from the socket. This virtually puts the set out of action till the slight misplacing of the valve has been remedied by a gentle reinstatement of it in its former position in the valve holder.

By a careful check over on these lines even the novice can often restore a "dead" set to life again.



(Left) Moving contacts of this kind can be lifted and a "cleaner" inserted as shown.

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When the milliammeter is connected as above, it will indicate the total anode current consumption of the set.

THE milliammeter is a form of ammeter arranged so that it measures in thousandths of an ampere. Like the voltmeter, it is invaluable as an aid towards getting the best results. Not only does it enable the constructor to measure the anode current taken by each valve, or the total current consumed by all the valves, but it can also be employed to detect valve overloading, which is a very frequent cause of mutilated reproduction.

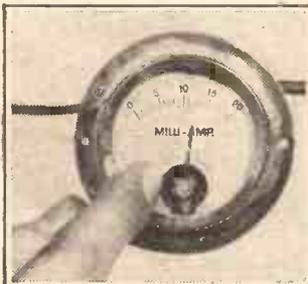
"What type of milliammeter ought I to get?" is a natural question. In the first place it pays to purchase a good moving-coil instrument, and this is the only way that real accuracy can be achieved. The scale should be an open one, so that the current measurements can be easily read.

For a three-valve set of the battery type in which there is a super-power valve in the output stage, a meter having a range of 0-25 milliamps is about right. In the case of a mains design it is quite possible that the set will take 30 milliamps or more, and therefore the range may have to be up to 50 milliamps or so for this type of receiver.

A two- or three-range instrument is very convenient because by changing over a lead to the appropriate terminal the meter can be adapted for different purposes.

For example, in determining the total anode current taken by a set, obviously the range of the meter must be such that the

EASY TO READ



When purchasing a milliammeter it is essential to choose one having a range suited to the set, and an easily readable scale.

USING A MILLIAMMETER

anode current reading will come within its scale.

On the other hand, such a meter may not be ideal for measuring the small current taken by a detector valve. Suppose, for instance, that the total current consumption happened to be 40 milliamps, the full scale deflection given by the meter being 50 milliamps, and the detector only consuming 2 milliamps.

On a 50-milliamper scale, the 2 m/a. would not be easy to read accurately, especially if the meter had a scale length of only 2 in. or so. This is where a two- or three-range instrument is convenient. One might have ranges of 50 and 5 milliamps, in which case the 5 m/a. scale would be very suitable for small

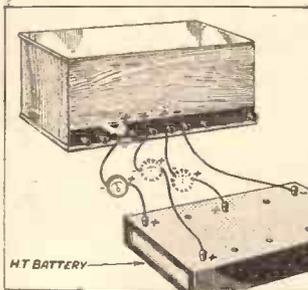
either of these valves, we must withdraw the one whose current we do not wish to know from its holder.

So you will see that it is quite easy to find the current consumption for any one valve in the set. The milliammeter is inserted in each positive lead, as shown, + on the meter being joined to + on the H.T. supply.

If we wish to measure the total current taken by all the valves, we shall have to connect the meter in the H.T. — lead joining + on the meter to the H.T. — terminal on the set, and — on the meter to H.T. — on the H.T. supply.

The reading on the meter should then be equal to the sum of the currents taken by the individual valves.

INDIVIDUAL CURRENTS



The milliammeter is connected in each H.T. + lead in turn for finding the currents taken by the individual valves.

currents such as the detector or screening grid of an S.G. valve.

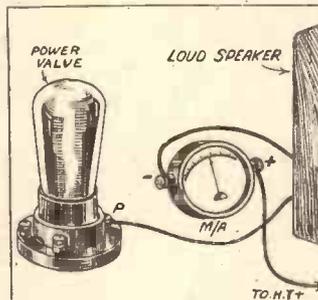
Since a milliammeter is a current measuring device, it is always connected in series with the circuit, and not across the two ends of a circuit like a voltmeter.

On this page there is a sketch of an H.T. battery joined up to the H.T. terminals of a set. In order to illustrate the method of connecting the milliammeter in the various H.T. leads, we have assumed that there are three positive tappings on the battery supplying (say) the screening grid of an S.G. valve, the detector and the output valve and S.G. valve anode.

In many battery sets the last-named are coupled together. Hence the maximum voltage on the H.T. terminal will probably be joined in this case to the anodes of the two valves we have mentioned.

Therefore, if we wish to measure the current taken by

DETECTS OVERLOADING



For checking valve overloading the meter is joined in series with the anode of the output valve.

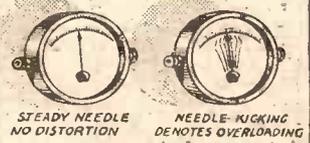
It is rather a good plan to leave the meter in circuit with the H.T. — lead, and to withdraw the valves from their holders.

If when this is done the needle on the meter shows that current is flowing, it is an indication that a leak exists somewhere in the set, and all the by-passing condensers should be tested in case one of them is defective.

On the other hand, it must be remembered that in S.G. sets the screening grid sometimes has a fixed potentiometer connected between H.T. + and H.T. —. This potentiometer, unless arranged so that it can be cut out of circuit when the set is not in use, is liable to give misleading results on the milliammeter, because, even with the valves withdrawn from their holders, the needle will show a reading of a milliamp or so.

Now how can we tell whether the output valve is overloading simply by using a milliammeter?

If we connect it in circuit



A certain amount of needle kicking can be tolerated, but large swings call for reduced volume.

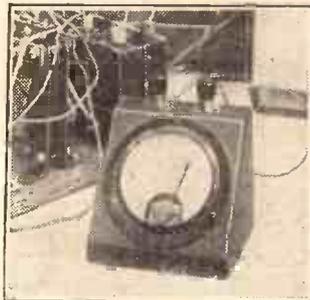
with the H.T. supply to the output valve so that the current flowing through the meter goes only to this valve, and to no other, we shall obtain a steady reading of milliamps, depending upon the type of output valve, H.T. voltage and grid bias. The needle should remain perfectly steady both when the set is not in tune with the station, and also when a programme is being received.

If, however, we adjust the volume so that the amount of energy the valve is called upon to handle is more than it can deal with without introducing distortion, then the milliammeter needle will kick either one way or the other to an extent depending upon the amount of overloading.

A certain amount of needle movement can be tolerated because the ear does not notice slight distortion. It is, in fact, very difficult in practice to adjust meters so that the needle is absolutely steady. You may rotate the volume control to give a reasonable volume and think that since the needle exhibits no tendency to kick violently, the set can be left like that, but unfortunately a sudden crescendo or loud passage will usually produce temporary overloading, unless there is a substantial margin of safety.

The best way of adjusting the volume with a milliammeter in the output circuit is to rotate the volume control knob until a point is reached where the needle commences to kick. Then we can work backwards and find a point at which the needle remains steady.

HOW MANY MILLIAMPS?



An instrument of the moving-coil type is the most accurate. Its movement should be well damped.

NEXT WEEK :

The Voltmeter in use. — Moving-Coil Loudspeakers. — High Tension Hints. Concerning Coupling.

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FERRO-Q

- KIT "A"** Author's Kit of First Specified Components including ready-drilled panel, but less valves and cabinet. Cash or C.O.D. Carriage Paid, £12/16/6. or 12 monthly payments of 23/6. **£9:18:0** or 12 monthly payments of 18/3
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Described this week.

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- KIT-BITS** You pay the postman. We pay post charges orders over 10/-
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|-------------------------------------------------------|---------|
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| 1 Radiophone band-pass super-het. tuning unit, B.R.P. | 3 15 0 |
| 1 Set of 6 valves as specified (less rectifier) | 3 7 9 |
| 1 Westector Rectifier, model W.6. | 7 6 |
| Peto-Scott ready-drilled panel and baseboard | 6 9 |

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| Ready-drilled panel and baseboard | 8 3 |
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Send for Free 1/4 Constructional Chart and Full Size Blueprint
NEW REVOLUTIONARY Q.P.P. KIT SET

SHORT-WAVE NOTES

BY W. L. S.

All the interesting news and views of current short-wave practice

ONE of the spasmodic bursts of good conditions is in full swing, as I write these notes. On the 20-metre amateur band the Americans are arriving "in quantity" at any time between noon and 10 p.m., which is always a good sign. All the American broadcasters have gone up to two or three times their accustomed strength, and the short-waver's life is now a happy one—for a few days!

These little flashes in the pan serve to show us what we may expect from the short waves when the sun-spot cycle reaches a more favourable part of its somewhat erratic curve. As I have said before, I have distinct hopes that by the time we reach the next "trough"—eleven years from now—somebody will have found a method of taming the ether.

A Tango Programme.

With all the brains of the radio world concentrated on means of making the ultra-short waves more reliable, I cannot imagine that we shall be taking "bad conditions" lying down for much longer.

"L. W. D." (Faversham) reports reception of a "fuzzy" carrier-wave just above W 8 X K on 48.86 metres, modulated with a programme of tangos. He thinks it might be the Venezuelan, Y V-11 B M O. I can't verify it for certain, but it seems more than likely, especially on account of the "fuzzy" carrier (good description, that!).

Cold Valve for Short Waves.

"L. W. D." is also anxious to know what the new "cold valve" will do for short waves. So am I, "L. W. D."—very.

"C. H. D." (Peterborough) doesn't agree with me that short-wave DX conditions have been bad recently, and quotes his reception of North and South American broadcasters on the loudspeaker to prove it. The point is, "C. H. D.," that these high-powered stations ought to come in on the loudspeaker even if conditions are bad. Really bad conditions show up first of all on the low-powered people, especially the "fly-power" amateurs; they have to be absolutely dead to stop the 50 and 100 kw. men from coming over.

W3XAU on about 31 metres is mentioned by several correspondents this week, and another newcomer is W 2 X V (New York), in the region of 49 metres.

Heard All Continents.

"A. H. H." (Newquay) makes quite sure of being included in the Heard All Continents Club by sending me his verification cards from the various stations. Thanks, "A. H. H."

"R. S. W." (Towcester) wants identification of the station on about 14 metres, who put out an interval signal with the notes D, F-sharp, A, D. Can anyone help him? I haven't heard this station myself, as yet.

During some recent tests with my own telephony transmitter on 40 metres, I

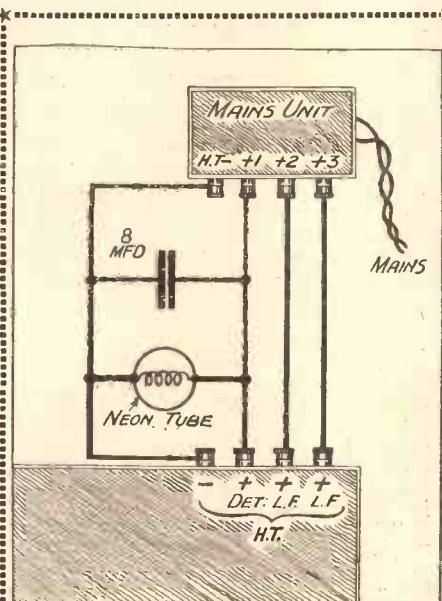
have had the pleasure of chatting with two "hams" whom I remember very well as regular correspondents of mine. I wonder how many of the keener folk who write nice letters to me do get bitten so badly that they eventually end up with a fully-fledged transmitting licence?

Once one gets really keen, there is no knowing where the end will be! The usual steps seem to be "listener," "short-wave receiving station," "artificial aerial" transmitting licence, aspirations for more, and finally the arrival of the "more" in the shape of a full radiating licence.

The Last Step.

There is another step—the "black sheep of the neighbourhood" grade. I have been that in my time, but I think they have all passed me over as a hopeless case now. I shall never forget a 'phone call I had telling me that "my speech was louder than 2 L O." I replied somewhat indignantly to the charge, and didn't hear any more from that quarter.

But just think of a modern receiver that gets interference on 356 metres from a quite low-powered crystal-controlled transmitter on 20 or 40 metres. Selectivity in excelsis!



WHEN USING THE MAINS

IT is not the easiest thing in the world to get a short-waver working perfectly from a mains unit, particularly of the A.C. variety. The usual precautions are generally successful in getting rid of hum, but if the mains are at all unsteady, the set will creep gently in and out of oscillation in a most annoying way.

A very large reservoir condenser goes a long way towards stopping this; a further 8-mfd. across the detector H.T. is nearly always completely effective. Be careful to see that it is across the detector tapping, as it will be wasted (for the purpose for which it is intended) if it is across the main supply, since slight variations in the feed to the L.F. stages will not matter much.

A neon tube of the 200-volt variety is also a great help if the output of the mains unit is in excess of 200. This should be connected across the extra condenser.



BY G.T. KELSEY

Weekly jottings of interest to buyers

THE stabilisation of the radio industry is something to which we can all look forward for the very simple reason that it will be of benefit both to producer and user alike.

At the present time absolute stability is far from being the order of the day, a state of affairs for which the undermining influence of price-cutting and discount-splitting is largely to blame. My advice to those who would be tempted to buy apparatus, particularly complete receivers, at "so much off" list prices is very definitely to leave them alone.

The temptation should under no circumstances be allowed to outweigh considerations of reliability and performance, for it should be remembered that no receiver sold at a cut price is backed by the maker's guarantee.

That fact alone would frighten me off it! What is perhaps the boldest policy for combating the menace of price cutting is to place the weapon of low prices in the hands of the bona fide traders and to restrict distribution to the proper channels; but that is not always economically possible.

Such a policy has recently been adopted by E. K. Cole, Ltd., and in announcing drastic reductions in the prices of Ekco receivers the Chairman and Managing Director, Mr. W. S. Verrells, has issued a statement outlining the future policy of the company.

It is clear from the statement that the reductions in prices have been made with the sole object of combating the price-cutting menace, and particular attention is drawn to the fact that the quality of Ekco products will remain unchanged.

Westector Types.

I am able this week to give you some further details of the new Westinghouse H.F. rectifiers, or "cold" valves, the first announcement of which appeared exclusively in "P.W." a few weeks ago.

In fact, full constructional details of a set using one of the new Westectors are being published in this very issue of "P.W." (I have seen the set, and it is a most interesting arrangement.)

These rectifiers, known as "Westectors," are used in receivers in place of the usual detector valves, thus saving both the H.T. and L.T. consumption.

Four types of rectifier are available—the W.4 and the W.6 for half-wave rectification, and the WM.24 and the W.M.26 for full-wave. In the case of the WM.24 and the WM.26, a centre tap is provided.

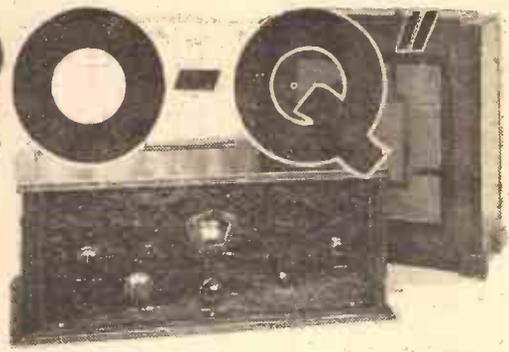
The retail list prices have been fixed for 7s. 6d. for the half-wave types, and 10s. for the others.

Blue Spot Again.

April the First will be a red-letter day in the history of Blue Spot activities, for

(Continued on page 80.)

The "FERRO-Q"



LAST week we gave theoretical details of the latest development in receiver design—the "Ferro-Q." It was shown how by the use of the new Ferrocart coils a high level of selectivity was obtained without the sensitivity falling below a certain high degree.

An Amazing Performance.

Coupled with quiescent push-pull these coils provided a set having an amazing performance with abnormally low running costs. The power output is exceptionally great owing to the use of Q.P.P. and the Ferrocart coils enable full power to be obtained on a surprising number of stations.

The final design of the set is somewhat different from that indicated in the diagram of one of the experimental models last week, and the layout is altered from that of the receiver illustrated in the previous article. Substantially, however, the circuit is the same, only minor points being changed, the largest of which is the substitution of a variable-mu S.G. valve for the "ordinary" S.G. shown last week.

This change is essential to provide efficient volume control without introducing unwanted damping into the coil system. Pre-detector volume control is essential in a set of this nature, for the insensitivity

associated with many of the normal types of band-pass circuits certainly is not present in the Ferrocart coils, which provide good band-pass selectivity with the sensitivity that is normally associated with straight-tuned circuits.

So good is the amplification obtained from the S.G. stage that the layout of the set has to be very carefully carried out to prevent back-coupling, and the inclusion of a local-distance switch was found essential, for with up to 16½ volts on the variable-mu valve it was found impossible to reduce sufficiently the volume

"volume" of the variable-mu potentiometer control the valve tends to "spill over." This occurs only on the medium waves, and is due no doubt to the internal self-capacity of the valve.

The control could be arranged by so fixing the bias of the valve (by a series resistance in series on one side of the potentiometer) that the full maximum amplification of the valve was not then obtained and therefore the tendency to "spill over" was never encountered.

This would be a foolish step, however, for on the long waves, where the frequency being dealt with is lower the valve shows no tendency to oscillate and

the full amplification can be used. Were the resistance limiter to be employed this would be impossible.

Stray Capacities.

This verge of oscillation point should occur only when the potentiometer is "all-out" at the maximum setting. If it occurs at a point further round to the left it is a sign that either a valve with an unusually high self-capacity is being used or else your layout is not as good as it should be, stray capacities between anode and grid being present to too great a degree.

Quite apart from any amplification control provided by the variable-mu valve and the local-distance switch (which in the "local" position inserts a resistance of 100 ohms across aerial and earth) we found that a tendency

(Continued on next page.)

Complete constructional details of an entirely new type of receiver, incorporating the latest developments in radio. Utilising Ferrocart coils, band-pass tuning and Q.P.P. low-frequency amplification, it is a design remarkable for its

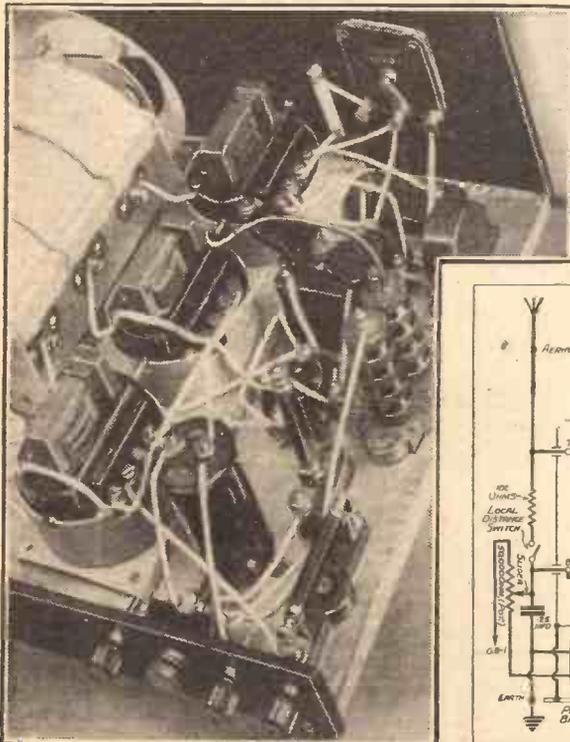
HIGH SELECTIVITY. EXCEPTIONAL POWER. ECONOMY IN UPKEEP.

from the local station 12-15 miles away.

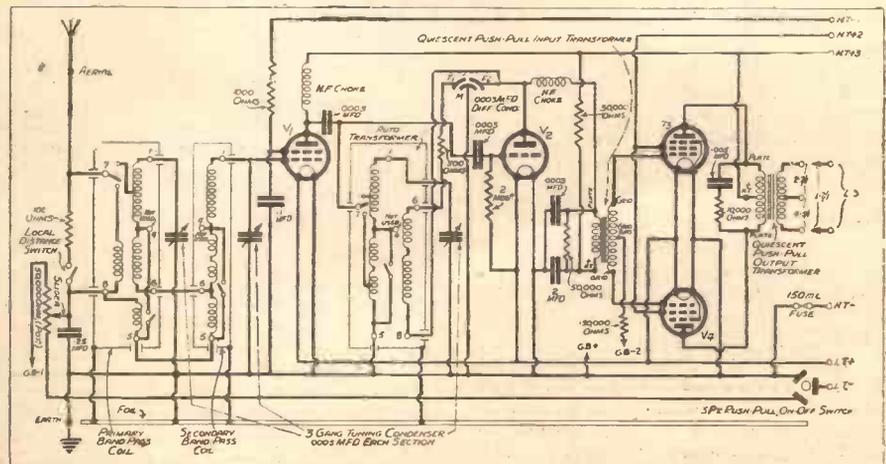
This great volume (remember it is a band-pass circuit) is accompanied by a selectivity that gives the impression that two S.G. stages have been used instead of one. Indeed the space we found between the London Regional and the Midland Regional was so great that we at first feared that we were not going to get the latter station as we tuned upwards until it surprised us by arriving at a strength that can in reality be described as "local."

As a matter of fact, the stage gain obtained by the Ferrocart coils is somewhat in excess of that given by most other coils, and it is probable that you will find that at the limit of "full

WITH THE "CANS" REMOVED



THREE TUNED CIRCUITS—GANGED CONTROL



The "Ferro-Q" employs four valves, two of these being pentodes connected in quiescent push-pull. The unusually small physical dimensions of the special coils can be seen from the above photograph, their high permeability cores and low losses give the set marked advantages from the standpoint of range and selectivity. Other features of this outstanding design are variable-mu volume control and "local-distance" switching.

THE "FERRO-Q"

(Continued from previous page.)

to develop parasitic oscillation on the long waves was present.

This made reaction impossible to carry out on these wavelengths, though it was perfectly normal on the medium band. Such parasitic troubles are usually easy to cure and this one yielded to the well-known method of inserting a resistance of about 500 ohms in series with the reaction feed.

Following the interposition of this resistance the control of reaction on the long waves was perfectly smooth and free from any trace either of parasitic oscillation or "ploppiness."

Careful Ganging Essential.

As would be imagined, ganging with the Ferrocart coils is not a "twist and hope" business. It has to be carried out very much more carefully than in the case of normal tuning units. The reaction method is of great assistance here, the set being adjusted to the verge of reaction on some

low wavelength on the medium band and the tuning adjusted to give the "earliest" setting of the reaction condenser for oscillation.

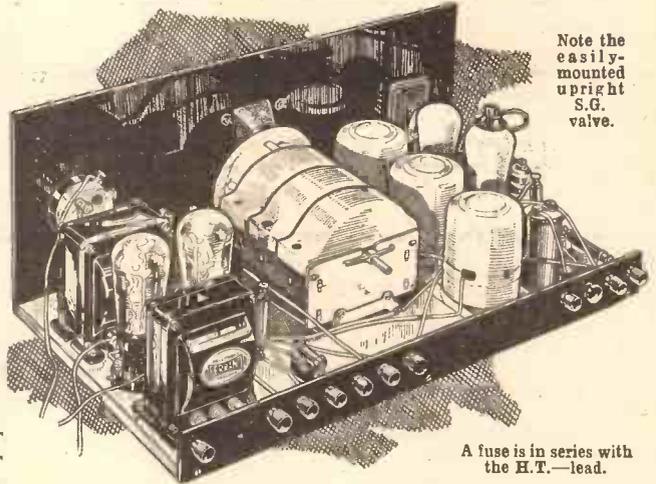
Following the detector valve we have a quiescent push-pull input transformer, with its normal shunting resistance across the primary. Before we come to that, however, we insert a shunt condenser on the H.T. side of the reaction

VALVE MAKES AND TYPES

Make	S.G. Stage	Detector	Push-Pull Stage (Pair of Valves)
Mullard	P.M.12V.	P.M.1 H.L.	P.M.22A or P.M.22
Cossor	220 V.S.G.	210H.L.	220H.P.T., 230P.T. or 220P.T.
Mazda	S.215V.M.	H.L.2	Pen.220 or Pen.220A
Marconi	V.S.2	H.L.2	P.T.2
Osram	V.S.2	H.L.2	P.T.2
Tungsram	—	H.210	P.P.230
Micromesh	—	H.L.B.1	Pen.B.1

In accordance with the most up-to-date practice, the coils and "ganged" tuning condenser are fully screened. In this way a far higher degree of efficiency is achieved than would otherwise be possible.

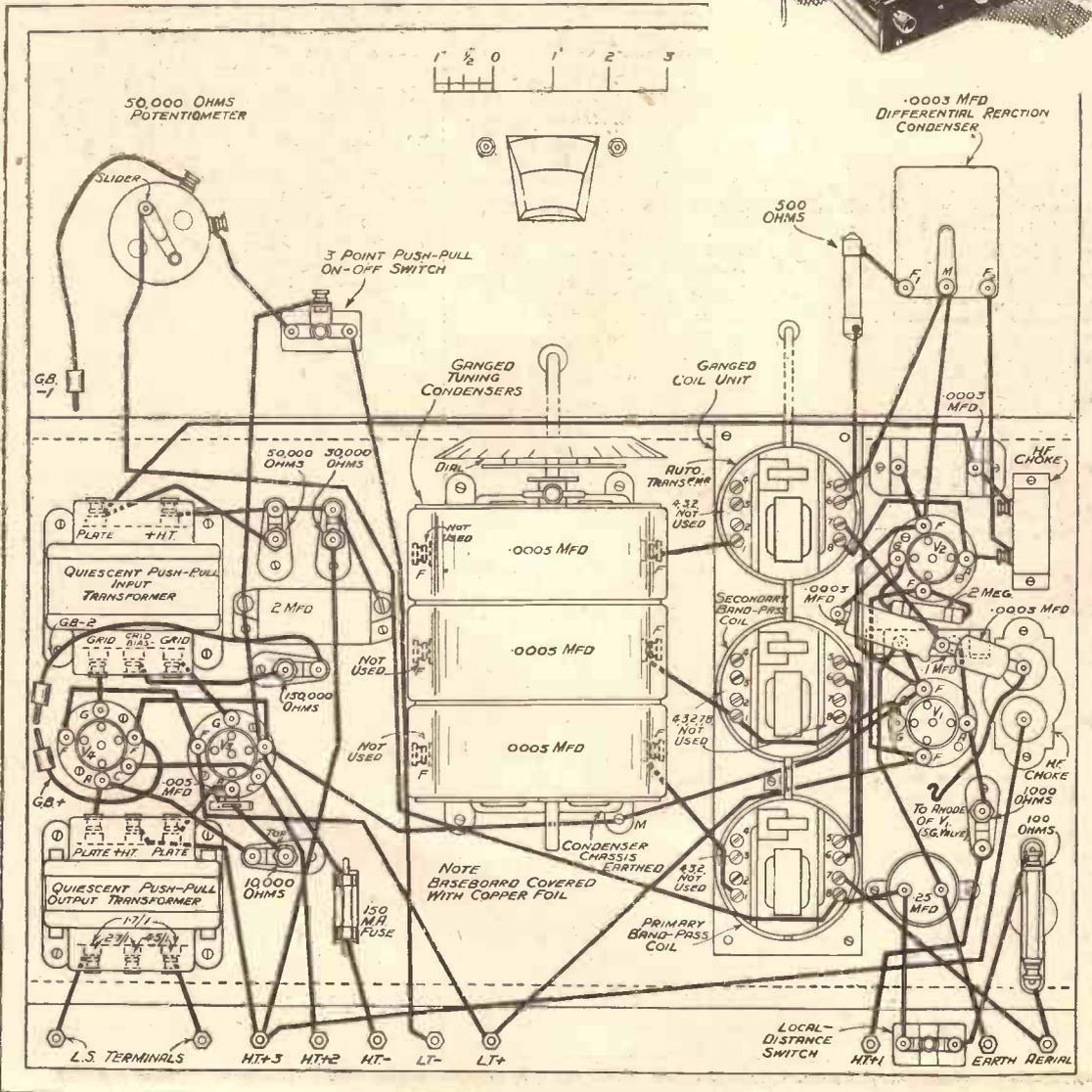
The "local-distant" switch is located on the terminal strip between the H.T. +1 and "Earth" terminals, and is invaluable for local listening.



Note the easily-mounted upright S.G. valve.

A fuse is in series with the H.T.—lead.

CONCENTRATED EFFICIENCY



The one wave-change switch controls the three tuned circuits from the panel.

choke to reduce the possibility of stray H.F. getting into the L.F. side of the receiver.

It must be appreciated that with the use of high-efficiency coils the possibility of stray H.F. getting through is increased, due to the great strength of voltage

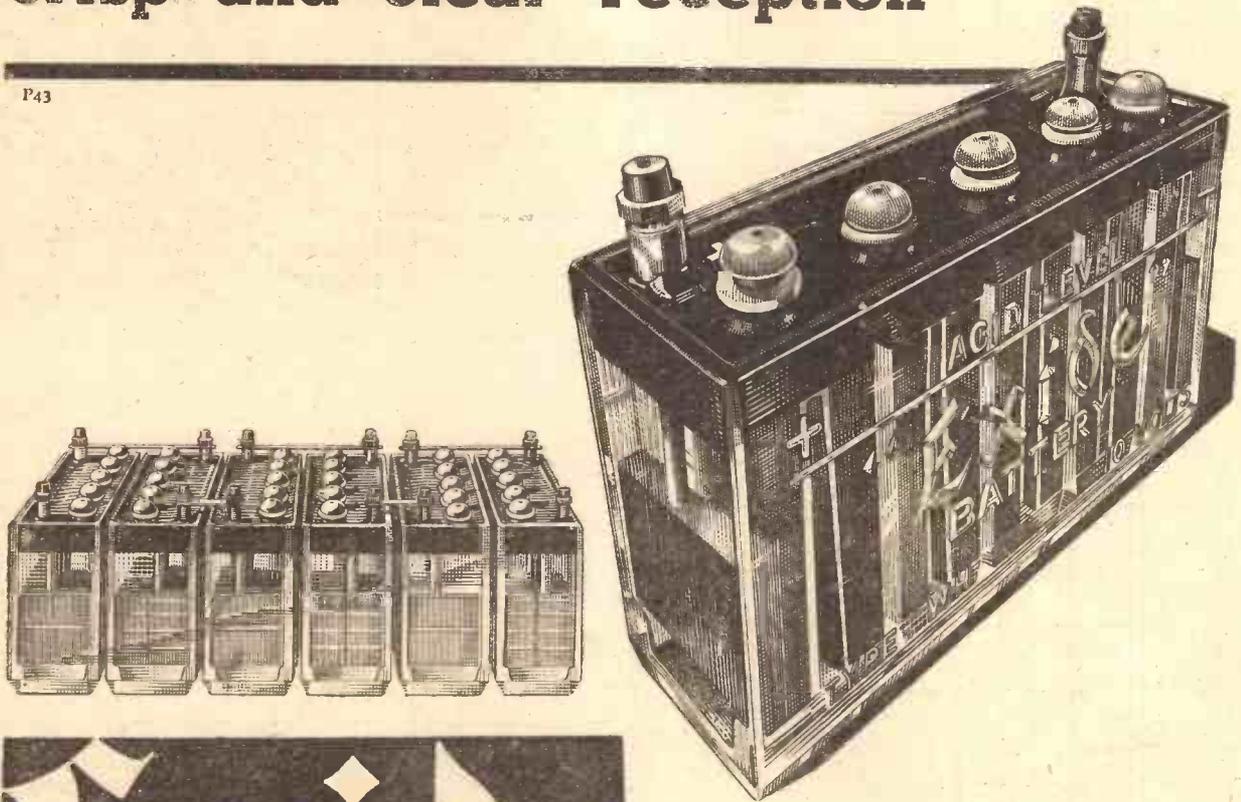
(Continued on . . . 1 page)

"FERRO-Q" ACCESSORIES

- LOUDSPEAKERS.** — Standard Type: Marconi-Phone, R & A. Celestion, G.E.C., B.T.-H., H.M.V., Epoch, Igranic, Amphion, Baker's Selhurst, Ormond, Lanchester, Atlas, Blue Spot.
- Special Q.P.P. Types: Amphion, B.T.-H., Celestion, Rola.
- H.T. BATTERY.** — 120 volts or special "Quiescent" type (Ediswan, "Silver Knight," Drydex, Pertrix, Magnent, Siemens, Marconi-Phone, Ever Ready).
- GRID-BIAS BATTERY.** — 16 volts (Ever Ready or see above).
- L.T. BATTERY.** — 2 volts (Block, Exide, Ediswan, G.E.C., Oldham, Pertrix).
- AERIAL & EARTH EQUIPMENT:** (Electron "Superial," Graham Farish "Filt" Earthing device.

Don't put up with wireless that buzzes
 and crackles . . . This is the way to
 crisp and clear reception

P43



Exide

H.T. WIRELESS ACCUMULATORS

● Prices per 10-volt unit ● Type WJ 2,500 milliampere hours, 5/-
 Type WH 5,000 milliampere hours, 6/3. Type WT 10,000 milliampere hours, 12/-
 Also complete batteries in crates. (These prices do not apply in the Irish Free State.)

Almost all the unwanted noises in a wireless set come from the H.T. supply. If the H.T. supply is perfectly smooth and steady, then nothing will be heard but the programme. Every wireless engineer knows that the accumulator is the only source of H.T. that is perfect in this respect. That is why the B.B.C. use them. That is why Exide H.T. Accumulators have been chosen for almost every important speech relay. They are economical too, for although they cost more at first they can be recharged when run down. If you want the clearest reception it is possible to get, invest in an Exide H.T. Accumulator.

From Exide Service Stations or any reputable dealer. Exide Service Stations give service on EVERY make of battery
 EXIDE BATTERIES, EXIDE WORKS, CLIFTON JUNCTION, NR. MANCHESTER. Branches: London, Manchester
 Birmingham, Bristol, Glasgow, Dublin, Belfast

THE " FERRO-Q "

(Continued from page 68.)

applied to the detector. Also, with pentode output circuits, it is more than desirable, it is essential, that H.F. shall be kept to that section of the set to which it belongs.

Thus, on the most powerful transmissions we have the .0003-mfd. (or thereabouts) on

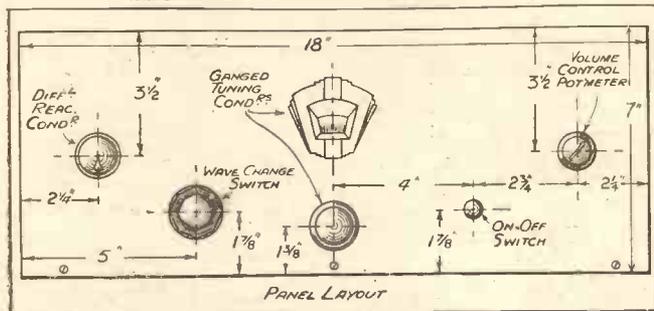
the earth side of the differential reaction condenser between anode and filament neg. of the valve, and on the other side of the H.F. choke we have a like capacity to earth.

If In Doubt—Enquire.

The push-pull stage is the normal quiet-type and needs no further discussion here, except the usual pointing out that the correct output transformer for the speaker you intend to use should be chosen, the average moving-coil type requiring that specified. If you have any doubt about it, however, please write either to us or to the transformer makers, giving details of valves and speaker, for it is absolutely essential that the correct ratio be employed. Wrong matching between valves and speaker will wreck the results of the whole set.

Across the anodes of the pentodes is con-

SEEN FROM THE FRONT



The central knob is the main control, the reaction condenser being needed only for the very distant stations.



The L.F. end of the "Ferro-Q," showing the Q.P.P. input and output transformers. The output transformer has a tone compensating resistance and condenser across its primary winding. The variable-mu potentiometer can be seen on the panel.

THE PARTS YOU WILL REQUIRE

Component.	Make used by Designer.	Alternative makes of similar specification recommended by designer.
1 Panel, 18 in. x 7 in.	Goltone	Peto-Scott, Permcol, Becol, Direct Radio, Wearite
1 Baseboard and foil, 18 in. x 10 in.		
1 Cabinet to suit above	Peto-Scott	Camco, Gilbert, Direct Radio, Osborn
1 Three-gang .0005-mfd. variable condenser	Polar Star	
1 .0003-mfd. differential reaction condenser	Telsen W.185	Graham Farish, Ready Radio, Polar, Bulgin, Peto-Scott, J.B., Ormond, Dubilier, Ferranti, T.C.C., Telsen
1 2-mfd. fixed condenser	Igranic	
1 .25-mfd. fixed condenser	Dubilier, type 9200	
1 .1-mfd. fixed condenser	Telsen, small type	
1 .0003-mfd. fixed condenser	Dubilier, type 610	Ferranti, Telsen, Ready Radio, Goltone, T.C.C., Graham Farish, Dubilier type 670, Telsen, Igranic
1 .005-mfd. fixed condenser	T.C.C., type M	
1 .0003-mfd. fixed condenser	Dubilier type 665	
1 .0003-mfd. fixed condenser	Dubilier type 670	
1 50,000-ohms potentiometer	Lewcos Standard	
1 10,000-ohms resistance with vertical holder	Graham Farish	Colvern, Wearite
1 150,000-ohms resistance with vertical holder	"Ohmite"	
1 50,000-ohms resistance with vertical holder	"Ohmite"	
1 30,000-ohms resistance with vertical holder	"Ohmite"	
1 100-ohms resistance with horizontal holder	"Ohmite"	
1 1,000-ohms resistance with vertical holder	"Ohmite"	
1 500-ohms resistance with wire ends or terminals	Dubilier 1 watt type	Graham Farish "Ohmite"
1 2-meg. grid leak with wire ends	Goltone	Tunewell, Dubilier 1 watt type, Igranic
1 Set Ferracort coils	Colvern types F.1, F.2, and F.3	
1 H.F. choke for S.G. valve	Igranic Binocular	Bulgin S.G., Slektun, Ready Radio, Tunewell, Goltone Super, Wearite, Lewcos Super
1 Three-point on-off switch	Ready Radio	Bulgin, Telsen, Wearite, Tunewell, Peto-Scott
1 On-off switch	Ready Radio	See above
2 Four-pin valve holders	W.B.	Telsen, Benjamin small type, Ready Radio, Peto-Scott
2 Five-pin valve holders	W.B.	See above
1 "Quiescent" input transformer	Ferranti type AFC11c	R.I., Varley, Sound Sales, Multitone
1 "Quiescent" output transformer or choke	Ferranti type OPM13c	Varley, Multitone, R.I., Sound Sales. Note: In choosing the output choke or transformer care should be taken, to see that the correct one is used to match the speaker with the push-pull valves
1 H.F. choke	Telsen W.75	Lewcos M.C.
1 Fuseholder	Belling & Lee type 1034	Telsen, Goltone, Bulgin
1 Terminal strip, 18 in. x 1 1/2 in.	Goltone	
6 Indicating terminals	Clix	Bulgin, Belling & Lee, Goltone, Eelex, Igranic
7 Battery plugs	Belling & Lee	See above
2 Accumulator spade terminals	Eelex	See above
6 Yards of insulated sleeving	Goltone	Wearite
8 Yards of 18-gauge tinned copper wire	Goltone	Wearite
1 Fuse	Belling & Lee, 150 ma., type 1056	Bulgin, Telsen, Goltone
1 Slow-motion disc drive	Polar	

nected the usual impedance equaliser, and we found that for most cases the valves specified were best. You may, however, have a loudspeaker that can do with a bit more "high stuff" and in that case the value of the resistance should be increased above 10,000 ohms, 20,000 or so being tried.

The construction of the "Ferro-Q" is perfectly easy, though we would like to stress more than ever the importance of following not only the layout of components, but the actual wiring shown in our diagram.

It may appear at first sight that as we use the copper foil for earth returns in certain cases, it can be used thus indiscriminately. This is far from being the case, and to avoid any slip-up by inadvertently altering these apparently straightforward "earth returns," it is essential that the wiring be slavishly followed point for point.

Care With Earth Returns.

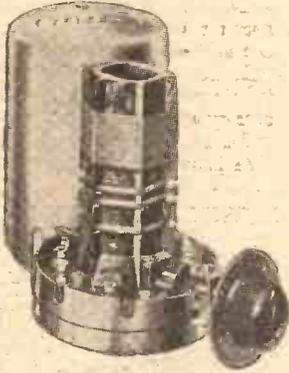
It would take too long here to explain the whys and wherefores of this injunction, but it is a fact that in designing a high-efficiency H.F. stage very great care has to be exercised to avoid any possibility of earth returns carrying H.F. being common to two or more circuits, and especially is it necessary to avoid such returns being in more than one tuning circuit.

When the set has been built it is connected up in the usual way, with about 75-80 volts on H.T. + 1, the full H.T. voltage on H.T. + 3 (i.e. 120 volts or so) and about 12 volts less than this on H.T. + 2. It is best to get two matched pentodes from the makers and so do away with any need of impedance matching in the set.

(Continued on page 80.)

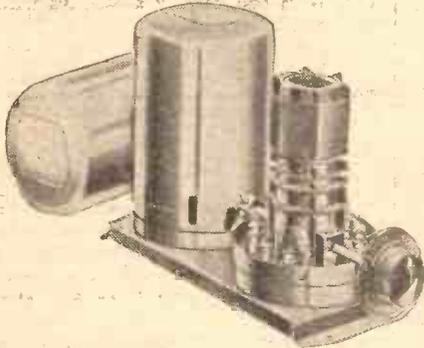
TELSEN COILS

A range which caters for every requirement



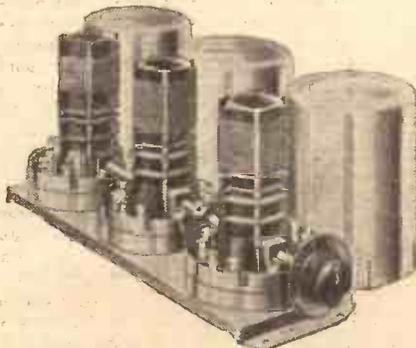
TELSEN OSCILLATOR COIL

Particularly suited to Superheterodyne circuits in conjunction with the Telsen Band-Pass Coils. Operates at a frequency separation of 110 kilocycles from the Band-Pass tuning range, maintaining a constant frequency separation over both wave ranges **8/6**



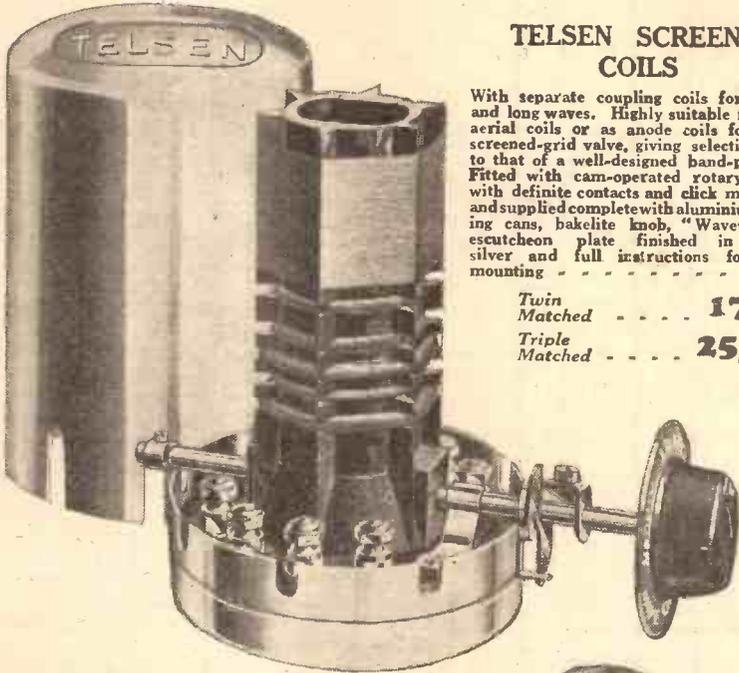
TELSEN BAND-PASS COIL UNIT

Comprises two accurately matched Screened Band-Pass Coils, on a single rigid plinth base. The coils are independent of each other and can be wired for any of the three types of Band-Pass Filter to give exceptional quality with Selectivity **17/6**



TELSEN SUPERHET COILS (Band-Pass and Oscillator Coil Unit)

Comprises the Band-Pass Coils and Oscillator coil combined into a single compact unit. All wave change switches are ganged, with single knob control. Ideal for any Superheterodyne circuit **25/6**



TELSEN SCREENED COILS

With separate coupling coils for medium and long waves. Highly suitable for use as aerial coils or as anode coils following a screened-grid valve, giving selectivity equal to that of a well-designed band-pass filter. Fitted with cam-operated rotary switches with definite contacts and click mechanism, and supplied complete with aluminium screening cans, bakelite knob, "Wave-Change" escutcheon plate finished in oxidised silver and full instructions for **8/6** mounting

Twin Matched **17/6**
Triple Matched **25/6**

TELSEN DUAL-RANGE AERIAL COIL

incorporates a variable selectivity device, making the coil suitable for widely varying reception conditions. This adjustment also acts as an excellent volume control, and is equally effective on long and short waves. The wave-band change is effected by means of a three-point switch and a reaction winding is included **7/6**

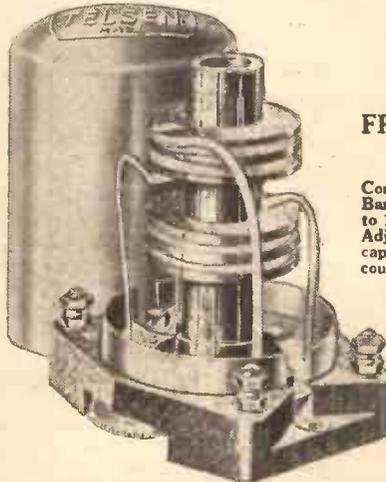
TELSEN DUAL-RANGE H.F. COIL

may be used for H.F. amplification with Screened-Grid Valve, either as an H.F. Transformer, or, alternatively, as a tuned grid or tuned anode coil. It also makes a highly efficient Aerial Coil where the adjustable selectivity feature is not required **5/6**



TELSEN INTERMEDIATE FREQUENCY TRANSFORMER COIL

Consists of two tuned circuits comprising a Band-Pass Intermediate frequency filter tuned to 110 kc. by two pre-set balancing condensers. Adjustable for different values of stray capacities, with variable filter **12/6** coupling



TELSEN



GOLSTONE "MIDGET" CONDENSERS

ALTHOUGH everybody knows that the prices of radio components and accessories have fallen very considerably during the past few years, I doubt if it is generally appreciated how drastic some of these reductions have been.

Can you call to mind any component which has been reduced in price by over eighty per cent? That is, is now available at only about one-sixth the price asked ten or so years ago?

It will be the more expensive items to which your thoughts will almost inevitably turn.



An inexpensive component which is sufficiently compact and light to be suspended by its leads.

used, for example. Ten years ago the average price of a fixed condenser was 2s. 6d. To-day—well, Messrs. Ward and Goldstone are listing their "Midgets" in all values up to .002-mfd. at 5d. each!

And quite well made they are, too!

In view of the fact that the 5d. has to include all distributing charges and vending profits as well as manufacturing costs, it amazes me that so low a figure should be possible, even in these days of scientific mass production.

These Golstone "Midgets" are built into moulded bakelite cases and they are fitted with terminals as well as soldering tags.

As they are very compact and light in construction, though quite robust, it is possible to suspend them in wiring if desired.

The samples I have tested all proved to be efficient and accurate in regard to their capacities.

THE "DAVENSET" TRANSFORMER

I was once asked by a constructor, whom I met at an exhibition, how I would identify the best mains transformer of a bunch of different makes.

After explaining that it was impossible to read the virtues of such a piece of apparatus at a glance, and that, in any case, there was not always much difference

between the good ones, he was still dissatisfied and pressed for a "rule of thumb." I couldn't give it to him, but in a burst of candour I admitted that I always pictured the best mains transformer as the one I'd least like to drop on my toes!

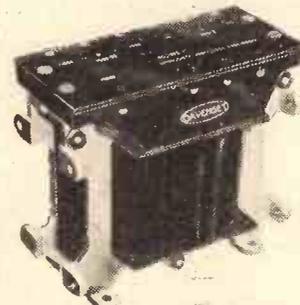
Mind you, that is only a personal idea, though it is, of course, based on sound principles or I would not air it at all.

As I have done so, I must justify it, I suppose! Well, then, all can appreciate that robustness is a desirable quality in mains apparatus. And a substantial, well-laminated core is essential if the component is to "transform" coolly and effectively. For good voltage regulation, i.e. the absence of marked voltage differences between "load" and "no load" conditions, the wire must be of low resistance, and therefore not too thin.

All this makes for weight and massiveness. Nevertheless, one must not pursue this line of reasoning too far. By very skilful design and manufacture it is possible to achieve considerable and comparative lightness.

Alternatively, every big and heavy transformer is not necessarily of high-class quality.

The Partridge, Wilson & Co.'s "Davenset" mains transformer is an admirable compromise. It has mass to please the engineer and neatness to satisfy the constructor.



A well-made and efficient mains transformer.

In short, it is a fine piece of work and functions in a manner that defies criticism.

TWO R & A REPRODUCERS

I have already said something about present-day price levels; continuing the theme, what would we have said three years ago if a moving-coil loudspeaker had been introduced at 27s. 6d.?

But, remembering the processes involved in the manufacture of a device of that kind, it is still a wonderful accomplishment.

The 27s. 6d. "M.C." is to be found in the R & A range of reproducers, and it is known as the "Bantam." And at the above figure it is sold as a complete unit with built-in, three-ratio transformer!

Of course, it is not up to the standard of the "senior" moving-coil class of speaker; it is definitely a "junior." But if you want to pay more and obtain the superior results one would rightfully expect by doing so,

R & A can oblige with equal competitiveness.

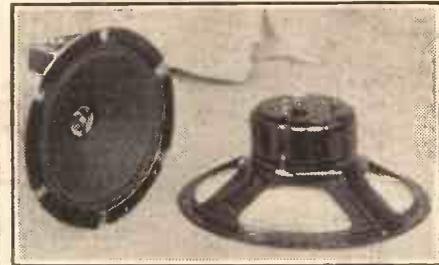
All the same, the "Bantam" is, I consider, an excellent little proposition and one which is deserving of the closest consideration. It is surprisingly sensitive and its response is by no means as restricted as its size or price might to some seem to imply.

The next step in the R & A range-brings us to the Type 50 Reproducer.

This is a first-class electro-magnetic speaker unit designed in accordance with the best modern practice.

It has a "floating" cone carried on a substantial chassis and the mechanism is totally enclosed.

Possessing great sensitivity, its reproduction is very bright and it has much more



The R & A "Bantam" and Type 50 Reproducer.

bass than one usually associates with this type of instrument.

It lists at 15s. complete.

FOR ECONOMICAL GANGING

I have encountered a gadget which deserves all the prominence I can give it. It is the Condenser Ganging Device, made by British General.

Costing only 2s. 6d., it enables the constructor to gang two ordinary condensers.

There are doubtless tens of thousands of constructors who would be prepared to accept some sacrifice for the sake of "using up" old "ordinaries" in a modern gang-control circuit. Especially in these hard times!

As a matter of fact, I found that the results given by a receiver using the British General Ganging Device were vastly better than no doubt many technicians would believe ought to be the case!



British General's device for ganging ordinary condensers.

ESSENTIAL
FOR
battery operated
Q.P.P.



the new day
DOUBLE CAPACITY
ACCUMULATOR

The accumulator of a new day! No bigger, no heavier, hardly more costly than your present 40 a.h. type—yet with a capacity of 80 a.h.'s! Such a performance, of course, is invaluable for a Q.P.P. circuit. What is the secret? Elimination of the wasteful accumulator "plates." And not only is the new accumulator immensely stronger than the old kind—it's very handsome, too, in its coloured bakelite. See one to-day.

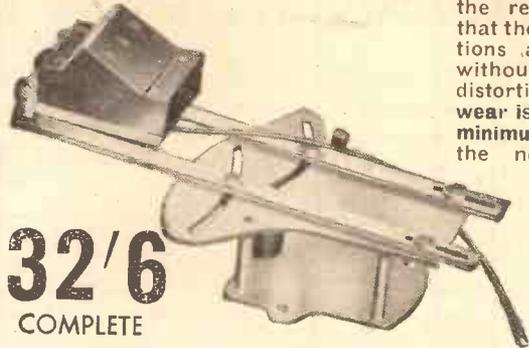
80 AMP. 2. **11/6**
HRS. V.

BLOCK
Plate-less Accumulators

BLOCK BATTERIES LTD., ABBEY RD., BARKING. TEL. GRA 3346

PERFECT TRACKING
LESS WEAR
FINER TONE

The Simpson Straight Track Arm and Pick-up gives such superb reproduction because the angle of the needle in relation to the record is such that the sound vibrations are picked up without the slightest distortion, and record wear is reduced to a minimum, because the needle moves radially across the record, ensuring perfect tracking.



32/6
COMPLETE

SIMPSONS STRAIGHT TRACK
ARM & PICK-UP GIVES THEM ALL

With this method of electrical reproduction, purity of tone is ensured and the finer qualities of your records are brought out, while the **playing life of them is doubled.** This Straight Track Arm Pick-up can be fitted to all gramophones by anyone who follows the simple instructions; and priced at 32/6 presents remarkable value for money. Obtainable from all good retailers. Fill in the coupon below for Free Booklet about this pick-up and graph of its performance.

GUARANTEE:
Unconditional guarantee to repair and replace, free of charge, within 12 months (misuse and abuse excepted.)

SIMPSONS SYNCHRONOUS
MOTOR & TURNTABLE

No Mechanical Noises!
No Vibration!
Only 2 1/2" deep



This motor is manufactured in two sizes, 10" and 12" diameter, and finished in Bronze or Nickel, the price is only 39/6 and is obtainable from all good dealers. Fill in coupon below for your free copy of a booklet describing this revolutionary motor.

The Simpson Electric Turntable is the only motor to consider when constructing or converting a radiogram. Weighing only 8 lb., and not more than 2 1/2 in. deep, it can be fitted by even the most inexperienced in a few moments. A flick of the finger starts or stops it, and while revolving at a constant speed of 78 (correct speed) there is no mechanical noise or vibration. Current consumption is negligible.

39/6
COMPLETE

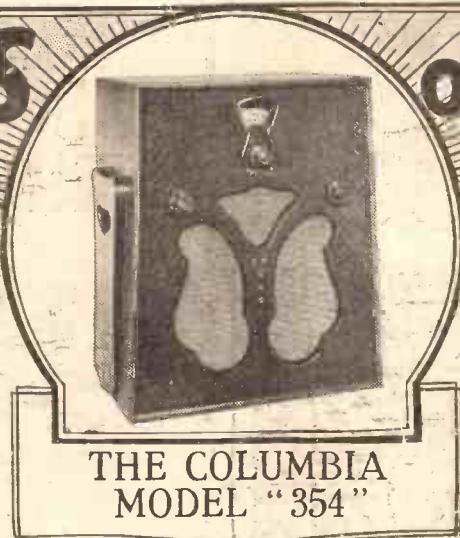
FREE SIMPSONS ELECTRICALS LTD.,
Grange Road, Leyton, London, E.10

NAME.....
ADDRESS.....

To interested readers of "Popular Wireless," we shall be pleased to send our illustrated Folder (containing all technical details) on receipt of complete coupon.

RECEIVERS

of RENOWN



THE COLUMBIA
MODEL "354"

THE listening public of to-day can be roughly divided into two classes.

There are those to whom contentment in the radio sense is nothing more ambitious than quality-perfect reception of the local and semi-distant stations, and the others who, to put it bluntly, are just distance fiends. The type of person who never listens to anything for more than a few minutes on end, but who, nevertheless, is perfectly satisfied so long as his set will receive a sufficiently large number of stations, irrespective of quality.

One can say without fear of contradiction that a year or so ago the "distance fiends" held sway, and in many respects that was a state of affairs for which we now have cause to be thankful. But for that "itch for distance" on the part of the buyer which, in the designing sense, necessarily resolved itself into a requirement, the present standards of commercial set efficiency might never have been so high.

But the order of things has changed. Distance lends enchantment these days only when the stations are thousands instead of hundreds of miles away, and to the great majority of present-day listeners, quality of reproduction has come to be regarded as the paramount consideration.

A Firm With Foresight.

These are the masses. These are the people who buy radio sets. These are the listeners who have done more to stabilise the industry than anything else. The people who keep the B.B.C. up to scratch—seven-eighths, possibly even nine-tenths of the 1933 listening public. It is so, isn't it?

Now then, to bring matters a little nearer home, how many instances can you call to mind where commercial set manufacturers have had the confidence to place the feature of tone purity above all else?

One has reluctantly to admit that there are very, very few.

But there is one firm of commercial set manufacturers which had the foresight to anticipate the present trend months and months ago, and which, ever since, has been steadily but effectively driving home the importance of tone purity from every possible angle. Now, others are following, but it was Columbia who set the lead, and by their foresight they have earned for themselves a reputation which is second to none.

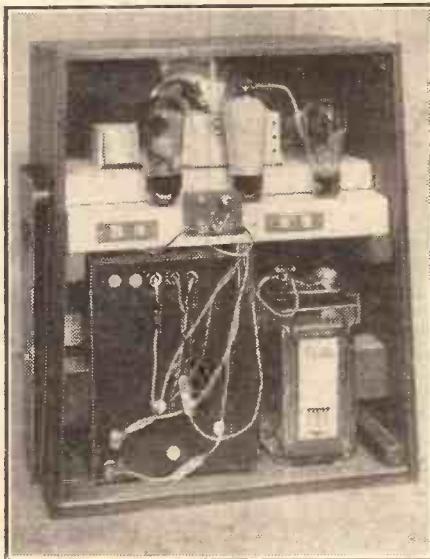
That is what makes it so easy for us to approach the review of a set that is one of the products of this enterprising organisation. As with all other Columbia instru-

AN EXCELLENT THREE-VALVE BATTERY RECEIVER

ments, the model "354" is renowned for its quality of reproduction. But it should not be thought for one moment that it is lacking in any of the other essential respects.

Without any attempt at exaggeration, it is a fine instrument in every respect, and

INSIDE INFORMATION



Compare this with the description, and you will realise the compact interior arrangements.

what is more it is a battery-operated set, which is no doubt an important contributory factor to its tremendous popularity.

The "354" is entirely self-contained, with the exception, of course, of the aerial and earth. The circuit has wisely been based upon the popular S.G., det., pentode arrangement, but the provision of band-pass tuning has resulted in a degree of selectivity rather above the average.

Absolute Simplicity.

Of the many refinements that characterise the design, perhaps the most interesting are the local-distant adjustment and the heterodyne interference eliminator, which is a form of tone control. The provision of ganged tuning makes for absolute simplicity of operation, and from every point of view the calibration of the dial in wavelengths is a great advantage.

The actual grouping of the knobs at the front is proof, if proof is wanted,

of the skilful way in which the receiver has been designed. Everything is just where it should be, and nothing has been made the subject of a control, except what is absolutely necessary for the achievement of completely satisfactory results. In other words, the Columbia "354" is of genuine domestic utility.

After all, what are the requirements of a really good receiver for modern conditions? As we see them, they can be summarised under the three general headings of good quality of reproduction, sensitivity and selectivity in keeping with modern conditions and ease of operation, which is really the primary domestic consideration.

Essential Requirements.

These are the essential requirements, and it is in these respects that the Columbia model "354" has passed our tests with flying colours. The fidelity of reproduction given by the balanced-armature speaker incorporated is very little short of moving-coil standards—in fact, it is infinitely to be preferred to some of the moving-coil speakers we have heard.

Frankly, at the price of £9 17s. 6d. (which includes everything) we know of no battery-operated three-valver more eminently suitable for modern conditions. The "354" is a fine set, and we congratulate the makers for having so successfully worked up to a standard, yet down to a price.

TECHNICAL SPECIFICATION

GENERAL DESCRIPTION.—Self-contained three-valver for battery operation.

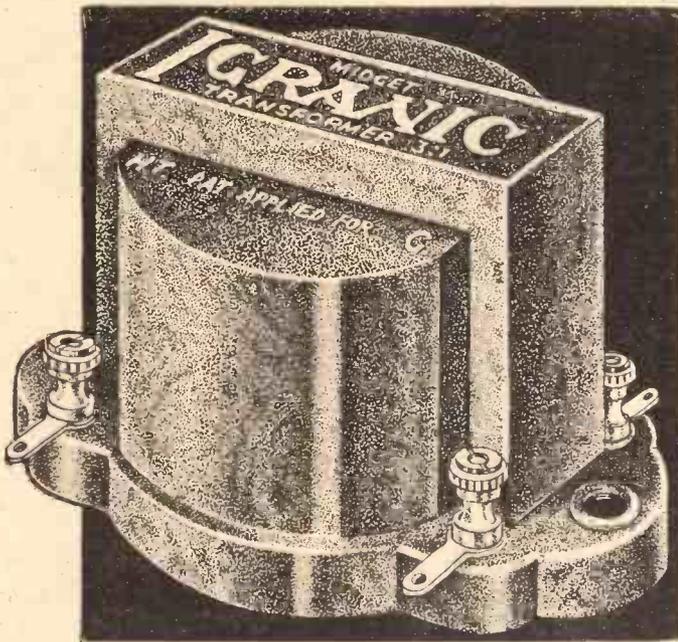
CIRCUIT DETAILS.—S.G. H.F. with ganged band-pass tuning, leaky-grid detector and pentode output.

CONTROLS.—Knobs for main tuning and "local-distant" adjustment are concentrically mounted and are located immediately below tuning scale

window. Control to the left at front is three-position switch, giving "M.W." "L.W." and "off" position. Right-hand knob is reaction control. L.S. adjustment can be set by means of small set-screw in centre of speaker fret. Heterodyne interference eliminating scheme is operated by plug and sockets at back of instrument.

SPECIAL FEATURES.—(1) Extremely economical H.T. consumption (7-8 m.a.); (2) heterodyne interference eliminator or tone control; (3) ganged tuning; (4) "local-distant" variation device; (5) compact design; (6) low initial cost.

PRICE.—£9 17s. 6d. complete.
MAKERS.—Columbia Graphophone Co., Ltd., 93-108, Clerkenwell Road, London, E.C.1.



A Transformer I purchased in February 1925 is still in constant use and as good as ever. My slogan after all these years is "Once a user of Igranic, always a user of Igranic."
"Igranic Enthusiast," Leyland, Lancs.

IGRANIC MIDGET TRANSFORMER

Igranic have specialised in Transformer manufacture since the inception of Broadcasting, and many years of experience and costly research has led to the production of the "Midget" Transformer — unsurpassed for quality and performance. This wonderful Transformer renders the highest standard of tonal purity without a trace of "drumming." Its reproduction reaches a standard never previously attained by a Transformer of such reasonable price. Supplied in ratios 3-1 and 5-1. Price **10/6**

Write for fully illustrated Catalogue
No. R.201 of Igranic Quality Components.

Igranic Electric Co. Ltd., 149 Queen Victoria St., E.C.4.

**IGRANIC COMPONENTS WILL
BE THE MAKING OF YOUR SET**

The First Super-Het

RADIOPAK
TRADE MARK
THE ONLY COMPLETE BAND-PASS TUNER



Specially Chosen for the P.W. "WESTECTOR SUPER"

The advent of the Super-Heterodyne Radiopak commences a new era in the construction of Super-Heterodyne receivers, and in specially designing the new "Westector Super" round this tuning unit, "Popular Wireless" have lost no time in taking full advantage of its tremendous possibilities for the benefit of their readers.

The "B.P.-Super" Radiopak, which is used [in this outstanding receiver, consists of the necessary screened coils accurately matched to the three-gang super-heterodyne condenser; illuminated slow-motion drive calibrated in WAVELENGTHS and wave-change switch all completely wired and mounted neatly on a metal chassis.

Every constructor should build this amazingly efficient receiver which represents the latest advance in "Supers," combining perfect reproduction with highest selectivity and featuring—

- | | |
|-----------------------------------------|----------------------------------------------------------------|
| 1. Single dial band-pass tuning. | 4. Cold valve diode detector giving undistorted rectification. |
| 2. Perfect factory matched tuning unit. | |
| 3. Wavelength calibrated scale. | 5. Tone compensation on the L.F. side. |

FOR THE "WESTECTOR SUPER"

B.P. Super Radiopak 110 k.c., Type 535E, less potentiometer but with extra knob and trimming tool
PRICE **75/-**

THE BRITISH RADIOPHONE, Ltd.,
Aldwych House, Aldwych, W.C.2. TEL: Holborn 6744



RADIOTORIAL

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

QUESTIONS AND ANSWERS

AN S.G. STAGE FOR SHORT WAVES.

T. A. (Tollington Park).—"My craze for distance always lands me into a short-wave set in springtime, and this year I want to try an S.G. amplifying stage preceding the detector.

"The circuit that appealed to me was one you gave about Christmas-time, and I think it was recommended by W. L. S. as being the type he favoured in preference to most of them. I know it was a 'parallel-feed,' but am uncertain of condenser values. Could you give me just the S.G. valve's connections in words. I don't need the full circuit, filament and all, but only the general scheme of connections for the S.G."

The important features of the circuit were the following:

The S.G.'s grid terminal was joined to the usual grid coil, and a .0001-mfd. tuning condenser, this "aerial tuning" circuit being fed either by a separate aerial coil or by the ordinary variable-capacity coupling, using a pre-set.

The screening grid itself was connected to a separate H.T. + tapping, and also to a 2-mfd. condenser, the other side of which was taken to earth.

The plate of the S.G. valve went to an H.F. choke (of good quality) and to a .0001-mfd. variable condenser for coupling. (Unless there is already a series condenser joined to the aerial terminal lead inside the set itself, in which case that will do for the coupling condenser.)

The other side of the H.F. choke is taken by a separate lead to the H.T. battery, and this completes the wiring except for the usual filament and earth connections.

LOUDSPEAKER OPERATION FROM "FILTERED" SETS.

The advantages of relieving the loudspeaker from carrying the steady plate current to the last (i.e. output) valve have often been outlined in "P.W." But a number of readers have recently raised questions about the matter, and the following notes, applying as they do to all ordinary cases,

IS YOUR SET BEHAVING ITSELF?

Perhaps your switching doesn't work properly? Or some mysterious noise has appeared and is spoiling your radio reception? Or one of the batteries seems to run down much faster than formerly? Whatever your radio problem may be, remember that the Technical Queries Department is thoroughly equipped to assist our readers, and offers its unrivalled service.

Full details, including scales of charges, can be obtained direct from the Technical Queries Dept., POPULAR WIRELESS, The Fleetway House, Farringdon Street, London, E.C.4.

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

LONDON READERS, PLEASE NOTE: Inquiries should NOT be made by phone or in person at Fleetway House or Tallis House.

are intended as a general reply to the majority of these questions.

First, it should be realised that although some of the sets described in "P.W." do not include a "filtered" output circuit, this latter is always advantageous. The reasons why it is not invariably shown are that often the extra components necessary for it (usually an L.F. choke and 2-mfd. condenser) cost extra money which many readers would rather not spend even for the advantages obtainable, and that many loudspeakers contain their own "filtering" arrangement in the guise of an "input transformer," so that additional expense for providing another filter in the set may be quite unnecessary.

If no filter at all is used, and the loudspeaker is connected direct in the plate circuit of a power valve, the possible disadvantages are many.

(a) It may be a rather high-resistance loudspeaker which will, in effect, rob the valve of some of its H.T.

(b) The loudspeaker windings, if of fine wire, may "warm up" owing to the considerable current flowing through them, which may result in breakdown or impaired reception.

(c) More important still, the magnetic effect of a power valve's plate current, when passed through a coil, is considerable, and this may impair the magnetic balance of the armature types of L.S. (unless a suitable adjustment is provided). Or, what is worse, it may "saturate" the core magnetically, with similar results.

(d) Long loudspeaker leads to different rooms are likely to give rise to H.T. leakage, etc., unless a filtered circuit is provided.

(e) Most important of all, the speaker's impedance should always be matched with the output valve. This can best be done by a transformer or choke-capacity arrangement (the choke may be tapped).

Further details will be given in "P.W." (in the Beginners' Supplement, etc.) for those interested in this subject, but from the foregoing it will be seen that a "filter" of some kind is nearly always advisable, and sometimes (especially in the case of moving-coil instruments) is absolutely essential.

Apropos the above, the following extract from a letter from Mr. J. B. Clark, of 6, Woodberry Crescent, N.10, is interesting. He says: "I have just built the 'P.W.' 'Airsprite' Two, and I think it is a wonderful set. Four stations full speaker strength and others on 'phones."

After giving some interesting details of his mains unit—unfortunately of too simple a type for general use—Mr. Clark goes on to say:

"AIRSPRITE" RESULTS—AND THE H.T. REQUIRED.

The Editor, POPULAR WIRELESS, Dear "P.W."—(I prefer to call you thus, for "P.W." conjures up for me a whole host of genial fellows whose sole object in life is to make home radio as simple and perfect as the "Airsprite" Three.) (Thirty-eight word introduction no extra charge!)

Well, anyway, I've just built the "Airsprite," and you will doubtless be glad to know that I received no fewer stations than thirty-one (long and medium) on Sunday last, with only 45-volts high-tension. And here's the difficulty:

Could "P.W." give, in a week or two—i.e. before my 45 volts have gone—details of one of the "Safe Power Units" specially for the "Airsprite" suitable for running off D.C. mains to have H.T.—, H.T. plus 1, plus 2, plus 3, and, if possible, a trickle charger for 2-volt batteries?

I know this is almost impossible, but so was the "Airsprite," and "P.W." did it that time!

All the best to "P.W."

Yours very truly,

G. W. F.
2, Alcester Crescent,
Upper Clapton, E.5.

EDITORIAL NOTE.—Although there is no D.C. H.T. unit of this type available in the "Safe Power" series, the "M.W." 6d. Blue Print No. 10 gives details of a suitable instrument with suitable + tappings. (It also includes a voltmeter which enables correct output voltages to be obtained.)

As regards the trickle charging, this is not usually incorporated in a D.C. unit because it is more economical to arrange for the house-lighting current to be utilised for the purpose. (The necessary charging board can be easily installed by an electrician.)

"Personally, I consider the 'Airsprite' Two works better with the output filter described on page 1136, 'P.W.' February 4th, No. 557. Anyway, it's a darn good set!"

The filtering of the output of such a set is often likely to be an improvement, even when the "filter" is only a simple choke-condenser arrangement and no attempt at exact match-

"P.W." PANELS. No. 116.—HILVERSUM.

The allotted wavelength of this popular Dutch station is 296.1 metres. By special arrangement it works in conjunction with the Dutch long-waver Huizen, and until the 1st April the Huizen programme and announcements ("Hier Huizen") are to be heard on Hilversum's wavelength.

Similarly, on Huizen's wavelength (1,875 metres) the Hilversum programmes and announcements ("Hier Hilversum") are now to be heard, but each will revert to its own from April 1st till June 30th.

Hilversum has a male announcer. Its distance from London is 232 miles, and the power employed is 20 kilowatts after 4.40 p.m., and 7 kilowatts for the day programmes.

ing of loudspeaker impedance and valve impedance is made.

(Details of the necessary wiring, etc., for fitting a filter circuit were given on page 1350, March 4th "P.W.")

THE EFFECT OF REACTION.

C. W. (Cambridge).—"Is it true that in an ordinary radio set of, for example, H.F., Det. and L.F. type the detector uses less current

(Continued on page 78.)

DO YOU KNOW—

the Answers to the following Questions?

There is no "catch" in them; they are just interesting points that crop up in discussions on radio topics. If you like to try to answer them, you can compare your own solutions with those that appear on a following page of this number of "P.W."

- (1) What will be the power of the B.B.C.'s new long-waver, a site for which has just been purchased at Wychhold?
- (2) How does that compare with the present National's power?
- (3) If five condensers—respective capacities 1 mfd., .1 mfd., .01 mfd. and .001 and .0001 mfd.—are joined in parallel, what is the effective capacity of the group?

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120-VOLT Pertrix Battery tapped at -0, 50, 60, 64½, 69, 75, 100, 110, and then at every 1½ volts to 120 volts. A 15-volt G.B. section is included in the same carton.

130-VOLT Pertrix Battery tapped at -0, 50, 60, 64½, 69, 75, 100, 120, and then at every 1½ volts to 130 volts. An 18-volt G.B. section is included in the same carton.

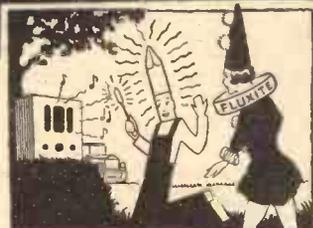
150-VOLT Pertrix Battery tapped at -0, 60, 84, 120, 135, and thereafter at every 1½ volts up to 150 volts. A 24-volt G.B. section is included in the same carton.

159-VOLT Pertrix Battery tapped at -0, 60, 84, and 120, and thereafter at every 3 volts up to 159 volts. A 9-volt G.B. section is included in the same carton. *This battery is specially suitable for PYE "G.B." Receivers.*

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MULTITONE
TONE CONTROL I.F. TRANSFORMER

RADIOTORIAL QUESTIONS AND ANSWERS

(Continued from page 76.)

when a programme is being heard than when it is not tuned to any station?

"And if so, what is the result of applying reaction? Would this take more current or less from the battery as far as the detector valve is concerned, and ignoring the effect on other valves altogether?"

When the ordinary "leaky grid" detector is used, the plate current of the detector valve drops during the process of detection. For a weak station the drop is small; for a powerful programme the drop is comparatively large.

Remembering these two facts, consider what will be the effect of applying reaction. We know that, in a general sense, it will turn the weak programme into a strong one. So we might expect that it will increase the drop in plate current of the detector, for such a drop is always greater in the case of the more powerful station.

This is exactly what happens. A sensitive milliammeter will show that even a weak programme will cause a small drop in the detector's plate current, and a stronger programme, or the same programme strengthened by reaction, will cause a greater drop in the current—which is, of course, that supplied by the H.T. battery.

The application of reaction, therefore, results in drawing slightly less, and not more, detector-valve current from the H.T. battery in the case of a set using "grid-leak rectification."

THE ANSWERS

TO THE QUESTIONS GIVEN ON PAGE 76 ARE GIVEN BELOW:

- (1) 100 kilowatts.
- (2) Daventry National's power is only 30 kilowatts, so the new station will be between three and four times as powerful.
- (3) Capacities in parallel are added together so the total capacity would be 1'1111 mfd.

DID YOU KNOW THEM ALL?

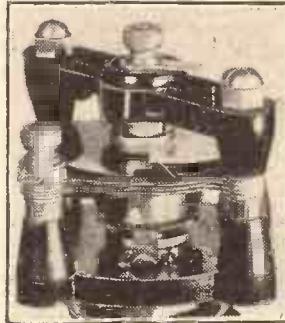
MODIFYING DIFFERENTIALS FOR A.T.B

ALTHOUGH one manufacturer is now advertising self-shorting differential condensers specially designed for use in Automatic Tone Balance (A.T.B.) circuits, many readers will wish to modify existing differentials for the purpose.

All that is needed is for the moving vanes to "short" or touch one set of fixed vanes when they are adjusted to be "all in" with them.

This set of fixed vanes must be that which is usually connected to the tone balancing condenser or to earth, depending upon the method of wiring employed.

In many makes the actual shorting can be arranged as shown last week, or as in the accompanying photograph of an Ormond slow-motion model. (One fixed plate bent

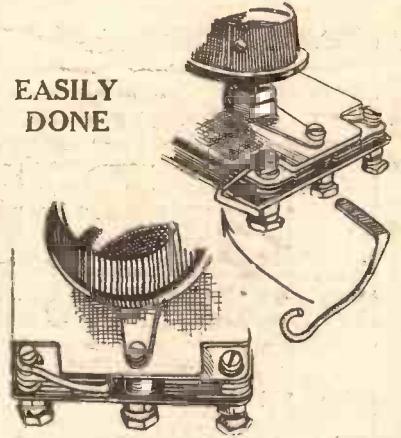


How the Ormond Differential is modified for A.T.B.

up so that when the moving plates are "all in" on that side one of them will touch this fixed plate.)

There are several ways in which the Telsen differential can be modified although the one illustrated will probably appeal most to constructors.

If the condenser is examined carefully it will be found that the moving vanes are



The Telsen Differential with shorting strip fitted.

visible, as they strike against the centre-contact's insulating bush, when it is adjusted "all in." So a piece of ordinary 18-gauge connecting wire is cut and bent to the shape shown in the sketch and the one end is flattened somewhat by beating it with a hammer.

The loop is then secured under the appropriate "fixed vanes" terminal and the flat end of the wire forced down between the edges of the vanes and the insulating sleeve.

Free The book that solves H.T. problems

THIS H.T. BUSINESS

LET'S SETTLE IT ONCE AND FOR ALL

24 PAGES CRAMMED WITH VALUABLE INFORMATION.

Are you tired of buying dry H.T. batteries? Are you weary of carrying heavy lead-acid H.T. accumulators to charge? Then send a post-card TO-DAY for this bigger, better, more informative book about the Milnes Unit. It tells you how you can cut out the replacement costs and annoying voltage drop which are inseparable from dry batteries, how you can avoid the expense of re-charging; how you can have H.T. current always as full, constant and reliable as the mains, but without a trace of background. It tells you all about the Milnes H.T. Unit—the unique accumulator of nickel cadmium cells which are recharged automatically from the L.T. accumulator, and which cannot be harmed by over-charging, shorting, or neglect.

You are wasting money and denying yourself 100% H.T. efficiency if you use any other source of supply. Send for the book NOW.

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PRICES IN GT. BRITAIN:

90-volt ..	£2.18.0	Electrolyte extra.
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MILNES H.T. SUPPLY UNIT

Dear Sirs

I think you deserve appreciation for having on the market the Milnes H.T. Supply Unit. I have used a 150 v unit since last September, and up to the present time it has been absolutely trouble free. Hard work does not seem to lower the general efficiency, this I have proved by the fact that the unit supplies approx. 20 milliamps for at least 50 hrs. per week. After 10 hours continuous discharge there is no noticeable volt drop. This in itself speaks highly for the Milnes Unit as no dry battery could ever stand up to this discharge rate and hold its voltage for very long. The initial expense may seem prohibitive to many listeners, but they can take it from me the Milnes Unit is a chance not to be missed, for the saving in dry batteries and the 100 per cent. efficiency the unit gives, amply repays the first cost. With the Milnes Unit the first cost is the last. I have written you this letter because I know there must be thousands who rely on dry batteries (which to my mind are the bog-bear to perfect radio or gramophone reproduction) not knowing that all their troubles as far as H.T. goes can be cured by installing a Milnes Unit. If you would like any further particulars concerning the unit I have, I would be pleased to supply you with them.

Yours faithfully,

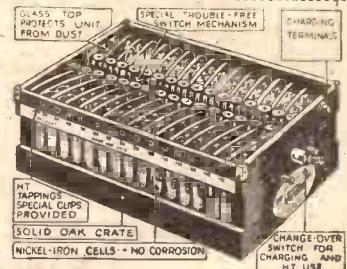
J. E. WILKINS (Electrical Engineer).

"With the Milnes Unit the first cost is the last."

Read what an expert user says:—

Keir-Dawson-Bradford

P.S.—This letter is entirely unsolicited.



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SPECIAL "TROUBLE-FREE" SWITCH MECHANISM

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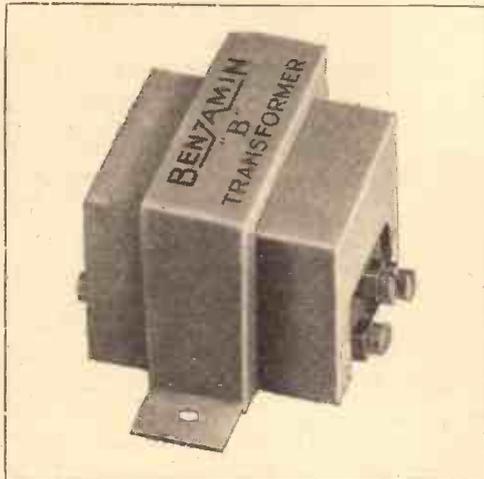
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The Benjamin Transceda (Price 11/6) used as a first L.F. Coupling Unit will make an ideal combination with the Benjamin Driver Transformer shown here.

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THE "FERRO-Q"

(Continued from page 70.)

The bias for the valves will depend on the make and type, about $12\frac{1}{2}$ will be O.K. for Mazda Pen.220A, with 120 volts H.T. and $16\frac{1}{2}$ with Mullard P.M.22. Other useful valves are given in the list, but the greatest power output is obtainable from these and the Cossor 220 P.T.

The trimming of the tuning condenser has now to be done. Tune in a distant station as low down the medium waveband as you can, and, turning reaction to the "just off" point of oscillation, trim the three circuits, using as little capacity as possible. As you go into trim you will find the reaction setting will have to be decreased to prevent the set from oscillating, while the strength of the received station will increase.

Keep this strength reasonably down, however, by the volume control, so that as much reaction as possible can be used without the reception becoming loud.

Each trimmer is adjusted in turn till maximum strength of reception is obtained, and it will be found that the settings are quite critical. You cannot just turn the trimmer haphazard and trust more or less to luck; it must be done slowly and carefully for the correct setting is quite sharply defined in each case.

We have assumed you have found a station somewhere below 250 metres for the trimming procedure. If not, carry on as indicated with the lowest station you can find, and then search again for a lower one when the condenser is trimmed. It will be easier now to find the low-wave

station, and, having found it, the final trimming adjustments can be made.

The matching of the push-pull output can leave to the reader provided he bears in mind the instructions given by the makers of the output transformer. K.D.R.

THE LINK BETWEEN

(Continued from page 66.)

on that date an entirely new range of Blue Spot speakers is to be released.

The new range, which is particularly comprehensive, includes speakers for all classes of listeners, and the prices vary from 32s. 6d. to 87s. 6d. Most of the new models are of the permanent-magnet type, either cabinet or chassis models, but two mains energised speakers are also included.

The high reputation which the Blue Spot people have earned for themselves as the manufacturers of first-class speakers leaves no doubt in my mind as to the excellence of this new range. If they are better than the old ones (and I have it on unimpeachable authority that they are), then all I can say is that they must indeed be good. I await with more than usual interest the report of our technical staff.

Meanwhile, if there are any readers who would like full details of this new range, just send me the usual postcard, and I will arrange for literature to be sent off as soon as it becomes available. (No. 28.)

★.....★
 "P.W.'s" postcard literature scheme saves you time and money! Week by week in these columns reviews are given of all the latest catalogues and leaflets appertaining to every aspect of radio, and if you want any or all of the literature to which reference is made you need only send a postcard giving the numbers of those in which you are interested, and the required literature will be sent off to you free of charge except where otherwise stated. The reference numbers in each case are given at the end of the appropriate paragraph, and applications may refer to any issue of "P.W." published in the last four weeks. Postcards, on which your name and address should be printed in block capitals, should be sent to G. T. Kelsey, at Tallis House, Tallis Street, London, E.C.4
 ★.....★

MIRROR OF THE B.B.C.

(Continued from page 50.)

The time fixed for the start of the race, namely 3.45 p.m., is certainly unfortunate for those who want to go out, but we cannot blame either the B.B.C. or those who make the arrangements for the contest. The race is rowed on the flood tide, about an hour and a half before high water, and no one can control the time when that shall occur.

However, apart from the time of starting, the race, so far as it affects listeners, will be as usual, even to the extent of Cambridge registering another win, if the prophets prove to be correct! Cambridge has now won nine races in succession, and it is whispered among the superstitious in Oxford that broadcasting seems to have brought most luck to the rival university.

No Objections.

The more practical minded point to other causes for Oxford's long continued eclipse, so there will be so serious objection to the launch "Magician," on which the commentator will follow the crews during their four and a half miles gruelling ordeal, taking up its position under the Middlesex bank about an hour before the start of the race.

This time is wanted to ensure perfection of the arrangements, that signals from the short-wave wireless transmitter aboard the "Magician" are being satisfactorily received on the roof of Harrod's Depository near Hammersmith Bridge, from where they are passed by telephone line to the control room at Broadcasting House.

Specified for

"P.W." "CLASS B" FOUR



DRIVER TRANSFORMERS

These transformers have been very carefully designed to meet the requirements for push-pull input into any "Class B" type output VALVE and for use following any type of driver valve. Their efficiency is of the order of 80% and their primary inductances are very high when carrying currents of 4 to 6 m.a. maximum.

The windings are very carefully matched and balanced in order to ensure faithful reproduction. Two types of driver transformers are now available: one giving ratios 3:1 and 2:1 per secondary, and the other giving ratios 5:1 and 4:1 per secondary. Both these types of transformer are capable of handling up to a maximum output of 75 milliwatts, and the efficiency of 80% is at this output figure.

The highest grade of core is used and the windings have exceedingly low resistances which is imperative for this method of amplification.

An additional important feature is that the leakage inductance is very low, thereby maintaining a negligible loss of voltage due to transformer leakage.

List No. DY 37. Ratios 2 to 1, 3 to 1.

List No. DY 38. Ratios 4 to 1, 5 to 1.

Price, Each (Royalty 1/6 extra) ...

15/-

Radio Instruments Ltd., Croydon, Surrey

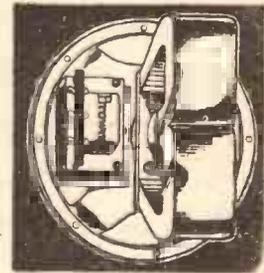
AMAZING BARGAIN 1933 BROWN P.M. MOVING COIL UNIT & CHASSIS

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Do not miss this remarkable opportunity for obtaining a really first-class PERMANENT MAGNET MOVING COIL SPEAKER at a greatly reduced price. This entirely new 1933 BROWN Unit and Chassis, with TAPPED TRANSFORMER incorporated, is a bargain that will instantly appeal to the man who already has a good Set, but a poor Speaker, and to the home constructor who is building his set.



An exclusive feature is the entire protection of the pole faces to prevent dust and metal particles from entering the gap, and it is hum-free, having no energising coils. Overall dimensions: 8 1/2 in. diameter, 4 1/2 in. deep, on Baffle Board 12 in. square. Send only 2s. 6d. deposit and try it for 7 days. If satisfied, send further 5s. at once, then complete purchase by 6 monthly payments of 5s. (Cash in 7 days, 32s. 6d.)

GET IT FOR 7 DAYS FREE TRIAL

Only a limited number! This Offer may not be repeated, so send at once!

The deep, rich tone and wonderful volume without distortion, obtained with this Speaker, will double the pleasure and enjoyment you get from your radio. And remember you are saving 17s. 6d.

The British-made WATES UNIVERSAL METER is the only popular-priced instrument testing resistances as well as batteries, valves, circuit, and all components: 4 readings on one dial.

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THE "CLASS B" FOUR

(Continued from page 49.)

The potentiometer should have a value of 20,000 to 50,000 ohms in all cases except where specific values are indicated by the pick-up maker.

And now, a few words in explanation of the action of Class B amplification.

You will have noticed that no grid bias is provided for the output valve, and so the valve will have a positive grid as soon as "signals" arrive, and therefore grid current will flow.

The valve is a special triode double valve, and is connected in circuit in the usual push-pull manner. Thus the grids are fed alternately with positive and negative impulses.

Comparing Methods.

Now, if the Class B valve were an ordinary pair of valves, biased to the bottom bend of their anode-current/grid-volts characteristic, we should have ordinary quiescent push-pull. The positive half-cycles would be made use of, while the negative halves would send the grids further negative and result in no appreciable change in anode current.

Thus we would use only the half cycles that send the grid towards the positive side, reducing the bias and allowing more anode current to flow.

That is the state of affairs for ordinary quiescent push-pull.

Now visualise the Q.P.P. valves in one glass case. Operation just the same. Next, and this is the crux of the whole thing, imagine that by so altering the natural characteristics of the valve they have arranged that the curve instead of running as it does in the left of the diagram on the next page, runs like that in the right.

We then see that we have the anode bend occurring at zero volts grid bias.

Now, apply the normal positive input voltages and the valve grid becomes fully positive at once. Up goes the anode current (as we want it to), but the grid being positive in relation to the filament also collects electrons, and there is a flow of grid current.

Plenty of Output Power.

We have always been taught that such a flow will cause distortion. So it will if the grid circuit of the valve is not suitably arranged, but if the coupling from the previous valve is designed to provide power (for A.C. current is now flowing in the transformer secondary) instead of only voltage, we are O.K. from that point of view, provided the anode-current fluctuations of the Class B valve do not reach any saturation point.

Thus in Class B we have a valve that operates on the positive side of the grid zero line, and which has an anode current capable of going right up to 60 milliamps without reaching saturation.

Thus, with the enormous anode-current swing available with the B valve we may expect plenty of output power, with a quiescent anode current of a very small order. Actually this is true. The power available is as high as 2,500 milliwatts with 150-volts H.T., or 1,500 milliwatts at a mere 120 volts, while the quiescent anode current is about 1 milliamp per

(Continued on next page.)

5 New FERRANTI Transformers for QUIESCENT PUSH-PULL

- 1 Type AF11c. Ratio 1/10. Inductance 50/25 hys. 0/10 m/A. Good amplification curve, giving approximately double the amplification at 50 cycles hitherto obtainable. Price **34/-**
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- 4 Type OPM12c. Ratios 1/7 and 40/1. To correspond in quality with the AF12c. Carries D.C. Primary Current up to 75 m/A in Q.P.P. (150 m/A in ordinary P.P.). For use with high resistance Speakers or low resistance M.C. types with or without built-in Transformers. Primary Res. approx. 210 ohms. Price **15/-**
- 5 Type OPM13c. Ratios 1/7, 2/7 and 4/5/1. Also specially suitable for use with the AF11c, but for operating high resistance Speakers of any kind, including M.C. Speakers with built-in Transformers. Max. D.C. Primary Current 100 m/A in Q.P.P. (200 m/A in ordinary P.P.). Primary Res. approx. 230 ohms. Price **26/6**

ALL PRICES INCLUDE PUSH-PULL ROYALTY

NOTE.—Either of these Quiescent Push-Pull A.F. Transformers may be used with any of the three Output Transformers mentioned above. Both the AF11c and AF12c types may be used in ordinary Push-Pull circuits, or as straight A.F. Transformers.

This system enables much greater power to be obtained from Battery Operated receivers and amplifiers for a given expenditure of High Tension Current than has hitherto been possible. In fact, by its use, Power Output and Volume comparable to that given by the average Mains set are obtainable, even when employing the small H.T. Batteries in common use.

Ferranti Ltd. have produced these five transformers to enable the experimenter to obtain the best possible results from the Quiescent Push-Pull system.

It will be noted that the inductances and ratios of these new Ferranti Transformers are unusually high.



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THE "CLASS B" FOUR

(Continued from previous page.)

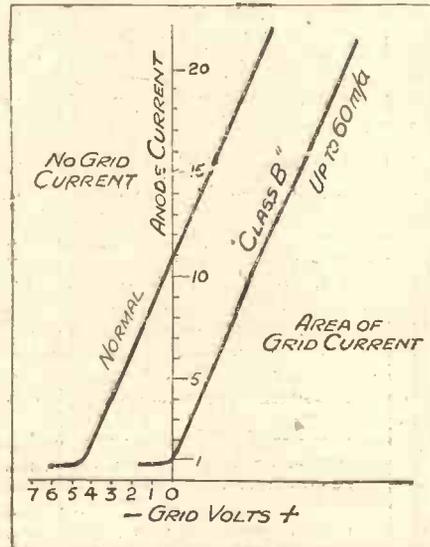
anode, or 2 milliamps for the complete double valve.

No grid bias being used, the need for careful matching and readjustment as H.T. voltage falls is removed. The valve is supplied matched, and, incidentally, costs round about 15s., instead of the 35s. which would have to be paid for the couple of pentodes needed even to approach the same output with Q.P.P.

We have seen, therefore, that provided the grid current does not upset the L.F. characteristics of the grid circuit we can get very fine power output by running the grid-current type of valve.

The L.F. transformer is more like a power transformer. It has ample iron and

NORMAL—and "Class B"



The totally different conditions under which ordinary and "Class B" valves work is depicted by these two curves, and it will be seen that "Class B" appreciable anode current flows only when the grid of "either half" is positive.

a step down ratio of 2:1. The secondary has to carry about 10 milliamps of A.C. grid current, so that the resistance has to be low.

The valve used in the intermediate L.F. stage is known as the drive valve, because it has to supply power to the output valve, not merely voltage impulses. So a small power type is employed.

This gives the whole set a quiescent anode current of some 8-10 milliamps—a small amount when one realises that the latent output power of the set is something like 1,500 milliwatts.

Actually, in use the mean anode current of the set is 12 milliamps, the "B" stage (which includes the "drive" valve) taking about 6-7.

THE IDEAL GOVERNOR OF THE B.B.C.

(Continued from page 56.)

He should not neglect the Regional stations, but should visit them regularly and see them at work. Provincial talent is frequently as good as that of London, and local patriotism in broadcasting is not to be despised.

A Governor should be *ex officio* member of all the Advisory Committees, and should

attend them when possible in order to make friendly contact with useful people and to see something of their work. The meetings of the Council for Adult Education and the Schools Council should see him as often as possible, and he should be familiar with the doings of the Opera Syndicate and other bodies directly or indirectly subsidised in return for contributions to the programme.

He should attend some of the performances of the B.B.C. Orchestra and the Opera, to judge of their merit and to observe the reaction of the public to them. He should attend other concerts, plays and variety shows in order to detect fresh talent for the microphone.

He should spend a considerable amount of time listening, for the double purpose of watching the progress of technical development and of noting the artistic quality of the performances.

Acquaintance with Music.

A good working acquaintance with life in all classes, whilst not indispensable, would be exceedingly helpful in estimating tastes and preferences. A sufficient acquaintance with music not to be made a fool of, and with politics not to be made innocently guilty of first-class blunders is of real importance.

Add to all these things enough business knowledge to appreciate the meaning of a balance sheet; enough common-sense to know when value for money is given; enough courtesy to keep everybody content with his job; enough firmness to keep off raids on the exchequer; and enough comradeship to excite the finest *esprit de corps* within the Corporation, and you have in such a Governor one who, though not immune from the criticism which nobody could escape, would do much to convince the humblest listener that his wants are not forgotten, and that he is esteemed, by those who serve him, a partner in a great enterprise.

TECHNICAL NOTES

Some diverse and informative jottings about interesting aspects of radio technique.

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

A Curious Pick-up Effect.

I HAD a curious case a day or two ago with a pick-up which had a special form of tone control; this was operated by means of a knob on the motor-board, and when first used was quite effective—in fact, it gave a very nice adjustment of the tone and enabled it to be reduced from a harsh, rather scratchy, effect down to a very nice round mellow quality.

After some fiddling about with the interior of the set, when separate pick-ups and speakers had been connected, it was noticed that the tone control knob didn't work at all—by that I mean that nothing whatever happened when you turned it.

As it only operated a variable resistance, it was just a little difficult to see what could possibly have gone wrong with it, but it soon appeared that the input from the pick-up was split into two parts and

(Continued on next page.)

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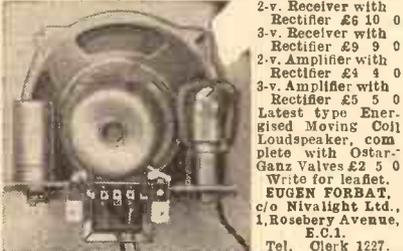
These valves work direct off either A.C. or D.C. supply. No transformers or resistances required. Remarkably free from mains hum.

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TECHNICAL NOTES

(Continued from previous page.)

this variable resistance was across the one part but not the other.

Owing to an accidental reversal of the main leads from the pick-up—that is, the two “outside” leads, as it were—the variable rheostat had been put into the wrong part of the input, where it had no effect.

Reversing the Leads.

On reversing the leads again, the tone control again became fully effective as before. I mention this point because, when you are using a commercial radio-gram, if you have occasion to disconnect any of the wires you want to be careful to put them back exactly as they came apart; you never know what sort of patent little dodges the makers may have adopted, and it is not always at all easy to find out.

For instance, you could scarcely think that reversing the pick-up leads would have put a tone control device out of action, would you?

Tuning and Reaction.

Tuning and reaction controls are often operated by means of very small control knobs. I suppose this is done by the makers in an attempt to “improve” the appearance of the front panel of the set. Personally, I think that, even from this point of view, it is not desirable to use very small knobs, and I think that a large knob, if properly made and finished, often has the effect of adding to the handsome look of the receiver.

But altogether apart from the question of appearance there is no doubt at all that a large knob makes for very much better and more accurate control. This does not, perhaps, apply so much to the reaction as to the tuning. After all, reaction, as we all know, should not be pushed to such a limit that it requires a micrometer control to adjust it.

When it comes to tuning it is quite a different matter and it is difficult to get the best out of a set if the knobs are so small that only coarse adjustment can be obtained with them.

Jumpy Control Knobs.

Any of you who may have had experience of tuning all kinds of sets and all kinds of control knobs will, I think, readily

(Continued on next page.)

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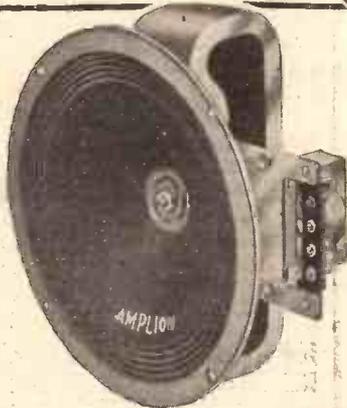
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TECHNICAL NOTES

(Continued from previous page.)

agree with me when I say how much more convenient it is to operate a set with a good large tuning knob, a couple of inches in diameter (with vernier adjustment as well, of course) than with a little fiddley knob that jumps ten degrees before you can stop it.

Even in regard to reaction, and notwithstanding what I just said above, it is an advantage, especially on the shorter waves, to be able to adjust with reasonable accuracy.

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A Divided Aerial.

I was making some tests the other day on a number of wires strung about as indoor aërials, and got some very curious results. In one case, a wire had been fixed against the wall from the top of the house and right down to one of the rooms on the ground floor. It came down to the floor level and then went up again to a large brass curtain rail, and was continued again for a few feet at the opposite end of the rail, the wires being connected to the rail so that the rail itself formed part of the aerial.

This gave fairly good results, but seemed to suffer from too much capacity. Later on the aerial was divided, and the part consisting of the picture rail and the few feet extension remained connected to the original set, whilst all the part of the aerial "before" this was connected to another set.

THE "AIRSPRITE" TWO.

The Editor, POPULAR WIRELESS.

I have made up as an experiment your "Airsprite" Two. The results I've obtained with this receiver are wonderful.

J. HENS.

10, Great Queen Street,
Kingsway, W.C.2.

Curious Effect.

In these conditions the original set, which had what I might call the curtain-rail aerial, operated much better than before, although the aerial was only about one third of the height and one-third of the length.

The really interesting point was that the aerial consisted simply of the brass curtain rail, about 10 ft. in length, 12 ft. high from the ground floor and consisting of a tube 2½ in. in diameter, with a down lead of only some 6 ft., and the set worked very much better than when it was connected to some 20 yards of wire running up to the roof of the house.

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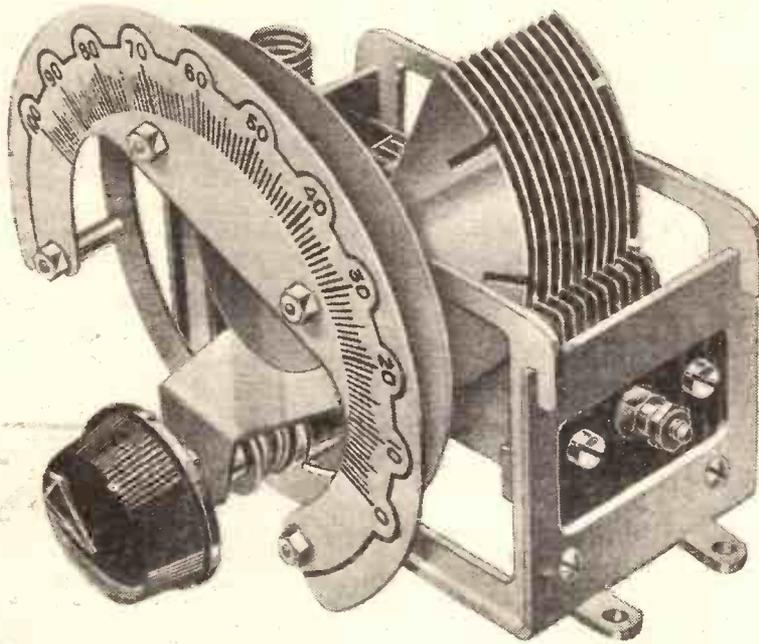
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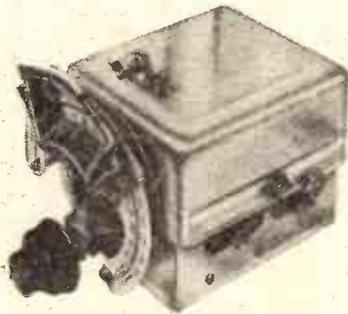
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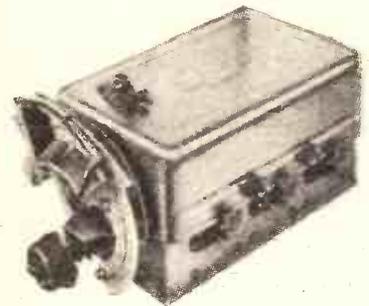
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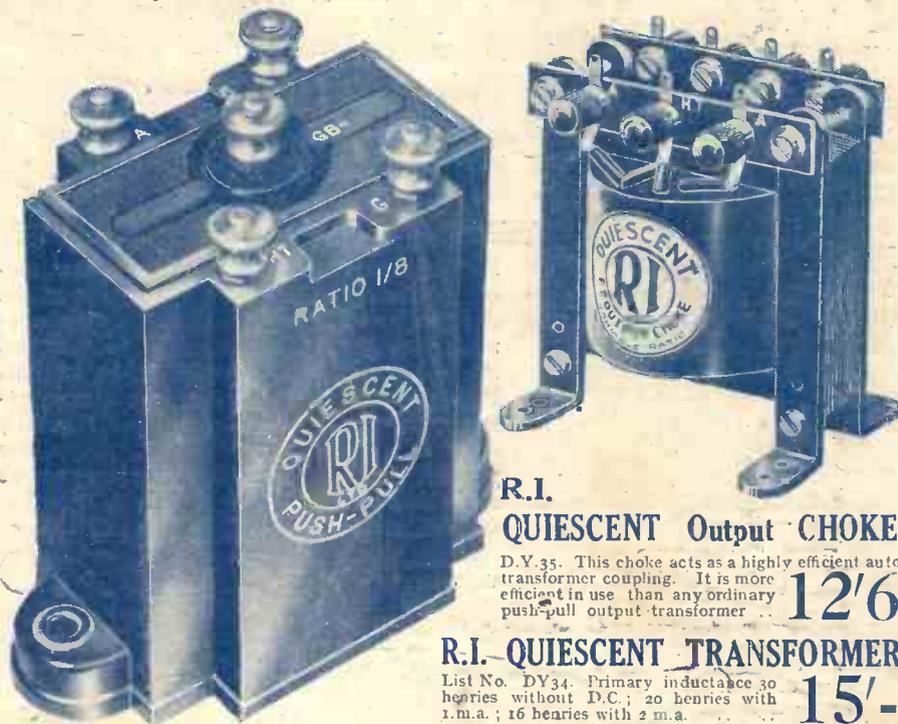
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