

THE VERY LATEST THREE-VALVER

FAULT FINDING
FOR THE
BEGINNER

Amateur Wireless

and
Radiovision

Every
Wednesday

3^d

Vol. XXII. No. 565

Saturday, April 6, 1933

OUR UP-TO-THE-MINUTE THREE

(Ferrocart Westector)



BY
W. JAMES



FULL
DETAILS
IN THIS
ISSUE



EDISWAN

the name that means 'EXCELLENCE'

*"Quiescent Push-Pull" was successfully
launched by the Mazda engineers*

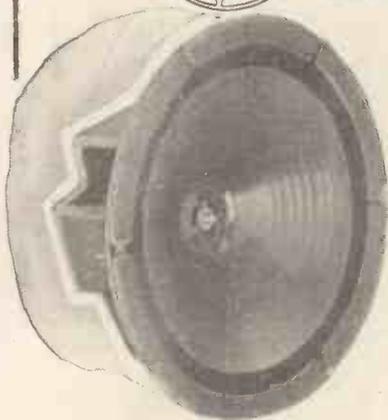
**NOW—here is a
specially designed
Permanent Magnet**

B.T.H.



**MOVING
COIL
REPRODUCER**

for use
with Q.P.P.
output



R.K. "Minor" Permanent Magnet Loudspeaker fitted with Q.P.P. output transformer and high efficiency permanent magnet. Price 57/6. Also available complete with cabinet.

Here is a new model B.T.H. R.K. Reproducer specially designed for operation by a "Quiescent Push-Pull" output stage. It incorporates a special accurately matched transformer to suit Mazda PEN.220A valves. The speaker itself is of the well-known "Minor" R.K. type with powerful permanent magnet. The combination produces the best possible results from Q.P.P. receivers.

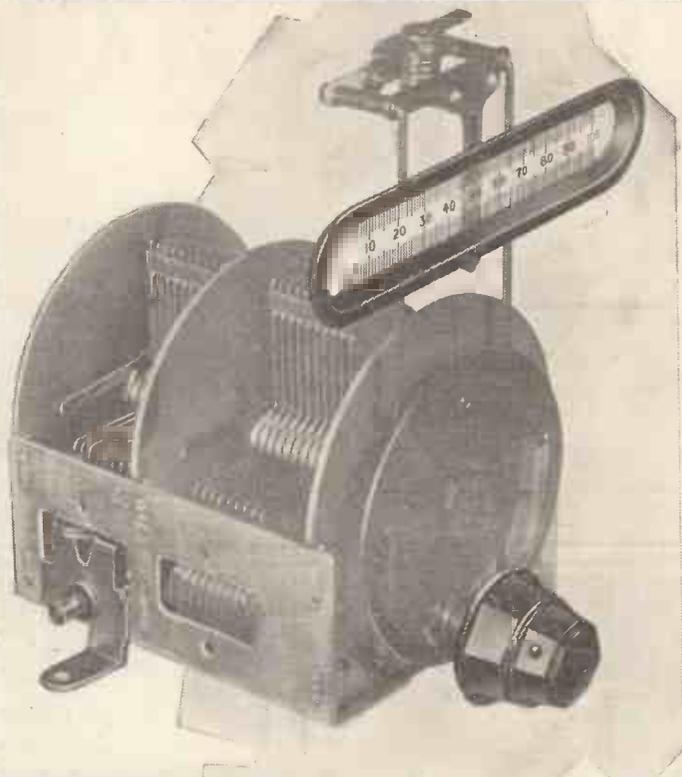


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W.208

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This new Utility two-gang condenser is probably the finest condenser made. It is matched as near as possible to zero error—the guaranteed matching is $\frac{1}{2}$ per cent.—and it will remain permanently matched during the life of the condenser. And to make it as perfect as possible it is sold complete with the Utility Straight Line Dial with the unique feature of a moving pointer transversing a stationary scale.

W 312/2 2 gang condenser complete with straight Line Dial as illustrated **24/6**

SPECIFIED FOR THE
"SUPER-HET SHORT-WAVE ADAPTOR" **7/6**
Utility W 181 Dial, the finest S.M. Dial made

From your dealer or post free from the makers.

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UTILITY WORKS, HOLYHEAD ROAD, BIRMINGHAM
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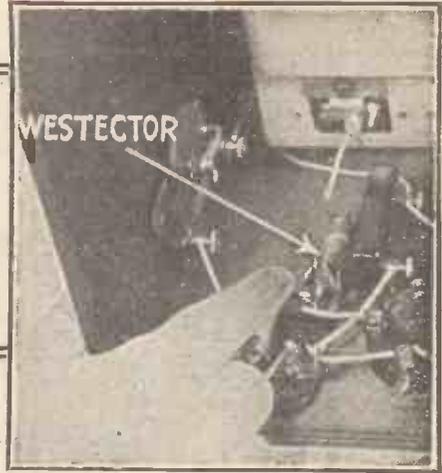
MR. W. JAMES'S FIRST RECEIVER

using the new

WESTECTOR

The main difficulties which confront the designer of present-day battery-operated receivers with large H.F. gain are preventing detector overloading, ensuring as perfect rectification as possible, regardless of the input signal voltage and economy in H.T. current consumption.

Mr. W. James, in his "Up-to-the-Minute Three," solves each of these problems by the use of the new "Westector." The "Westector" takes no anode or filament current and cannot be overloaded at all easily (thus eliminating the need for pre-detector volume control), it takes up but very little space and gives the most efficient possible rectification.



The illustration shows that portion of A.W.'s "Up-to-the-Minute Three," which revolutionises present battery set design by the use of the Westector, shown in the photograph above. You'll want to know more about this new method of detection. The attached coupon will bring you full particulars.

The Westinghouse

WESTECTOR

high-frequency metal detector

COUPON

WESTINGHOUSE PUBLICITY,
82 York Road, King's Cross,
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Please send me full particulars of the new Westector.

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A.W.84

THE BEST COMPONENTS



The Lewcos I. F. Transformers with and without pigtail. Price 10/6 each.

The Lewcos All-Wave Choke. Price 6/6



Constructors are invited to write for a series of free leaflets (Ref. A.) describing the full range of Lewcos Radio Products.

In the early days of wireless the pioneering and research work undertaken by "Lewcos" established this world-famous firm as the leading radio component and wire manufacturers.

To-day they still maintain their leadership by consistently producing only quality components—the very best obtainable.

Make sure of the best by asking for the component you require by name—"LEWCOS"!



Radio Components

A Lewcos Type MC HF Choke (Price 2/6) is recommended by the designer for use in the "Super-het Short-wave Unit." Also a Lewcos (ref. LFT4) LF Transformer (Price 6/9) for the "Up-to-the-minute 3."

THE LONDON ELECTRIC WIRE COMPANY AND SMITHS LIMITED, CHURCH ROAD, LEYTON, LONDON, E.10

Mention of "Amateur Wireless" to Advertisers will Ensure Prompt Attention



**AND BUILD YOUR OWN
NOW! ALL-ELECTRIC
SKYSCRAPER**

**MOST
POWERFUL
RADIO EVER
PUT INTO
THE HANDS
OF HOME
CONSTRUCTORS
— AND
SAFE!**

Now, at last, you can equip your home with ALL-ELECTRIC RADIO, SELF-CONSTRUCTED. Here, for the first time, is a complete All-Mains Kit for the Home Constructor which is at once completely practical and completely safe. You build the "All-Electric Skyscraper" yourself and so you know that there are no mysteries in it—you have no fear of letting the family handle it, and you can "tinker" with it yourself if you want to adjust it at all.

The "All-Electric Skyscraper" works from A.C. Mains. It is a self-contained receiver, with provision for Mains Aerial. You simply plug in and switch on. Unique to this A.C. "Skyscraper" is the special Safety Fuse Plug—which is the fullest possible protection ever provided in a Mains Receiver, and makes this the first really SAFE A.C. Constructors' Kit, AS SAFE TO HANDLE AS A BATTERY SET!

**CHART OF THE AC SAFETY
"SKYSCRAPER" FREE**

Lissen have published a beautiful and practical coloured Chart which gives you plans and photographs and exhaustive descriptions of every single point in the construction, operation and enjoyment of this receiver. Matched Valves. Pentode Output. Variable Mu Screened Grid H.F. Stage. Drives Moving Coil Speaker at full volume. Metal Chassis. One Dial Tuning. Ganged Reaction and Volume Control. Walnut Consolette Cabinet which you assemble yourself and so save money. Power Pack an integral part of the chassis. Heavily insulated Mains Lead. Every refinement of the most expensive All-Mains Receiver is incorporated in the All-Electric "Skyscraper"—and SUCCESS IS CERTAIN WHEN YOU FOLLOW THE GREAT LISSSEN CHART.

**IN WALNUT CABINET WITH
MOVING COIL SPEAKER £10.12.6**

Obtainable from all Lissen dealers at the following prices:—

"All-Electric A.C. Skyscraper" Chassis Kit, complete with Power Unit, 4 Matched Valves and Mains Lead with special Safety Fuse Plug. Price £7 19s. 6d.

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Ask your dealer or post coupon below for FREE CHART.



**PRICE
COMPLETE WITH
FOUR VALVES
£7.19.6**

**LISSSEN
AC
SAFETY**

**"SKYSCRAPER
KIT**

**POST
COUPON
TO-DAY**

To LISSSEN, LTD., Publicity Dept., Isleworth.
Please send me FREE copy of the Chart of "All-Electric Safety A.C. Skyscraper."
Name.....
Address.....
A.W.A.C.I

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BRITAIN'S LEADING RADIO WEEKLY
FOR CONSTRUCTOR, LISTENER & EXPERIMENTER

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W. JAMES.

ASSISTANT EDITOR:
H. CORBISHLEY

NEWS & Gossip of the Week

THE VERY LATEST

THIS week our Technical Consultant tells you how to build a sensational receiver incorporating the latest improvements in radio. It's a three-valver which gives four-valve results, because it includes the new Westector detector, which does the work of a valve. And it is one of the most selective sets ever produced because it uses the new Ferrocart coil tuning. Designed by W. James, it has the "A.W." guarantee behind it, and it is certainly the last word in "threes."

RADIO PARIS CHANGES

LOOK out for some important changes in connection with Radio Paris, now that PTT has taken an official interest in this station from which you get your popular gramophone record programmes on Sundays. The mysterious Luxembourg is still trying to find a space in the ether round about 1,200 metres for its nightly tests. Rumour links Luxembourg with the new avenue for sponsored programmes, but no official announcement will probably be made until the European experts and the B.B.C. have met at Lucerne to find new wavelengths.

MORE ABOUT DROITWICH

Technical Details of New High-power Long-waver

TO take the place of the existing Midland Regional station, a 50-kilowatt transmitter will be built side by side with the high-power long-waver at Droitwich. Four diesel-type generator sets will be installed and, for reasons best known to the engineers, the output from these machines will be A.C. and not D.C. as at all the regional stations. Series modulation will be used for the 100-kilowatt long-wave station, which will be notable for the inclusion of two CAT14 super-power valves in the push-pull output stage.

HIGH-QUALITY AERIALS

ONE of the most important features of the new Droitwich station will be the erection of two 700-foot masts, as we forecast some time ago. These masts will support the aerials for the long-wave National station and for two sections of the aerial used for the new Midland Regional station. Special attention will be paid to the retention of a broad frequency response in the long-wave aerial,

Also in this Issue—

FEATURES YOU SHOULD NOT MISS

The "Up-to-the-Minute Three."
A New Set by W. James, with Ferrocart tuning and Westector detection.

A Super-het Short-wave Adaptor for Your Set.

The Class B Valve and Your Loud-speaker, by J. H. Reyner.

How to Design a Screen-grid Pentode Two-valver.

West Regional "On the Air."

AND SPECIAL SECTION FOR BEGINNERS—"WIRELESS MADE EASY"

which will bring out the high notes really well. First tests are expected in June, 1934.

"HIER IST FRANKFURT . . . !"



A new view of the Frankfurt station. This serves the south-west area of Germany. Have you heard it on 259 metres? It is a 17-kilowatt, coming in now at excellent strength

LIVEING COMES SOUTH

MR. E. G. D. LIVEING, North Regional Director, will shortly be assuming certain temporary duties at Broadcasting House. These will be in connection with the information branch during Mr. Gladstone Murray's absence in Canada. Mr. H. M. Fitch will act for Mr. Liveing during the latter's absence from the North Region.

B.B.C. ON A.C. CONVERSION

ACCORDING to the B.B.C. the recent case of Lakeman *versus* the Corporation of Chester may be taken as a precedent by owners of D.C. sets on supplies likely to be changed over to A.C. The case in point was decided, it may be recalled, in favour of the owner of a charging plant rendered useless by the Corporation's change-over from D.C. to A.C.

HAS RADIO HUMOUR FAILED?

WHAT looks very much like an admission of failure in the broadcasting of humour is contained in a statement in the recently published B.B.C. annual report. "The problem

A PROVED AND TESTED CLASS B ALL-IN SET—First Details Next Week

NEWS & GOSSIP OF THE WEEK

Continued

of conveying humour purely by oral methods within the limitations of microphone and programme policy," states the report, "has not yet been solved. The success of humour depends more than is generally realised upon visual impression and on an audience." Seems like a cry for television coupled with a pat on the back for the studio clacque, doesn't it?

MORE DANCE-BAND FIXTURES

SO popular are the hours of dance music in the evening programme, that the B.B.C. has fixed up for the studio "appearance" of several well-known bands within the next month or so. April 2 week sees Jack Hylton in the studio, and in the same week we shall hear a Hungarian gypsy orchestra. April 23 week there will be Maurice Winnick, June 4 week Harry Roy, June 11 week the Hungarians again, and June 25 week Percival Mackey's Band. These are, of course, additional dance music broadcasts and the above do not in any way interfere with regular late evening fixtures.

UPHEAVALS AT "B.H."

THERE is a tense atmosphere at the B.B.C.'s headquarters just now. Everyone seems to be caught up in the throes of the deep-seated upheavals going on in many of the higher administrative departments. So far as we can determine the effect of the changes now going on will be to concentrate the policy-making in fewer hands.

F.A. CUP BROADCAST TO EMPIRE

AS usual, the final of the Football Association Cup will be broadcast by the B.B.C. on April 29. For the first time, though, this will be an Empire affair, the commentary being Blattnered for zone transmissions later in the day. G. F. Allison will commentate and Derek McCulloch will be square-minder.

STORM AT ATHLONE

WHEN a thunderstorm made fun of the Shannon Scheme and the new high-power Athlone broadcaster, there was a serious dislocation. There was no broadcasting from Athlone as overhead 'phone wires connect the Dublin studio with the Athlone station and newspapers were unable, as a result of the breakdown in telegraph and telephone services, to carry on a proper news service. So Free State listeners are anxious for an underground "mike" cable and a radio link receiver as a stand-by at Athlone.

GERMANY'S EMPIRE PROGRAMME

THE Zeesen officials, piqued by the fact that the B.B.C. is now putting out an independent Empire programme, have created

a special programme service for Germans abroad. So if you tune to 49.8 metres you will find that Zeesen now gives a special programme and does not constantly relay the programme of other German stations. A kind of Empire programme board has been set up, with the man who was previously the head of the German International Programme Branch as the guiding light. So Zeesen looks like making a full-time job of these special short-wave programmes.

WASHFORD PUBLIC TESTS

Fading In the New West Regional Station

AS we forecast recently, the Washford station, to be known as West Regional, is now preparing for public transmission tests. So confident are the B.B.C. that these public participation tests have now been fixed up: They start on April 24, during the morning from 11.10 to 11.50, and in the evening for late dance music. In the meantime engineering tests are, of course, taking place, so that you may, if you listen to Cardiff's wavelength, hear something of Washford on almost any night.

SIGH NO MORE, LADIES!

THAT might well have been the motto of Pedro Tillet, a much-valued servant of broadcasting who is about to retire. The good Pedro has probably calmed more temperamental prima donnas than he would care, to count in his job of auditioning would-be concert artistes for broadcasting. All have passed through his hands, and many have reason to be grateful for the calming influence of his suave manner.

WASHFORD IS A LITTLE DIFFERENT

AS each regional station is completed one notices slight differences in the detail. Washford is no exception. The front of the building is faced with Empire stone. Inside are the standard 50-kilowatt transmitters made by Marconi's. The only difference here seems to be in the meters, which are of a different make from those at other stations.

THE RUSSIANS ARE NOT COMING!

HOW easily we seem to get scared of Russian bogey men—whether of the dreaded OGPU or of Russian broadcasting

stations! The latest fright—that London Regional was menaced by a 500-kilowatt station starting up immediately on 351 metres, is without any trace of truth. Apparently the rumour was started by an enterprising firm of super-het makers, who underlined their advocacy of the super-het system for super-



Controlling the trains. The traffic control room at the Leeds Central Station, from which a B.B.C. Outside Broadcast was taken last week, in connection with the goods traffic marshalling on the L.N.E.R.

selective tuning by inventing a situation that would certainly put most sets out of action!

B.B.C.'S BIG BEN NEARLY READY

ALL that scaffolding along the side of the Broadcasting House building is for the hoisting of the giant Truvox loud-speakers destined to take their place on the roof. Then, when wired up to amplifiers, they will once or twice daily—the Director-General has not yet finally decided this—blare out the chimes of Big Ben all down Regent Street. This relaying of the Westminster chimes seems to be catching. In future we can imagine a song being written thus: "If you want to know the time—ask the loud-speaker!"



An Easily-built SUPER-HET SHORT-WAVE ADAPTOR

Constructional details of a highly efficient unit which can be added to practically any broadcast wave-



band set, so that you can receive the short waves without building a special receiver

It is so easy to receive the short waves with a super-het. adaptor like the handy unit shown by the accompanying photographs.

And now that the long light evenings are here, you need a really efficient unit—preferably a super-het adaptor—if you are going to rake the short-wave ether with any degree of success.

This is a super-het short-wave adaptor.

A "straight" short-wave adaptor was described recently in AMATEUR WIRELESS, No. 562 (March 18).

How it Works

Each type has its own advantages, but the super-het. adaptor is definitely more sensitive and is in many circumstances, preferable.

How does it super-het.?

It is a single-valve stage added on in front of your present set without altering any of the set's wiring.

It does not take the place of the existing detector stage, as does a "straight" short-wave adaptor.

There are so few parts in this handy unit and it is so efficient that it cannot fail to appeal.

If you have any doubts about the economy, then look at the accompanying components list.

If you have any doubt about the efficiency—well, look at the circuit in conjunction with the photograph.

You will see that a dual-range short-wave coil is used covering the two wave ranges of approximately 18-32 and 30-64 metres. There is reaction, of course, and this is arranged to be effective on both wave ranges.

Reaction is essential, as with this super-het adaptor the H.F. stage or stages of your present broadcast band set are used as the intermediate frequency stages of amplification of the super-het hook-up. The adaptor, being connected up to the front of the broadcast band set, acts as a combined first detector and oscillator. That is why reaction is essential.

The rest of the parts in the unit make up an efficient single-valve stage. There is a short-wave tuning condenser with a very nice slow-motion dial, a neutralising type series aerial condenser fitted with a locking nut, a 3-megohm grid leak, and a 0002-mfd. grid condenser.

Look at the photograph to see the neat component layout. It is just ideal for short-wave work.

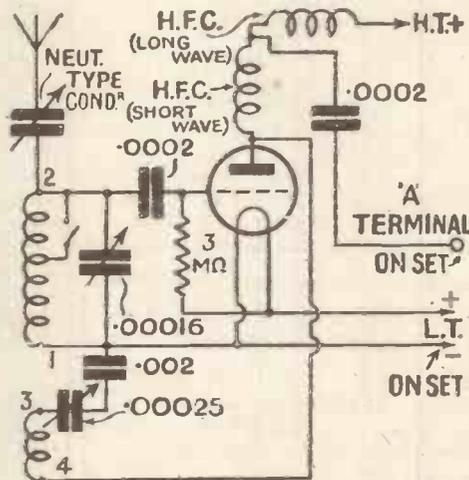
Construction

An "air spaced" valve holder is used with the grid leak connected directly between the grid and one of the filament terminals. The short-wave H.F. choke is also supported in the wiring without the use of clips. There are only two terminals being used for these.

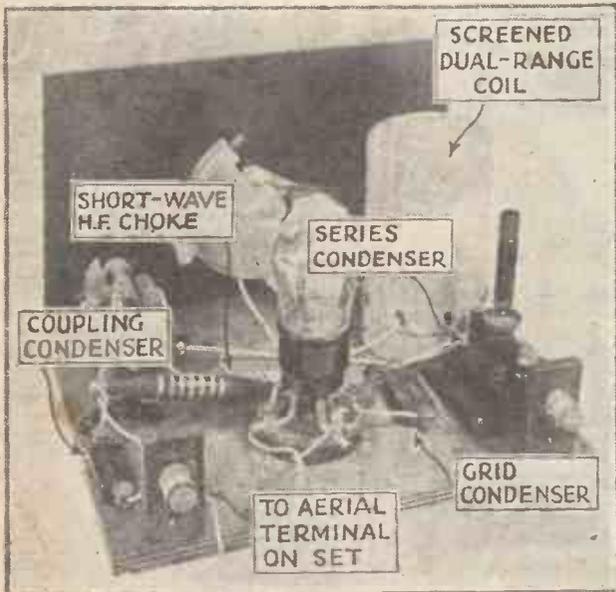
One is the input terminal, to which the aerial is connected, and the other is the output terminal which is connected to the aerial terminal on your set.

If there is a series aerial condenser in the existing receiver it should be screwed right down or, better still, short-circuited.

If you are in doubt about the layout, then get a full-size blueprint, which show you just where to mount the



The circuit of the adaptor. A dual range coil covering 18-32 and 30-64 metres is used but the full switching is not shown



The construction of the adaptor is simple and few parts are required. Compare this lettered photograph with the layout and wiring diagram on the next page

COMPONENTS FOR THE SHORT-WAVE ADAPTOR

CHOKES, HIGH-FREQUENCY

- 1—(Lissen Astatic with base, R.I., Lewcos, Goltone, Varley, Wearite, Kinva, Bulgin, Graham Farish).
- 1—Short-wave (Wearite, Eddystone, Igranic, Lissen, Goltone).

COILS

- 1—Type KSW (Colvern).

CONDENSERS, FIXED

- 1—0001-mfd. (Dubilier, type 670, Lissen, T.C.C., Telsen, Graham Farish, Ormond, British Radiophone).
- 1—0002-mfd. (Dubilier, type 670, Lissen, T.C.C., Telsen, Graham Farish, Ormond, British Radiophone).
- 1—002-mfd. (Dubilier, type 670, Lissen, T.C.C., Telsen, Graham Farish, Ormond, British Radiophone).

CONDENSERS, VARIABLE

- 1—00016-mfd. (Eddystone, J.B., Utility, Cydon).
- 1—00025-mfd. (J.B., Ormond, Utility, Polar).
- 1—Neutralising (Peto-Scott).

HOLDERS, VALVE

- 1—Short-wave (Eddystone, Ready Radio).

PANEL, BASEBOARD, ETC.

- Ebonite, 9 in. by 6 in. (Lissen, Becol, Goltone).
- Baseboard, 9 in. by 8 in. (Peto-Scott, Ready Radio).

RESISTANCES, FIXED

- 1—3-megohm (Eric, Graham Farish, Dubilier, Claude Lyons).

SLOW-MOTION DIAL

- 1—(Utility, Ormond, Telsen, Igranic, J.B.).

SUNDRIES:

- Connecting wire and sleeving (Lewcos).
- 2 yards thin flex (Lewcoflex).

TERMINAL BLOCKS, TERMINALS, ETC.

- 2—Terminal blocks (Goltone).
- 2—Terminals, marked Aerial and Output (Belling-Lee, type M, Clix, Ealex).
- 1—Wander plug, marked H.T.+ (Belling-Lee, Clix, Ealex).
- 2—Spade terminals, marked L.T.+ , L.T.— (Belling-Lee, Clix, Ealex).

(Concluded at foot of next page)

OUR LISTENING POST

By JAY COOTE

WITH the daily increasing number of women officials attached to studios to-day, it is interesting when listening to foreign stations to note how they are designated in those cases where they take up the duties of a male announcer. And there you have it; there is no word yet coined—except as a temporary measure—in any language to define a woman announcer. In the United States they term her: *announcress*; in Germany they have feminised the *Ansager* or *Sprecher* by adding the suffix *in*, thus *Ansagerin*. In France doubt still assails them and they refer indiscriminately to *annonciatrice* or to a Franco-English *speakerine* and in the Balkan states—as, for example, Belgrade—they call her a *spikerica* (pronounced: *spikeritza*). Nowhere do they seem to have discovered a right and fitting term. Can anybody make any suggestion? I think the studios would welcome one.

"High-power stations are cheap to-day," could be Europe's broadcasting slogan. What with Radio Luxembourg, Warsaw, Radio Paris on the long band, and Athlone, Poste Parisien, Breslau, Leipzig, Prague, etc., on the lower wavelengths, it would be difficult not to tune in some Continental stations even with the simplest of wireless receivers. Radio Luxem-

bourg is to be heard daily between 11 a.m. and 12 noon, and again in the later hours of the evening—sometimes until 1 a.m. You may notice that where announcements are made they are given out in both French and German by a woman and a man, as at Strasbourg.

Brussels Broadcasting House.

Brussels, in the near future may show considerable improvement in many ways. To replace the disused dance-hall which served as a studio, a miniature Broadcasting House is being built at Ixelles, one of the most important suburbs of the capital. It will contain several large studios and a theatre. Moreover, the twin transmitters—which, by the way, are not at Brussels, but at Velthem, near Louvain, some twenty-five miles away—will have their power increased this year to 60 kilowatts.

Further interesting details reach me regarding the 100-kilowatt station which is being built for the Ravag, on the Bisamberg near Vienna. For the first time, 300-kilowatt valves are to be used in this new transmitter. Up to the present, valves of half that power only have been incorporated in the Leipzig, Breslau, and Munich plants; but if the bigger model is a success the Germans will adopt

them for the stations they propose to erect during 1933 at Berlin and Hamburg. In addition, the Vienna transmitter is to be equipped with a vertical aerial similar to the one adopted by Hilversum. It will consist of an iron mast 130 metres in height, thus oscillating to exactly one quarter of the wavelength, namely, 520 metres.

From now onwards, I am informed, tourists going abroad will be afforded facilities to take portable sets into France and Italy. (Belgium has never offered much difficulty in this respect). All that is needed as regards France, is that the traveller should declare the receiver on arrival at the French port and secure a certificate for it. Italy, where at the frontier an official form must be filled up, requires in addition a payment equivalent to about 150d. a month; that is, a portion of the listening licence exacted by the E.I.A.R. Probably, very shortly, other countries may follow suit.

Continental listeners, and in particular the Germans, are not satisfied with the calls put out by the foreign stations; they consider that they should be given more frequently and also in a simpler way. As a step towards an improvement, it is likely that the German studios may modify these announcements. As an example, *Westdeutscher Rundfunk*, conveys nothing—or little—to a foreigner; in future, therefore, it is suggested that the station should announce itself as *Koeln* (Cologne), from which, in fact, almost all broadcasts originate.

"A SUPER-HET SHORT-WAVE ADAPTOR"

(Continued from preceding page) parts. It can be obtained, price one shilling, post free, from the Blueprint Department, AMATEUR WIRELESS, 58-61 Fetter Lane, London, E.C.4.

Battery connections are simple. There are two flex leads which connect up with the accumulator (there is no on-off switch in the unit) and there is one single flex lead which should be taken to 80-100 volts, H.T. positive.

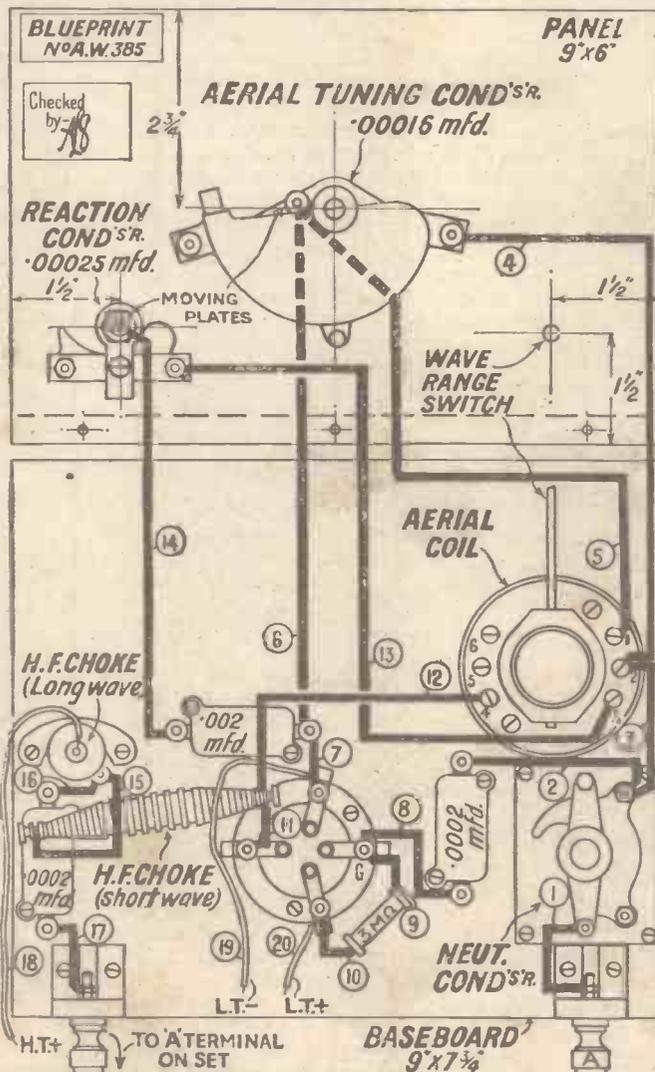
The wiring is too simple to need detailed description. Some of the leads are so short (the aerial terminal to the series condenser, and the grid-leak holders) that it is really not necessary to cover them with insulating tubing.

Note the coil connections, the coil being mounted so that the terminals 4, 5 and 6 face inwards.

When the wiring is done, then you can wire up, plug in a suitable valve, and make a first ether tour for short-wavers.

The following are recommended battery type 2-volt valves for this unit: Mullard PM2D, Cossor 210Det., Marconi HL2, Osram HL2, Mazda HL210, Six Sixty SS210HL, Lissen HL210, Eta BY1814, Fotos BC18, Dario Super HF, Tungram HD2.

The broadcast band set should be tuned to about 1,500 to 1,600 metres. It must be accurately tuned in, or otherwise you will lose the "punch" given by the intermediate frequency amplification.



Here is the layout and wiring diagram of the short-wave adaptor. A full-size blueprint can be supplied, price 1/-

Wire up the adaptor, removing the aerial lead to the aerial terminal on the unit and, after unlocking the ring on the neutralising type condenser, set the vanes about half-way out.

Set the unit gently oscillating (you will hear a rushing noise) and then very, very slowly rotate the tuning dial. When you pick up a station make extremely careful readjustment of the tuning of the main set to be sure that you are getting the full punch of the intermediate frequency amplification. Of course, if you have two screen-grid stages in your present set you may get better results than if there is only one. This unit cannot be used with a set in which there is no high-frequency amplification.

When you tune with the unit keep it gently oscillating and rotate the tuning dial very slowly, or you will miss stations.

On Easter Day the morning service will be relayed from York Minster to National listeners. The address by the Archbishop of York will be included.

Sir Henry Wood will conduct the Herbert Ware Symphony Concert at the Park Hall on April 9. This concert will be relayed to the Western Region from 9.5 to 10.15 p.m.

The Welsh Interlude for West Regional listeners on April 10 will be given by Mr. Griffith Quick. He will tell of his adventures in Central Africa. The Welsh Interlude for Daventry National listeners on April 15 will be given by Rev. J. J. Williams.

West Regional 'On the Air'

The new Regional station at Washford Cross, in Somerset, is now starting its



first tests, and here is an authoritative article by our Special Commissioner

WEST REGIONAL "on the air!" Everything has gone according to programme and by the time this appears in print the B.B.C. engineers will have put out their first test transmissions from the lonely West Regional station on the main Minehead road, two miles out of Watchet.

At the end of last year I went down to see the station during the course of erection. Such rapid progress had then been made—the exterior of the building being finished—that the engineers on the spot assured me that test transmissions would be going out by the end of last week.

And there has been no hitch!

The first tests are being made outside programme hours on Cardiff's wavelength of 309.9 metres.

After a few days the late night dance music will be taken over by the new West Regional transmitter and later on the Washford Cross transmitter will take over the whole of the West Regional programme.

The Regional

The Cardiff and Swansea transmitters will then be withdrawn, but it will take a week or so to "fade in" the new station, so it will be about the middle of May before West Regional has settled down to giving the whole Regional programme.

Then, after you have had two or three weeks of West Regional, West National will be "faded in" in the same way.

Although Cardiff and Swansea transmissions will be closed down, the studios will be maintained. One of the Cardiff studios is shown by an accompanying photograph and the Cardiff centre will be enlarged while the new Bristol headquarters in Whiteladies Road will be opened in time for the full West Regional transmissions.

While West Regional is being introduced in an easy fashion, West National will be more tricky. This will transmit on 261.6 metres and will be synchronised with London National.

B.B.C. tests have shown that the

National transmitter at Washford Cross will give a better service by synchronising it with London than with any other National transmitter.

Londoners will have to find relief in the fact that they can always turn to 5XX if the local National programme is subject to swamping.

Mush Areas

The idea is that by synchronising the London National transmitter with the new Washford Cross National station, the mush area, which is bound to result, will occur in districts where there is good 5XX reception.

While people actually living near London National will not be affected by the fact, listeners in the mush areas will have to turn to 5XX if the synchronising scheme

to Washford Cross you will have no difficulty in separating the two programmes.

A more important point than the necessity for ample separation between these two wavelengths is good long-wave reception.

The National programme on the long waves will be the solution to all medium-wave National programme synchronising troubles. In other words, if, when West National starts, up, you are troubled with selectivity or are in a mush area, then try Daventry!

A Bristol Change

By the time West Regional is transmitting in the programme hours the land-line arrangements to the station will be greatly improved.



(Left) One of the studios at the Cardiff headquarters, which will be considerably enlarged when West Regional opens. (Below) A studio at Bristol, where the new land-line control gear will replace that at the present Gloucester repeater station. Cardiff programmes will pass through Bristol



is continued.

Reading between the lines of the B.B.C.'s statements about Washford Cross, I see that they are banking on listeners over about fifty miles away from West Regional taking their National programme from 5XX.

And when "5XX" means the 100-kilowatt Droitwich instead of the present Daventry (which it will do within a year) then all the National programme difficulties will be solved.

The separation of 309.9 metres (Regional) and 261.6 metres (National) is a fairly generous one so that if you are living close

At present Gloucester is the land-line repeater station for this part of the country, but it will be closed down and the very latest type of land-line control gear fitted at the Bristol studio centre.

The cables from the Cardiff studios will run to West Regional via the Bristol control gear, but naturally the actual music control will be done at Cardiff.

HOW TO MAKE AND USE

A CAPACITY BRIDGE

A SIMPLE DEVICE FOR MEASURING THE CAPACITY OF ANY CONDENSER

THE real radio enthusiast is often handicapped in his experiments by the lack of laboratory measuring instruments, possession of which he is denied on grounds of expense.

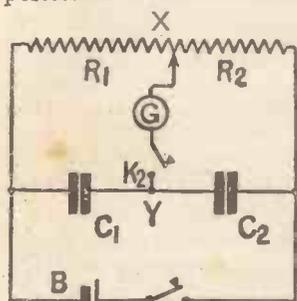


Fig. 1. Kelvin's Bridge

However, there is more than one piece of apparatus that he can build for himself, and which, while not having the ornate appearance characteristic of the professional article, will nevertheless give equally good results.

One very useful instrument to the serious experimenter is the capacity bridge, which will enable its owner accurately to measure the capacity of any fixed or variable condenser.

Before describing the instrument which is the subject of this article, a few words on the theory of the capacity bridge will not be out of place.

Fig. 1 is Kelvin's Bridge. On closing the key K, the two condensers C_1 and C_2 are charged by the battery B, and the potential difference across their respective elements will be inversely proportional to their capacities. If now the key K_2 is closed, the galvanometer G will show a sudden deflection unless the slider on the potentiometer is adjusted so that the potential at X is the same as the potential at Y. From this it will be seen that if the potentiometer is fitted with a scale, so that the ratio $R_1 : R_2$ can be obtained, and the capacity of C_2 is known, the capacity of C_1 can be calculated from the formula $C_1 = \frac{C_2 \times R_2}{R_1}$

The practical arrangement of the circuit employs a small battery and buzzer for charging the condensers, and a metre length of resistance wire, with scale and sliding contact for giving the ratio $R_1 : R_2$.

Construction

The support for the metre wire is made from a piece of 1 in. by 1 in. oak, $42\frac{1}{2}$ in. long, to the centre of which is screwed the board holding the components, as shown in the photograph. This board is made from $\frac{1}{2}$ -in oak, 10 in. by 8 in., and is secured to the centre of the bottom edge of the wire support so that it projects $1\frac{1}{2}$ in. in the front and $7\frac{1}{2}$ in. at the back. Two narrow

strips of $\frac{1}{2}$ -in. oak are glued to either end of the baseboard, to afford clearance to the sub-panel wiring, and two feet, cut from 1 in. by 1 in. wood, are secured to either end of the metre wire support, to enable the instrument to stand firmly on the bench.

After the woodwork is finished and polished, the components are mounted on the panel. These consist of buzzer, battery clips, switch, "standard" condenser, terminals for headphones, and terminals for the condenser to be measured. The com-



A "close-up" of the bridge, showing how the parts are assembled

ponents are wired as in Fig. 2 with stout insulated copper wire (18 s.w.g. or thicker).

The metre wire is a length of 30 s.w.g. Eureka or similar material, which is clamped at both ends of the wire support between two small copper plates, their inner edges being exactly a metre apart. Soldered connections to these plates pass along the under side of the wire support to their appropriate connections under the panel. The metre length is engraved on the wood in centimetres (and preferably fractions). Alternatively, a scale may be neatly drawn on stout paper, glued to the wood, and varnished.

A buzzer giving a consistent, high-pitched note is desirable, the one used by the writers being of the well-known wave-meter pattern.

The "standard capacity" should be a fixed condenser of good make, the capacity of which has been checked by the manufacturers. It is a good idea to employ two interchangeable "standards," say of .01 microfarad and .0001 microfarad, as these

will cover a useful range with a more open scale reading. Another important point is that the sliding contact at the end of the flexible lead should have an insulating grip,

- B—Battery clips
- S—Switch
- Z—Buzzer
- C—Standard condenser
- T1—Terminals for condenser to be measured
- T2—Terminals for phones
- R1 R2—Metre wire
- F—Flexible lead

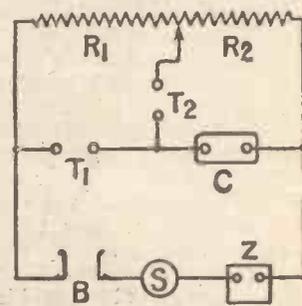


Fig. 2. The connections and details of the parts used in the capacity bridge

as touching any part of the circuit during operation will upset the "silent point" reading.

The operation of the instrument will be self-evident from the description above. The capacity to be measured is attached by short leads to the terminals at the rear of the baseboard and the headphones to their appropriate terminals. The buzzer is set working by closing the switch, and the sliding contact gently moved up and down the resistance wire until a point is found where no sound is heard in the headphones. Supposing a standard condenser of .01 microfarad is being used and the reading on the metre scale is 86, then substituting in the equation

$$C_1 = \frac{C_2 \times R_2}{R_1} \text{ we get}$$

$$C_1 = \frac{.01 \times 14}{86} \text{ microfarad or}$$

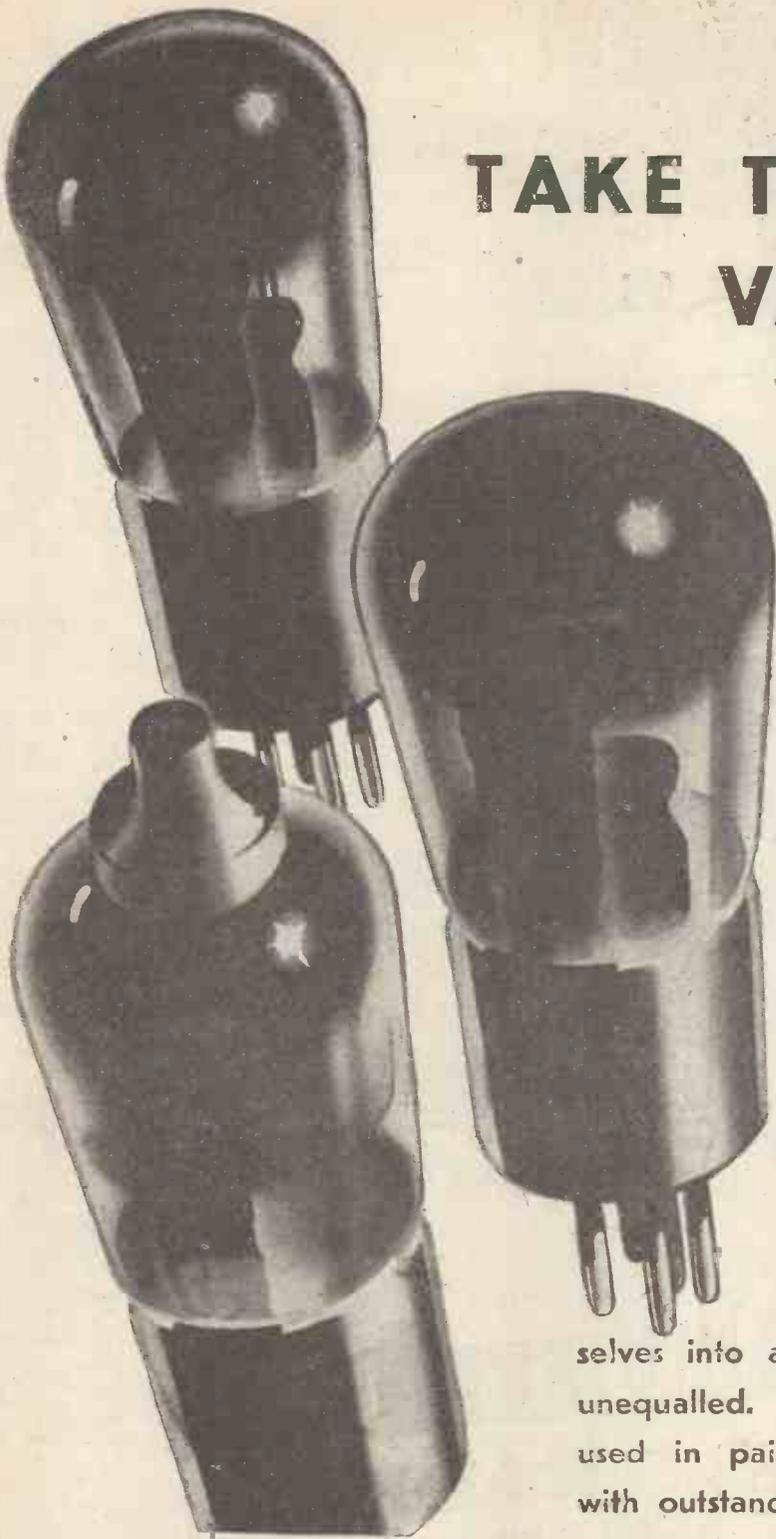
$$C = .00163 \text{ microfarad approximately.}$$

R. H. McCUE.
C. D. ABBOTT.

The annual dinner of the Swansea Orpheus Choral and Orchestral Society will be held at Swansea, on April 10, and listeners will hear Dr. Adrian Boulton reply to the toast of "Our Guest," proposed by the Chairman of the Society, Professor E. Ernest Hughes. This relay to the Western Region will be given from 7.30 to 8.0 p.m.

A concert will be relayed to West Regional listeners from the Olympia, Tredegar, on April 12, when the artistes will be Nora Gruhn, Dorothy Helmrich, Arthur Fear, and the Tredegar Orpheus Male Voice Party.

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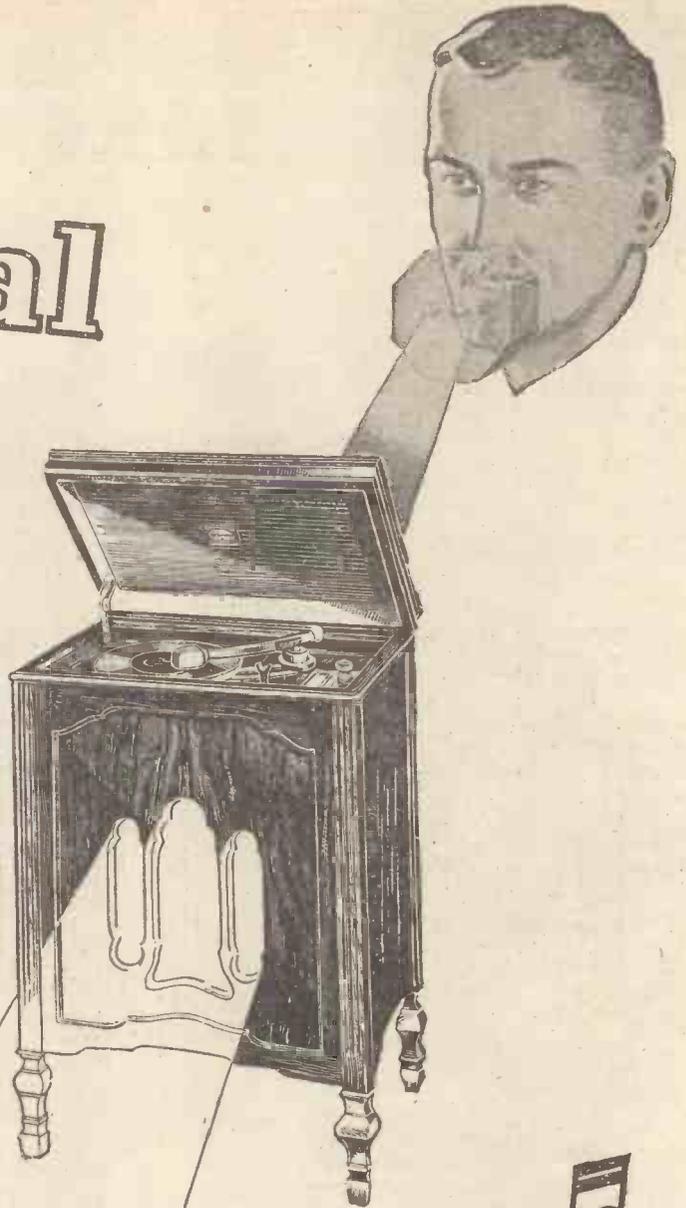
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On Your Wavelength!

SOME GOOD ONES

A READER hailing from the Isle of Wight has been good enough to send me a couple of fixed condensers which he removed from a friend's set after it had been "improved" by an alleged professional expert. Both of these are condensers of first-rate make, and there is no doubt that when the set went to the expert they were in good condition. When the set came back it would produce nothing but faint and distorted whispers, though it is of the popular detector and two L.F. type. On examining the condensers and reading what had been done to the unfortunate set, I am surprised that there was even a whisper to be heard. The grid condenser—both it and the other were of the flat bakelite-cased pattern—contained just exactly nothing in the way of plates. They and the sealing compound had been removed and huge blobs of solder, reminiscent of father's first efforts with the soldering iron, were attached to the lower ends of the terminal shanks. Between the terminals themselves a high-resistance path has been made by rubbing the top of the bakelite case with a lead pencil.

'WARE EXPERTS!

THE second condenser was used in a resistance-capacity coupling between the detector and the first L.F. valve. Its sealing had been tampered with, so I removed the large chunk of black material that had been run into the case. What the expert had been trying to do I do not quite know, but he had made a pretty good mess of the plates and the mica within. The grid leak in the R.C. circuit consisted of a piece of cardboard with a lead-pencil line on it. This is a good example of the kind of work that some of these fellows do when owners of sets are foolish enough to give them the job of making improvements. If you are ever tempted to let yours be "hotted up," make very sure, before you part with it, that the man to whom you entrust it knows his job—otherwise you may find it very much cooled down, so to speak.

WONDERFUL FIGURES

STATISTICS for the progress of wireless in 1932 were published recently, and a wonderful showing they make. At the beginning of the year the number of wireless licences was 4,329,170. By December it had risen to 5,244,277, an increase of 915,107. There is not the slightest doubt that we shall be well over the six-million mark by the end of this year, which will mean that more than half of the homes in this country are equipped with wireless sets. In a very early issue of AMATEUR WIRELESS I suggested that within ten years from then the wireless set would become as commonly

seen a household fitment as the sewing machine. Really, I think I am pretty good as a prophet! Has every other house its sewing machine? I quite expect to see an increase of very nearly a million this year again.

THE SETS THEY BOUGHT

PARTICULARLY interesting are the figures given by a trade journal for the different types of sets sold during the year. Battery sets of all kinds numbered 653,000 against 684,000 mains sets. Taking both kinds together, the three-valver was by far the most popular model; in fact, three-valvers outnumbered all others put together. The two-valver ran it a good second, but the popularity of these little sets is declining, partly because larger ones are now so cheap to buy and to run, and partly because an extra valve makes so much difference to the number of alternative programmes that are available. The battery portable no longer makes the appeal that it did. In a way, I am not surprised, for, convenient as they are, some of these sets do eat high-tension current. Both the super-het and the radiogram have made big headway, and the best part of 200,000 have been sold during the year. That figure will, I am sure, be doubled at the very least during 1933.

MOTOR-CAR SETS

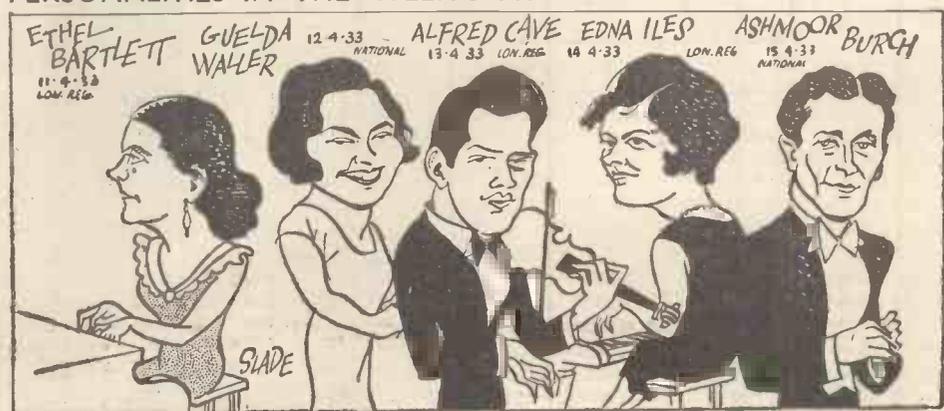
SEVERAL motor-car manufacturers, I hear, are investigating the possibilities of the built-in wireless receiving set. I almost wrote that they were exploring every avenue and leaving no stone unturned. Don't you love that delightful expression? In America built-in receiving sets are standard fittings nowadays on many makes of car, but over here they have not yet caught on to any great extent. Probably the reason for this is that there has been in the past so very little to listen to from the home stations during the afternoons and in day-

light hours at the week-ends, when most people do the bulk of their motoring. The B.B.C.'s Sunday service hours are much more extensive now than they were last year. Further, a good built-in set should keep one in touch with quite a few of the Continental giants nowadays, and some of these can always be relied upon to provide creditable entertainment. These things being so, there seems to be quite a field for the motor-car set, and I expect that it will become fairly widely used in the future. I can testify from personal experience that, if you are engaged in a long lonely drive, a portable set on the seat beside you is an admirable companion.

QUAINT QUERIES

SOME amazing queries come my way at times, not from "A.W." readers, but from people who apparently never see a wireless paper. The other day I had a letter beginning: "I have a three-valver worked from the electric by an illuminator." Then there was a chappie who told me that his valves did not seem to be quite up to the mark in consequence of his having connected a 9-volt grid battery by mistake to the L.T. terminals. Could I suggest anything? "My set, which I bought second-hand in 1925, is excellent in every way except that it brings in several stations at the same time," is quite a common sort of opening remark by correspondents. And I genuinely did hear from a Scotsman who was annoyed because, when he bought a new high-tension battery, his dealer would not allow him anything in part exchange for the old one, which still showed 20 volts. As for inventors—er, well! Sometimes the fellow has designed a two-valve set which brings in all Europe on the loud-speaker; sometimes he has a scheme for recharging accumulators for nothing, which works out, when you come down to brass tacks, at about five times the cost of sending them to the charging station.

PERSONALITIES IN THE WEEK'S PROGRAMMES



On Your Wavelength! (continued)

ALL THE YEAR'S OUR SEASON

ONE or two makers, I am glad to see, are boldly launching entirely new sets at a time which used to be thought to be pretty well the end of the wireless season. The truth is that the wireless season now extends from January 1 to December 31 without a break and, once certain prejudices have been overcome, there is no reason why business in complete sets or in components should not be just as brisk during the summer as during any other time of the year, save one. There will always be a peak just before Christmas, since wireless sets make such admirable Christmas presents either to other people or to oneself. **AMATEUR WIRELESS** and *Wireless Magazine* have proved conclusively that spring and summer need not be slack seasons. Do you remember the "Century Super" and the "Super Sixty," when they first came out? They appeared, if I remember rightly, in April and they were made up by thousands of readers. In fact, business in the parts required for them produced something like a boom right through the summer.

OLYMPIOMANIA?

BOTH manufacturers and the public have been inclined in the past to attach too much importance to the Wireless Exhibition at Olympia. Manufacturers held up new lines and surprises until the exhibition, and the public ceased to buy sets in any quantity after about the end of March because of the idea that it was better to wait a month or two and be sure of getting up-to-date models. The result has been that in many cases factories have been working night and day for part of the year, though at other times they were so slack that a considerable proportion of the hands had to be turned off. This year there is a welcome tendency to even things out. Besides the introduction of new models in receiving sets, Q.P.P. and Class B, which in former years might have been reserved as exhibition surprises, are already with us, and before so many weeks are past we shall have many entirely new valves, including the high-frequency pentode and the double diode triode.

SUMMER-TIME RECEPTION

TWO other factors combine to extend the wireless season over the summer months. One of these is the coming of the high-powered broadcasting station on the medium and long waves; the other is the enormous developments that have taken place in short-wave transmission and reception. On the medium and long waves it will certainly be possible to receive alternative programmes from dozens of European stations right through the lighter months. You cannot, as a rule, go outside Europe with your wireless set during the summer; but at that time certain of the short wave-

lengths are often at their best, and with a short-wave receiver the world remains your oyster.

A SPEAKER HINT

A FRIEND came to me not long ago in considerable distress because his loud-speaker, which is a moving-coil of rather ancient vintage, was giving a nasty rattle and buzz on certain low notes now that he was trying to feed it with about two and a half watts undistorted output. It used to be quite all right when he put the juice into it from a one-watt valve. Questions elicited that he had the right transformer and had gone through all the proper "drill" to find out what was wrong. I therefore lectured him learnedly on resonance and told him he would have to get a new speaker. A week later he called me up and asked if I could come and hear his set next time I was in his neighbourhood as he had something he thought I would like to know. Naturally, I went as soon as possible, and found that he had completely cured the nasty noise. The speaker diaphragm was very thin, and he had stiffened it by pasting on the back, from base to apex, five strips of writing paper cut one-sixteenth of an inch wide. He said that, in addition to curing the bass buzz, it had improved the high notes slightly and, he thought, reduced the sensitivity a little. I am going to get hold of one of those old, very thin, diaphragms and experiment. Meanwhile, I pass on the tip for what it is worth. But don't forget that it is easier to paste strips on a diaphragm than it is to get them off.

MAN-MADE "RADIO"

I AM afraid a good deal of nonsense appears in print from time to time on the subject of "wireless" waves which are said to be radiated by the human body and to give specific indications—by their different wavelength or frequency—of actual disease or of a predis-

position to disease, or even of personal peculiarities, such as the kind of food which is most suited to the particular person concerned.

Now, I am not saying that the body does not send out radiation of a kind. It will certainly radiate infra-red rays so long as the blood is at the normal temperature. And there may be other electrical manifestations, since it is known that nervous impulses are all ultimately electrical in character. But I do say that there is nothing in our make-up which can possibly produce a surge of current sufficient to create a wireless wave of the kind used in even the shortest of short-wave transmitters, and therefore there is no human radiation of a wavelength sufficiently long to be detected—much less measured—by any type of instrument that can fairly be called a wireless receiver.

NEONS AND WIRELESS

I WONDER whether the increasing use of neon tubes is going to affect radio practice. A good deal of research work has been done in the past few years on the discharge of electricity through gases, and the very rapid growth of luminous signs in red, blue, green, and other colours, has resulted from this research work. In consequence of this, our knowledge of the discharge of electricity in various gases, such as neon, argon, and helium, is greatly improved, and I should not be at all surprised to see accessories produced for use in conjunction with valves for various purposes in the radio sets of the future.

ROAD SIGNALS

THE simple neon tube, with its property of discharging only when a certain critical voltage has been reached, is put to increasing use in ordinary every-day existence. I wonder how many people realise that some automatic traffic lights are operated by this very principle. Particularly interesting are the traffic-operated lights.

In a road which has the right of way (i.e., showing green) the mechanism proceeds to charge a condenser through a high resistance, and if nothing happens at the end of a certain time the voltage will reach a sufficient value to discharge through a neon lamp and operate the relay which changes over the lights. Every vehicle which passes along the road, however, operates a pressure pad set in the road, and this momentarily discharges the condenser to a small extent; so that it is set back, as it were, and takes a little longer to reach the critical voltage where the neon tube will discharge. Consequently, as long as there is traffic on that particular road the way remains clear and the light will only change when there is an appreciable break in the traffic.

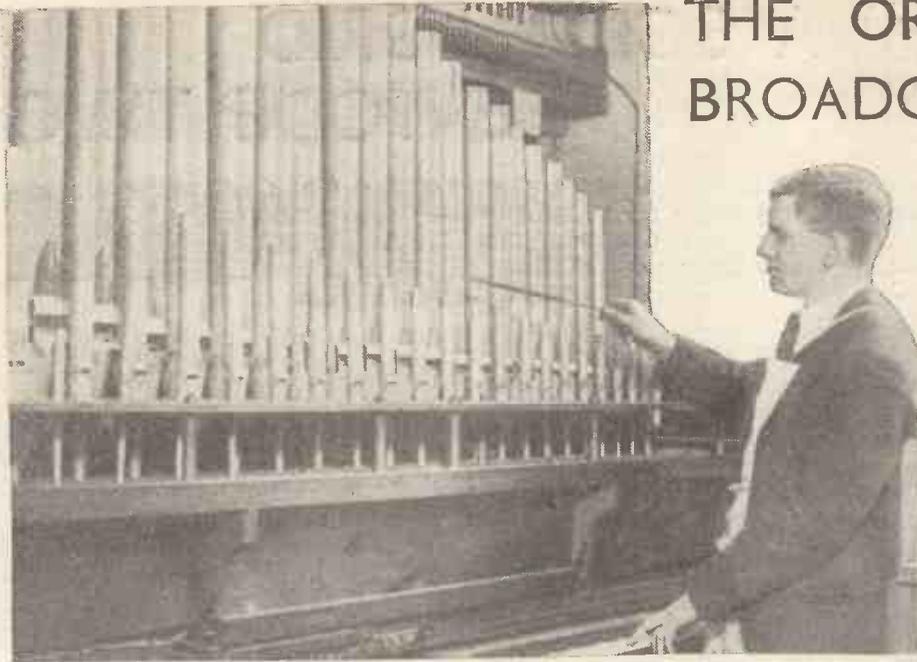
THERMION.

KEEP THEM TIGHT

Watch the wood screws which clamp the panel at right angles to the baseboard. They may work loose if the panel is not



supported by right-angle brackets, with the result that the panel may move and some of the wiring break loose at the back. Go over the wood screws occasionally and keep them tight



Testing the smaller pipes of the Broadcasting House organ. A temporary console is fitted below to control the wind to the pipes

GREAT strides have been made with the new organ since I last visited the Concert Hall at Broadcasting House. I should never have thought it possible to place any kind of organ in such small space and one so narrow. Most organ builders would have turned down the idea altogether as totally impracticable. Whether the John Compton Organ Company specialises in erecting large organs in small places or not, I cannot say; but it looks like it.

Having squeezed into a very narrow space behind the grid I was bidden to climb a vertical ladder. I found, to my profound interest as an organist, that the ranks of pipes usually forming stops were nowhere to be seen. It all seemed so different from my own instrument that I could hardly believe it was an organ.

Again, where were the usual bellows and feeders? There did not seem to be any of those, either. There are (as I mentioned in my last article on this organ) thirty-one

ranks of pipes. Each of these has a chest to itself. Consequently one passes nothing but these chests on one's way round.

I suddenly thought of the pedal organ. I have always held that an organ is not an organ unless it has a respectable pedal organ. I remembered they had told me at the works that there was to be a 32-ft. reed. Well, you cannot hide thirty-two-footers, however much you may wish to. I fell to wondering where the pipes were, but as I was jammed between the wall and one of those thirty-one chests, I had to wait until I had climbed another vertical ladder before I could ask the question.

Horizontal Pipes

When one thinks of 32-ft. reeds one conjures up visions of noble pipes soaring to the roof from either side of the console—or something artistic, at all events. I asked where they were. "They are right at the top," I was told. "If you can squeeze up this next vertical ladder you will

THE ORGAN AT BROADCASTING HOUSE

see them." Wishing I had gone on a diet for a few months and so reduced my proportions suitably, I ascended the ladder. And there, right along the wall in an horizontal position, were the pipes, not only of the 32-ft. reed, but of three 16-ft. pedalstops as well.

Of course, they will sound just as well that way as upright, but it was a shock to see them one above the other. When I go to play on the B.B.C. organ I shall have to forget that the very stops which are the bass and foundation of the music I play are in reality far above my head.

I saw nothing of the console. I did not ask, but I am sure it has not arrived yet. The Wireless Military Band was in the middle of a rehearsal in the Concert Hall, so that I could not go in to see. If it is not actually there at the moment, it soon will be. The idea of its being movable is one of the greatest points about that console. The organist *does* get a chance of being away from the instrument. I suffer from being too close to my own instrument and it is only when I hear others play on it that I really get any idea of how it sounds. You can imagine how fatal that would be when you take into consideration that strangers to the organ will constantly be broadcasting on it.

I hear that condenser microphones are to be used. They look like bombs to me. There is, however, a great advantage with them when compared with the carbon type; they do not cause blasting. With an organ that is very essential. It does not matter how careful a controller may be—or how watchful—an organist will catch him out some time or other. It is so easy to switch on the full power.

So much for a cursory glance at the instrument in its present stage. I hope, at some not too future date, to play on the completed organ and to give you some further impressions.

WHITAKER-WILSON.

"A SCREEN-GRID PENTODE TWO"

(Continued from preceding page)

results in a reduction of the voltage drop across the anode resistances, so that more voltage actually reaches the anode of the valves, which is desirable.

The coupling condenser is specified as .01 microfarad. If you want more bass you can get it by increasing the capacity to .1 microfarad. The .5-megohm grid-leak can be changed to 1 megohm without much difference. The grid stopper between the coupling condenser and the pentode grid should not exceed 50,000 ohms. If made much higher it will cut top notes.

Pentode Output Valve

The first point to note is the 10,000 ohms screen-grid resistance. This is not used so much for de-coupling, though it has that incidental advantage, as for keeping the

voltage on the screen or auxiliary grid lower than the anode voltage, thus economising total anode current. With the 1-microfarad fixed condenser it does also act as a de-coupling arrangement. Note that the third grid shown by the theoretical is internally connected to the filament.

Tone Correction

Almost certainly this will be required. It can be fitted inside the set or to the loud-speaker, whichever is more convenient. We suggest a 25,000-ohm resistance of the variable type and a .01-microfarad fixed condenser, the two in series across the speaker. The resistance can be fixed at 5,000 ohms as a good average, but much depends on the speaker and the baffle and allied conditions.

There is the usual fuse of 100 milliamperes in the lead between high-tension and low-tension negative. There is also a 2-microfarad fixed condenser between

high-tension negative and the maximum positive, this acting as a final reservoir for the battery voltage enabling the battery to be used to the last possible moment without intervening crackling.

We have now examined the circuit in every detail. The final work on construction is outside the scope of this feature, though it is simple enough even for the beginner. The assembled set will give good range, excellent selectivity and fine quality when used with a moving-coil loud-speaker.

An annual event of some importance to Manchester schoolchildren will be broadcast on April 6. This is a concert given by the Manchester Schoolchildren's Choir and Orchestra.

The third of "Our Northern Heritage" plays deals with the Siege of Lathom House, and has been written by Edwin Lewis for production on April 6.

WHAT THE "UP-TO-THE-MINUTE THREE" WILL DO

Amazing Results with a New-type Set

YOU will probably be surprised at the accompanying log of nearly sixty stations obtained with the "Up-to-the-Minute Three." This list was easily compiled during a four-hour evening test, which I carried out in South London about twenty-five miles from Brookmans Park.

A preliminary turn of the dial round the medium waveband firstly showed the amazing sensitivity of the set. So sensitive, in fact, is it that I switched over to a small aerial about 35 ft. long. Even then London Regional was so strong that the power valve was overloaded and it was necessary to reduce the screen voltage to 30.

VERY SENSITIVE—VERY SELECTIVE

Still using the small aerial I increased the screen voltage to 65 and tried the medium waveband for combined sensitivity and selectivity. Results were very surprising, being better than the average four-valver. Selectivity was almost up to super-het standard except, of course, in the immediate neighbourhood of the local stations.

The spread of London Regional was so small that both Hamburg and Strasbourg were easily received clear of interference—an amazing feat of selectivity for a set with three tuned circuits.

FREEDOM FROM INTERFERENCE

Getting plenty of stations is usually an easy task on the average modern set, but getting them at full loud-speaker strength with real entertainment value—that is free from irritating heterodyne whistles and sideband

splash—is a different story! This is where this new set scores.

As a conservative estimate I should say that thirty to thirty-five stations were obtained *really well* during my four-hour test. One could sit down and thoroughly enjoy the programme from each of those stations. Entertainment value is the crucial test of a set nowadays.

Rome, Breslau, Poste Parisien, Stockholm, Hilversum, Trieste and Heilsberg are typical examples of the foreigners received giving entertaining reception. From this it follows that there is no difficulty in separating adjacent high-power stations.

The amateur who revels in spending hours roaming the ether for the sole purpose of logging stations regardless of associated noises will find countless hours of amusement in turning the dial of this set.

On the long waveband Zeesen—or Königswusterhausen, as the station is sometimes

"Better than any battery set I have yet tested"

called—was the only station not free of interference. It was troubled by "twitter" from Daventry and Radio Paris. I heard preliminary tests from the new high-power station at Luxembourg. The strength of the signal was quite as loud as Daventry National. Luxembourg will be the powerful station on the long waveband when it is brought into permanent use.



The "Up-to-the-minute Three" is of fine appearance and has the "A.W." guarantee behind it

SIMPLE TUNING

I must stress one great feature of this set that is important. This is the extreme simplicity of tuning. You have one tuning knob and a reaction control and most stations do not require use of the latter control. Could tuning be simpler?

Both wavebands cover fairly large wave ranges. On the long waveband the range is from 1,000 to 2,000 metres and the medium from 220 to 600 metres.

Quality—rather an elusive thing to describe. It depends such a lot on the listener's personal tastes and the loud-speaker used. With a Rola permanent-magnet reproducer I found quality well balanced and very pleasant.

Concluding this report is a simple matter. The set, in my opinion, is outstanding. It worked better on test than any battery set I have yet tested. T. F. H.

Constructional details of the "Up-to-the-minute Three" are on page 578 of this issue

LIST OF STATIONS RECEIVED

Wave-length	Station	Dial Reading	Wave-length	Station	Dial Reading	Wave-length	Station	Dial Reading	Wave-length	Station	Dial Reading
Long Waveband											
1,083	Oslo	17	238.9	Nurnberg	4	321.9	Goteborg	27	408.7	Katowitz	53
1,154	Kalundborg	23	245.9	Common wave	5	325	Breslau	28	413	Athlone	55
	Luxembourg	25	247.7	Trieste	6	328.2	Poste Parisien	29	419.6	Berlin	56½
1,304	Moscow	35	253.1	Gleiwitz	7	331.5	Milan	30	435.4	Stockholm	60½
1,348	Motala	38	257.1	Horby	8	338.2	Brussels No. 2	32½	441.2	Rome	62
1,412	Warsaw	41	261.5	London National	10	341.7	Brno	34	459.4	Beromuenster	67
1,446	Eiffel Tower	45	269.8	Bari	12	345.2	Strasbourg	35	472.4	Langenberg	70
1,554	Daventry	55	273.7	Turin	13	355.9	London Regional	38	480	North Regional	72
1,635	Königswusterhausen	60	276.5	Heilsberg	14	372.2	Hamburg	43	488.6	Prague	75
1,725	Radio Paris	65	278.8	Bratislava	15	376.4	Scottish Regional	44	500.8	Florence	77
1,875	Hilversum	76	288.3	Scottish National	17½	381	Lvov	45	509	Brussels No. 1	78
1,935	Kaunas	80	296.1	Huizen	19	385.1	Toulouse	46	517	Vienna	80
Medium Waveband											
223	Fécamp	1	301.5	North National	21	389.6	Leipzig	470	533	Munich	83
			304	Bordeaux	22	398.9	Midland Regional	50	542	Sundsvall	85
			312.8	Genoa	24	403.8	Sottens	52	550	Budapest	87

DO YOU KNOW—

THAT a moving-coil loud-speaker should not be worked without a dust cover over the moving-coil and magnet-pole gap? A dust cover prevents any dirt getting in the gap and causing scratching noises.

THAT with a mains set, using mains-heated valves, there is a short delay before anything is heard after switching on, as the heaters take several seconds to warm up? No adjustment should be

carried out to the set in the meantime or a condenser breakdown may result. The full high-tension voltage is applied to the valves in spite of the fact that there is no filament emission (and therefore no anode current flowing) until the heaters warm up.

THAT battery leads can be shortened by looping them back and tying together with small rubber bands? This is much better than cutting the leads, if the alteration is

only a temporary one. If the wires are cut there is always a possibility of wrongly connecting the wander plugs and spade tags.

THAT trimmers on ganged condensers sometimes stick down so that the vanes do not separate when the trimmer knob is slacked off? This will give faulty ganging and shows that the trimmers of some condensers need occasional inspection.

FAULTS—AND HOW TO PREVENT THEM

In wireless, as in most other things, prevention is better than cure. An immense amount of time and trouble can be saved, in the long run, by taking steps to prevent faults which, if allowed to develop, might be decidedly difficult to locate and remedy.

Reliable, trouble-free reception can be secured quite

WIRING PRECAUTIONS

FAULTS in the internal wiring of a set may be due to short circuits or to ineffective contact in the joints and connections.

Risk of "shorts" can be almost entirely eliminated by taking one or two simple precautions. First, use proper insulated connecting wire, instead of the bare variety, for all internal wiring. Secondly, when connecting up flexibles, such as battery leads, remember to see that no loose strands of flex are left sticking out from the ends of the insulating covering, as these may touch bare portions of adjacent leads or terminals and cause more or less disastrous "shorts." Thirdly, see that there is ample clearance between all wires and moving parts such as condenser vanes, etc., to avoid any possibility of the latter coming into contact with the wiring and rubbing the insulation off.

SOME SOLDERING HINTS

WHEN soldering connections, attention to the following points will help to eliminate risk of faults developing after the set has been put into use: (1) The metal surfaces to which wires are to be joined should be clean and bright, and after smearing with a trace of flux, should be well tinned; (2) the soldering iron should be clean, well tinned and not too hot; (3) good, non-corrosive flux should be used, as sparingly as possible; (4) joints should be made quickly and cleanly; (5) any wires that show the slightest tendency to "come unstuck" should be re-soldered; (6) after soldering, the whole of the work should be gone over thoroughly with a clean rag, and every trace of flux carefully wiped off the metal and insulating surfaces.

FAULTY CONTACT

TROUBLES due to faulty contact can be eliminated by making sure that every joint and connection is firm, sound and clean. This calls for a little extra

time and care in the initial wiring-up of the set, but it saves no end of trouble afterwards.

Experience shows that, in actual practice, there is not very much to choose between soldered and solderless connections, provided that both are made with equal care.

In making solderless connections, any risk of poor contact can be avoided by seeing that the wire loops, which go over the stems of the terminals, are clean and bright, and by screwing down the terminal nuts as reasonably tight as possible.

The loops should, of course, pass in a clockwise direction round the stems of the terminals so that the rotation of the nut in tightening up will cause the loop to grip even more firmly, instead of forcing it open.

CLEANING COMPONENTS

NEW components are often dusty when one buys them from a local dealer, especially if they have been exposed in the shop window or on the shelves. Variable condensers, for instance, sometimes have an appreciable deposit of dust between the vanes, even when brand-new, resulting in crackling noises sooner or later. It is always advisable, therefore, to examine all new components and carefully remove any dust that is on them before building them into the set. Once they are wired up in, perhaps, an inaccessible position, they may be difficult to dust properly.

If, however, all the components in a set are perfectly clean in the first place, and the cabinet is reasonably dustproof, no trouble is likely to arise through dust accumulating on them while the set is in use.

GUARDING AGAINST DUST AND DAMP

MANY wireless cabinets that appear to be damp-proof and dust-proof, are very far from being so when actually put to the test. Often, however, it is an easy matter to remedy the defects by closing up cracks with some such

easily, with any reasonably efficient set, if one takes simple precautions to guard against faults developing. The practical hints which follow point to the loopholes through which faults may creep into the set, and indicate steps which can be taken very easily by every set-user to ensure almost complete immunity from breakdown.

preparation as plastic wood, and fitting wooden fillets around the edges of lids, panels, etc., to exclude dust and damp.

If the set is installed close to a window, it is particularly important to take these precautions.

COIL TROUBLES

THE development of faults in home-made coils can usually be prevented by taking suitable precautions when winding and constructing the coils. When cotton-covered wire is used, for instance, one should see that the cotton covering is perfectly dry. If the wire has been stored in a damp atmosphere, it should be dried out thoroughly before being put into use.

If the wire is wound on a paxolin tube, it is a good plan to seal up, with a little melted wax, the small holes through which the wire is threaded to "anchor" the ends of the winding; this prevents the corrosion that sometimes occurs at the point in question, ultimately resulting in the wire being eaten right through.

When building a set, it is advisable to test dual-range coils to make sure that the wave-changing switches are making perfect contact, as any defects in this respect are generally much easier to remedy beforehand than if left until the coil is actually mounted and wired up in the set.

POTENTIAL FAULTS

THERE is a good deal to be said in favour of testing all components before building them into a set. Naturally, this thorough preliminary testing causes some delay in assembling the parts, but it often proves to be a time-saver in the long run, by revealing potential troubles which might prove very baffling to trace on completion of the receiver.

DECOUPLING PRECAUTIONS

MANY sets work so perfectly without any decoupling at all, when newly built and fitted

with new batteries, that one may be tempted to cut down initial cost by omitting decoupling resistances and condensers.

Admittedly the provision of devices for thorough decoupling of all H.T. circuits is a comparatively expensive item, as it is essential to use first-class components for the purpose, in order to avoid risk of breakdown. It rarely pays in the long run, however, to neglect decoupling precautions, as this invariably results in the development of such troubles as "motor-boating" when the set has been in use for some time and the H.T. battery begins to show signs of deterioration.

FAULTS IN THE FILAMENT CIRCUIT

INEFFECTIVE contact, due to corrosion and sulphate deposit on accumulator terminals and L.T. spade tags, is frequently a cause of poor reception or hissing and crackling noises. The trouble can usually be prevented by using lead-coated spade tags for the L.T. wires. Corrosion of the flexible wires themselves due to acid creeping up from the terminals, can usually be prevented by a little judicious smearing of vaseline over the spade tags where they meet the insulating sleeves or tubes covering the ends of the battery leads.

PREVENTING AERIAL AND EARTH FAULTS

IF an outdoor aerial is used, risk of faults developing can be minimised by keeping the insulators and earthing switch clean, using enamelled wire in preference to the bare kind (to retard corrosion), and seeing that the wire is free from strain or chafing which might cause breakage in a high wind.

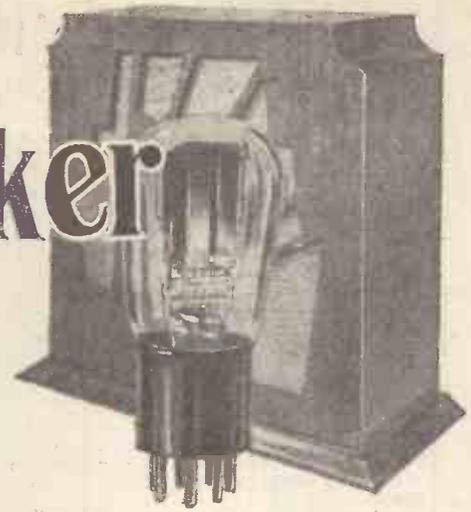
The most vulnerable part of an outdoor earth, as a rule, is the point of connection to the buried metal plate or tube. If this connection is kept sound, clean and free from corrosion, there is little likelihood of trouble developing.

W. OLIVER.



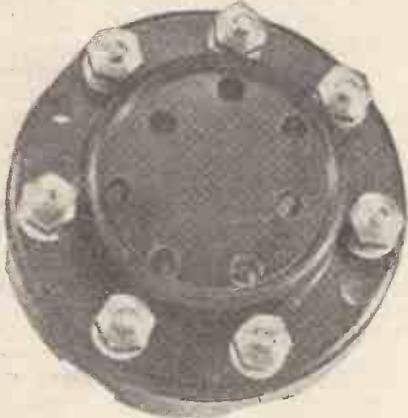
The Class B Valve and Your Speaker

One of the great advantages of the Class B system is that successful results do not depend upon very careful matching of the loud-speaker to the valve. At the same time, it is obvious that there is a best impedance of loud-speaker to use under different conditions. J. H. Reyner discusses this matter below.



FOR output measurements it is usually preferable to work with the anode current-anode voltage characteristics, and Fig. 1 shows these for the Cossor 240B valve. They will be seen to be very similar to those of a pentode. Thus we have a somewhat similar state of affairs to that obtaining in a pentode, namely, that the power output tends to increase as the anode load is increased up to a certain optimum value beyond which distortion becomes troublesome. A further examination of the characteristics shows that the conditions are somewhat different according to the manner in which the valve is used.

Let us examine, first of all, the full output conditions for this particular valve, that is, with a 20-volt peak grid swing. Under these conditions the optimum load is approximately 2,000 ohms, as will be seen from the load line for this value. With this load the anode currents at grid voltages of 5, 10, 15 and 20 are approximately 11, 23, 35 and 46 milliamps respectively. These values are practically in the proportions 1, 2, 3, 4, as they should be,



This is a holder for the Class B valve. Note that there are seven sockets and the valve is provided with seven pins, although only six of these are used for connections

indicating that this condition will give very small distortion.

At the full 20 volts peak we have an anode current change of 46 milliamps and an anode voltage change of 90 volts, which corresponds to an output of 2.06 watts.

We must arrange our output transformer, therefore, to give us the equivalent of 2,000 ohms for each valve or each half of the complete valve, whichever way you prefer to look at it. Remember that only one valve is working at a time and that the power supplied to the loud-speaker comes

alternately from one and then the other. Because of this I always find it convenient to regard each valve separately. Fig. 2 shows the output transformer circuit and we can regard each half of the primary separately in conjunction with the secondary winding for our present purpose.

If our loud-speaker already has an impedance of 2,000 ohms, then the winding A B should have the same number of turns as the secondary winding X Y. The next half-cycle, when the bottom valve is in operation, we have the power transferred

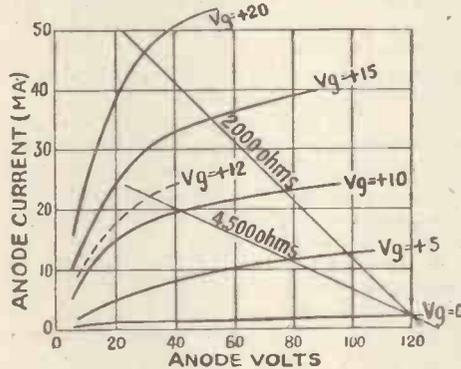


Fig. 1. The anode-current anode-volts characteristics of the 240B valve

from the winding B C to the secondary X Y; so that B C must also have the same number of turns, and therefore the total primary winding has twice the number of turns on the secondary.

Some people find it more convenient to consider the output transformer as a whole. In this case we have a 2:1 step-down transformer with 2,000 ohms across the secondary, which is equivalent to 8,000 ohms across the primary. We say, therefore, that the optimum condition for a 2-watt output from the 240B is 8,000 ohms anode-to-anode load. It does not matter which way you actually look at it, and you will sometimes find one way convenient and sometimes the other.

Matching

This brief discussion, although perhaps a little advanced, should make clear the mechanism of matching the loud-speaker to the Class B valve. If you are using a moving-iron or balanced-armature speaker, then you should obtain some average impedance figure from the manufacturers and use an output transformer having a ratio equal to

$$\sqrt{\frac{8,000}{\text{speaker impedance}}}$$

Most moving-iron speakers have an impedance of about 2,000 ohms, and can therefore be used with a 2:1 step-down transformer of the type just described.

Moving-coil speakers are usually made with low-resistance coils to-day, in which case a very much higher step-down ratio is required. In these cases, however, the transformer is usually incorporated in the speaker itself, and all you need to ask for, therefore, is a speaker having a total primary impedance, from outer to outer, of 8,000 ohms in order to match with this valve.

Alternative Methods of Connection

Now let us consider some alternative methods of connection. Sometimes one does not require as much as 2 watts output. There are two ways in which the valve can be used to give smaller outputs than this. One of these is to use the valve on 100 volts only, instead of 120. Then with the same load, but limiting the input swing to 15 instead of 20, it is possible to obtain a little over 1 watt output. This is rather a convenient arrangement, because one can use a battery having 120 volts, but normally employed on the 100-volt tap. Then, without any alteration beyond changing the H.T. plug from 100 to 120,

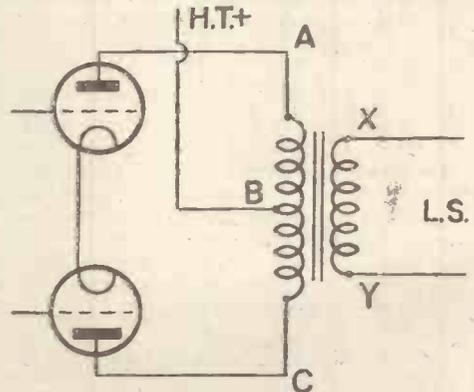


Fig. 2. The output transformer circuit

the maximum output may be increased from 1 to 2 watts. The converse is also true, namely, that if the circuit is arranged for 2-watt working it will still work satisfactorily and without distortion, although, of course, with less power output, when the H.T. voltage has fallen to 100 or even less.

(Continued at foot of next page)

FITTING RADIO TO YOUR CAR

Some Useful Hints on getting the Best Results

THE practice of having a good wireless set built in as a fixture on the car has become so popular in the United States that it is probably inevitable that it will



Fig. 1. The type of resistance for fitting to spark plugs

soon become a feature in this country. There are already on the market one or

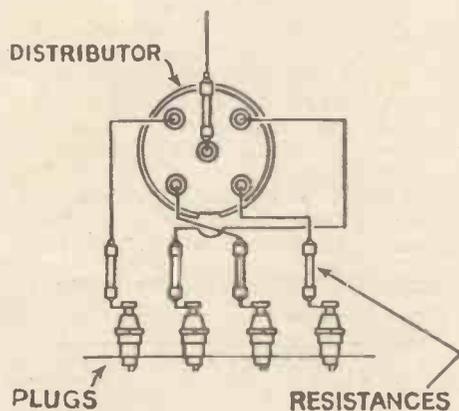


Fig. 2. This diagram shows how the resistances are connected in the ignition circuit

two commercially produced motor-car receivers.

The purpose of this article is not the design of such a set, but a review of the difficulties which must be overcome before

any set can be satisfactorily used on a motor car.

The question of aerial and earth comes to mind first, but actually the problem is not at all difficult. The type of set generally used has two or three screen-grid H.F. stages, and a comparatively short length of wire is adequate. In the saloon type of car it is usual to run the aerial in the form of a square spiral concealed in the roof. The earth should be a counterpoise, not an actual connection to the frame of the car.

Preventing Interference

The most serious problem is the suppression of interference from the electrical system of the car, and the method of dealing with the trouble is by the use of large-capacity fixed condensers and fixed resistances.

The battery-charging dynamo is a common source of interference due to sparking at the brushes. To cure this first of all see that the commutator is clean and that the brushes bed firmly, and then connect a 1-microfarad condenser across the two terminals of the dynamo. It is important to have this condenser as close to the dynamo as possible.

The spark occurring when the ignition coil or magneto make-and-break opens also causes noise, which can be cured by the use of a 1-microfarad condenser connected from the primary of the coil or magneto to the frame of the car.

Fully 90 per cent. of the interference comes from the ignition sparks at the plugs. The sparks generate waves which are radiated by the spark-plug leads. The cure is to insert suitable resistances in series with each spark plug and the distributor. These resistances, such as the Dubilier and Erie, are usually of 15,000 to 20,000 ohms; they damp out the high-frequency oscillations set up by the spark.

Owing to their proximity to the engine they must be proof against heat, oil and moisture. Fig. 1 shows the type of resistance fitted to the plugs, and Fig. 2 gives a diagram of the resistances and condensers correctly connected.

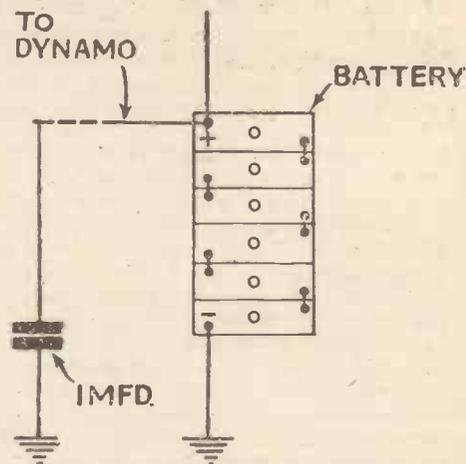


Fig. 3. Condensing the unearthed side of the battery will assist in reducing unwanted noises

There are other sources of noise which are all in the nature of poor contacts and which should be covered by proper care of the car. Such points as corroded or loosened battery terminals, lamp socket contacts, loose fuses, switch contacts should all be inspected and made in good order. Fig. 3 shows a condenser fitted between the unearthed side of the battery and the frame of the car. This will assist in reducing noises made by uncertain contacts. Provided that the electrical system is thoroughly dealt with as described above, wireless reception in the car can be quite free from noise and as satisfactory as listening in your own home.

"THE CLASS B VALVE AND YOUR LOUD-SPEAKER"

(Continued from preceding page)

A further advantage of this 100-volt working is the reduction in the standing anode current. With 120 volts the standing anode current for the two halves of the Class B valve together is about 3 milliamps and the driver valve takes a further 3 to 3½, making about 6½ milliamps steady current. With the 100-volt condition the total current from driver and Class B valve is in the neighbourhood of 4 milliamps only, which is quite an appreciable reduction.

There is, however, still another method of using this valve where an output of a little over 1 watt is sufficient. This uses 120 volts H.T., but limits the input swing to 12 volts. Now, if you will refer to the characteristics you will see that it is possible to increase the load very considerably if this limitation of input is applied, and, in fact, with an anode load of 4,500 ohms the operation is still practically free from

distortion. Under these conditions an anode current change of 22 milliamps is obtained with an anode voltage change of 100, which gives an output of 1.1 watt.

The advantage of this method of operation is an increased sensitivity. With the 2,000-ohm load an input of 12 volts only gives about 600 milliwatts, whereas with the increased load we are obtaining very nearly twice as much. On the other hand, very unpleasant distortion will set in if this grid swing is exceeded to any appreciable extent; so that the output is quite definitely limited with this method of working. Many people, however, feel that 1 watt is quite adequate and prefer to use the valve in this condition.

Transformer Ratios

For this condition, therefore, the optimum load per valve is in the neighbourhood of 4,500 ohms, which corresponds to an anode-to-anode load of 18,000 ohms. This requires a step-down ratio 1½ times as much before. Therefore, if a 2 : 1 ratio is used for the 2-watt working (or the

100-volt 1-watt working case) the ratio now should be 3 : 1 and correspondingly. Alternatively, where the loud-speaker has its own built-in transformer the total impedance on the primary side should be, 18,000 ohms for optimum results.

Incidentally it may be remarked that the Mullard PM2B, which is just about to be released, is designed to operate under these conditions. As far as can be gathered from advance information, it requires an anode load of the order of 4,000 to 5,000 ohms per valve and will give an output of a little over 1 watt with an input swing of 12 volts. Within the next week or two, however, this valve will also be on the market, and I hope to give definite characteristics and operating data.

Based upon Robert Browning's "Pied Piper of Hamelin," a lyric drama in one act, entitled *The Piper*, by Herbert Ferrers, is to be revived in the National programme on April 7 and the Regional programme on April 8.

OUR BROADCAST CRITIC



MABEL CONSTANDUROS

HINDEMITH WEEK

WERE we supposed to be having a Hindemith week, or not? And if so, why? What have we done that we should have him after supper on Sunday night, the whole of Wednesday evening, and again on Friday? He makes very poor broadcasting!

I must own to having listened in spasms only. The unpleasant dissonances try my patience far too much for me to listen for long at a time. I always come to the same conclusion, namely that this is cacophony and not symphony, and that it has nothing to do with the proper faculty of music. It is written by those who are unable to write melody and reasonable harmony, and is enjoyed by those who, I suppose, imagine they are members of the intellectual aristocracy of England. I say that without hesitation because I have examined many of the scores. Cacophony is a phase, but I shall be glad when it has passed.

The oratorio *Das Unaufhörliche*, translated as *The Perpetual* or, perhaps, better, *The Eternal*, was quite one of the most unpleasant works to which I have ever listened. It should have been called *Perpetual Gloom* or *Eternal Misery*. I consider it gross waste of time and money to broadcast a work of that nature, demanding four soloists, the B.B.C. Chorus, a chorus of boys from two London parish churches, and the B.B.C. Symphony Orchestra.

As for the effusion called *The Lesson*, given in the concert hall at Broadcasting House on the Friday evening, well... I was faintly amused because a work, supposedly serious, included a comedian. Harry Tate was well cast because he passed some of the time in his amusing manner. As for the humour itself it was the sort of heavy stuff that might appeal to the average German mind. It was no good for English listeners who are so advanced in the matter of humour (compared with the Germans) that the lines seemed merely silly.

The sooner Broadcasting House takes a strong line and helps to stamp out ultra-modern cacophony, instead of foisting it on listeners on every possible occasion, the sooner will broadcasting improve. This so-called music is *not* music.

Du Garde Peach's *Three Soldiers* was a strong play. The dialogue was everywhere natural—indeed, the whole production was powerful but not in the least forced. The question of unemployment was argued out in a convincing manner, and listeners must have been left wondering whether it did result from the War or not. *Three Soldiers* was as much a debate as a play, but the dramatic side gave it greater

broadcasting value than would have been the case had the sentiments been offered in the terms of an ordinary debate. We are learning to rely on Mr. du Garde Peach for plays with deep thought behind them.

I did not hear the Wednesday night vaudeville, but I heard reports of it. The complaint was that there was nothing outstanding except Mabel Constanduros' and Michael Hogan's broadcast which, I understand, was as good as ever.

On the other hand, I did hear the Saturday night "Music Hall." The experience left me wondering which of two methods I dislike the more: (1) having to wait for fifty minutes before anything worth hearing comes on, or (2) hearing two good items at the beginning and having to listen for (say) forty minutes in the hope that there will be something else good at the end. The "Music Hall" of Saturday night was in the latter class.

Stanley Kirby and Harry Hudson began the programme with an amusing song called "Any girl from anywhere, so long as she's a real nice girl." Good sentiment, that! Their other song was really clever. Its title was something like "We've got the married-man blues."

Four of us were listening to this vaudeville. After this item we looked at each

PROGRAMME POINTERS

There has been an improvement in the Epilogues. Instead of Scriptural excerpts there have been quotations from Thomas à Kempis. That, I think, is a step in the right direction. Even though distinctly religious in style and thought, the "Imitation" has a philosophy about it that may appeal to a wider public than readings from actual Scripture. On the other hand, I still venture to point to the value of an alternative Epilogue based on philosophy distinct from religion. I firmly believe that really fine Epilogues would be written specially if the B.B.C. asked for them. It seems simple enough to have a Churchman's moment on one side and Everyman's moment on the other. I wonder the suggestion has not been taken, and point once again to the fact that a great opportunity is being missed. Can it not be tried for a month or so and opinions be solicited?

other and said, "If it is all going to be as good as this we shall not complain." Then Ben Osborne and Nellie Perryer came to the microphone and told us what happened to them when they purchased a third-hand Ford car for five pounds. The way they did it made excellent broadcasting.

Cicely Courtneidge sang far too much and said far too little. I must write her a little note. "Dear Cicely, please be funny all the time next time; you *can* be, because I've heard you. Then I shall be Ever Yours."

Eve Becke let off two or three of those marvellous modern rhythm-songs. Silly words, sillier music. Why not something *clever*?

Sam Mayo sang novelty songs like "The roast beef of old England" and "Where do the flies go in winter time?" as well as some others that hardly mattered. He had them announced by some babyish nursery rhymes which made them rather feeble.

Florrie Forde, as the last broadcaster—the last I heard—*should* have been the best, judging by former methods of programme arrangement, but her song "Jolly old pa, jolly old ma, jolly good pals are they" was about as useful as you would expect from the title.

"Seven Days' Sunshine" was a splendid show. Very funny all through. Bobbie Comber as the old gentleman—the usual board-ship bore—was first-rate. Floy Penrhyn and Percy Parsons as the Americans, Renee Mayer and Claude Hulbert as the superior young lady and her young husband were most attractive. The whole cast seemed happy and it also seemed that the production had been written specially for them. We can do with more of this type of light entertainment.

The *Introduction and Allegro*, by Arthur Bliss, broadcast in the Sunday night concert, proved delightful. Modern—very modern in places—but always reasonable. I am glad *someone* knows where to draw the line. Modern harmony is so attractive when used reasonably that it is a wonder more of our composers do not realise its possibilities. Mr. Bliss certainly scored a good work and a success at the same time.
WHITAKER-WILSON.

The Chamber Music concert by the Henry Holst Quartet in the Imperial Hotel, Birmingham, on April 11, is being relayed to Midland listeners.

OUR UP-TO-THE-MINUTE

EMBODYING IN RADIO-FERRO THREE BY W

coil and that a separate aerial coil is used for the long wavelengths. The result is that the tuning is accurate over both wavebands and changes in the capacity of the aerial do not affect the results.

Owing to the efficiency of the coils a low aerial tap can be used, with the result that the aerial load does not materially affect the selectivity.

On the other hand, when the circuit is tuned in to a signal, a relatively large voltage is built up across the ends of the circuit. The special coils, therefore, tune more sharply than ordinary coils and there is a larger voltage for the grid of the first valve.

FERROCART COILS

This is a very good starting point for a set. I have always found that if you put a good selective circuit between the aerial and the first valve, and the circuit also supplies relatively strong signals, then the set will put up a good performance provided, of course, that the rest of the set is satisfactory.

With a poor input circuit, however, the results are likely in any event to be not too good.

The Colvern coils are made in two sections for the medium and long wave-



This is a rear view of the completed "Up-to-the-Minute Three" which incorporates two of the latest radio developments, Ferrocart and Westector

Below is the section of the receiver where the Westector is fitted

IT is a great pleasure to be able to describe the construction of a receiver having a performance so greatly in advance of good standard sets as this.

It is particularly true when the new set is easy to build and costs little for components. We have here a set with three valves and a Westector.

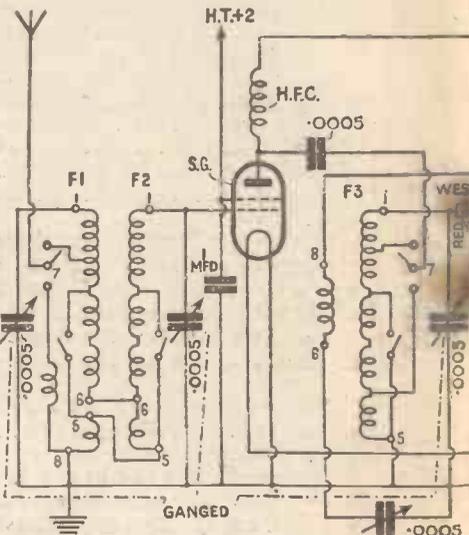
There are three sharp tuning circuits, with a three-gang condenser a reaction control and the switches.

EASY TO BUILD

Nothing could be easier to build or to operate, yet the results are far above those to which we have been accustomed.

The circuit diagram shows the connections. There is first an aerial-circuit input filter. The two sets of coils are coupled by a small coil and the characteristics of the two coils and the common coupling are such that extremely sharp tuning is obtained over the whole range.

It will be noted that the aerial is connected to a tap on the medium-wavelength



Here is the circuit of the "Up-to-the-Minute Three" Westector and then the low-frequency amplifier are used and a t



WESTECTOR

NUTE THREE

TWO OF THE LATEST DEVELOPMENTS ROCART AND WESTECTOR, THIS LATEST JAMES GIVES FOUR-VALVE RESULTS

lengths. These two sections are mounted upon a single base to form a unit with a detachable cover. The coils are accurately adjusted, as they must be, if advantage is to be taken of the low-loss construction.

From this it also follows that the gang-tuning condenser must be of sound design and also be accurately matched. The three-gang condenser used is a sound job and has a good drive. This, too, is important, for the tuning is so sharp that the mechanical drive must be sound, not having slip or a jerky movement.

A gang condenser that is not accurate should not be used, as you may find the circuits are in tune in one position and a bit out of tune in another. This would lead to broad tuning and loss of sensitivity. For these reasons a good gang condenser was chosen for the set.

The anode of the screen-grid valve has a high-frequency choke connected to it and this is coupled by a small condenser to the tuned grid circuit.

It should be observed that the anode circuit goes to a tap on the grid coil. This is to maintain the selectivity and to improve the magnification. But the Westector is taken to the top of the coil.

Its damping is very little in the way it is used and I found that the volume was a little greater than when it was joined to the tap. Now I want to make it clear

that the Westector was joined to the top of the coil for the best all-round results.

If you want a little more selectivity the Westector can be joined to the side of the coupling condenser going to the tap, but the overall sensitivity is reduced a little. Actually, I thought the tuning was rather too sharp with the Westector joined to the tap, but it is easy enough for anyone to try this for himself.

There is a 1-megohm resistance between the Westector and negative. The best valve is a low-frequency amplifier. A small amount of high-frequency is allowed to get through to the valve and the reaction condenser is connected to the reaction coil and to the anode of this valve. A by-pass condenser is also fitted.

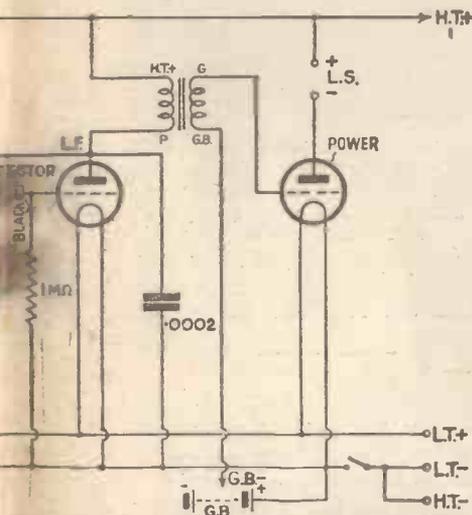
CIRCUIT DETAILS

This circuit is an interesting one. The valve has the full voltage of the high-tension applied to it and magnifies very well.

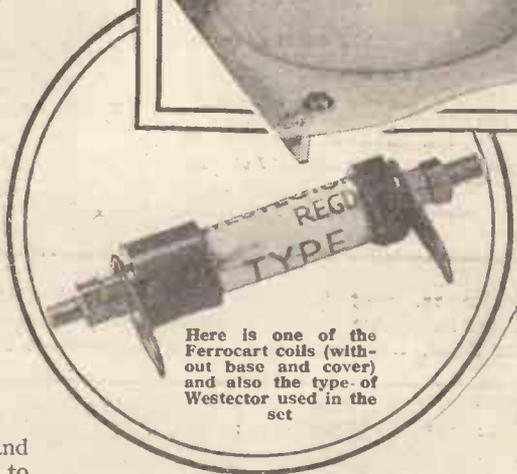
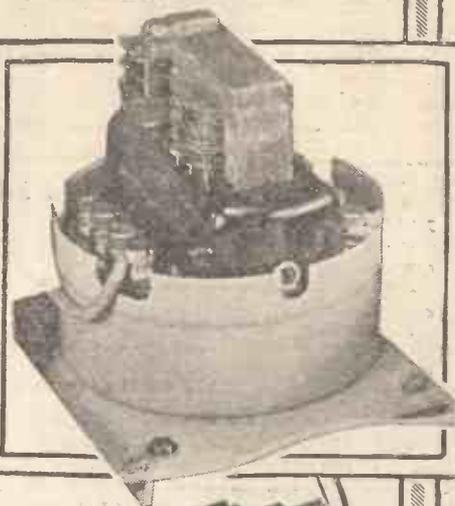
The output is taken to a triode power valve. You can easily fit a pentode if you prefer, but those who have tried the set think that with a triode there is all the magnification required.

A common high tension is used to all circuits except the screen of the screen-grid valve and this has a separate tap. It can be adjusted to obtain the greatest magnification.

The set has the tuning control in the centre, with the wavelength-range switch on the left and the reaction on the right. There is a filament switch at the back of the set, which you can put on the front panel if you prefer it there, but I thought it rather up-set the layout.



It has a screen-grid stage followed by the power and finally the power stage. Ferrocart coils and three-gang condenser

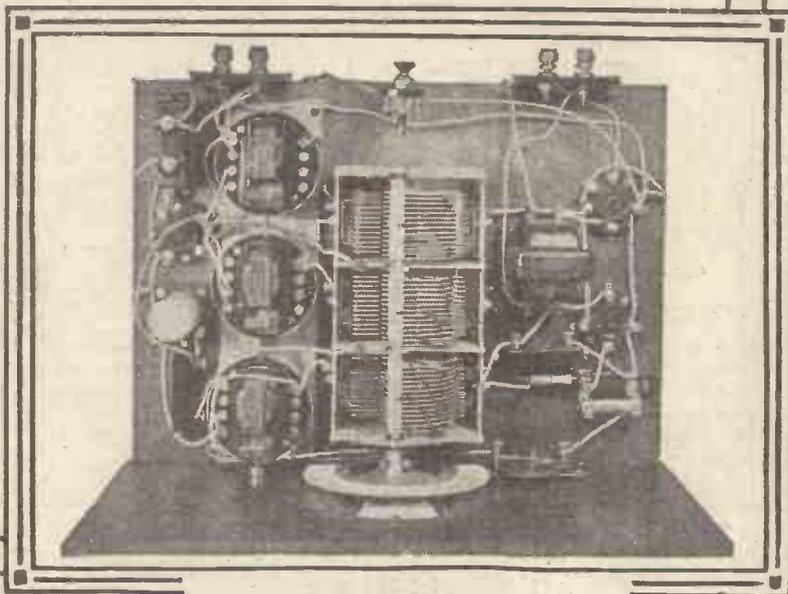


Here is one of the Ferrocart coils (without base and cover) and also the type of Westector used in the set

The parts are arranged upon the baseboard in a very convenient way, with the three-coil unit on the left, the gang condenser in the centre, and the Westector, first low-frequency valve and power valve on the right.

Essential wires are, therefore, quite short, as they should be, and the only long wires are the ones that don't matter, such as the filament and reaction wires

Thus there is very little to do in the



Compare this plan view with the wiring diagram overleaf

A NEW-TYPE SET!—FERROCART AND WESTECTOR (Continued from preceding page)

assembly or wiring. The layout and wiring diagram shows the exact positions of the parts, but there is nothing critical about these.

For ease of construction you should get the full-size blueprint, which can be

received the set full size and shows all the wiring very clearly.

The results given by the set are truly remarkable. Just now is not the ideal time of the year to see how many stations can be obtained, but will say that I have

tuned in exactly, for either side of the correct tuning point the strength falls off rapidly, as you would expect with such sharp tuning.

I always recommend a good aerial and earth in order that the ratio of signal

COMPONENTS REQUIRED FOR THE "UP-TO-THE-MINUTE THREE"

BRACKET

1—1½-in. (Bulgin, Wearite).

CHOKES, HIGH-FREQUENCY

1—Screened (Wearite, Kinva, Goltone, Bulgin).

COILS

1—Ganged set of two bandpass and one tuned-grid (Colveru Ferrocart, F1, F2 and F3).

CONDENSERS, FIXED

1—1-mfd. (Lissen, T.C.C., Dubilier, Ferranti, Telsen, British Radiophone).

1—.0005-mfd. (Lissen, T.C.C., Dubilier, Telsen, Graham Farish).

1—.0002-mfd. (Lissen, T.C.C., Dubilier, Telsen, Graham Farish, British Radiophone).

CONDENSERS, VARIABLE

1—3-gang with disc drive (British Radiophone, type 3345).

1—.0005-mfd. reaction type (Lissen, Graham Farish, Ready Radio, Polar, Utility, Ormond, Telsen).

HOLDERS, GRID-LEAK

1—Horizontal (Lissen, Bulgin, Graham Farish).

HOLDERS, VALVE

3—4-pin (W.B., Telsen, Lotus, Lissen, Bulgin, Ready Radio, Graham Farish).

PANEL, BASEBOARD, ETC.

1—Ebonite panel, 14 in. by 7 in. (Bacol, Lissen).

1—Baseboard, 14 in. by 10 in. (Peto-Scott).

RECTIFIER

1—Type W4 (Westinghouse "Westector").

RESISTANCES, FIXED

1—1-megohm (Lissen, Erie, Dubilier, Graham Farish, Claude Lyons).

SWITCHES

1—2-point filament (Bulgin, Lissen, W.B., Sovereign, Telsen).

TERMINAL BLOCKS, TERMINALS, ETC.

2—Terminal blocks (Sovereign, Belling Lee, Lissen, Junit).

4—Terminals, marked Aerial, Earth, L.S.+, L.S.— (Belling-Lee, Eelex, Clix).

0—Wander plugs, marked H.T.—, H.T.+1, H.T.+2, H.T.+3, G.B+., G.B.— (Belling-Lee, Clix).

2—Spade terminals, marked L.T.+; L.T.— (Belling-Lee).

1—Screen-grid anode connector (Belling-Lee).

TRANSFORMER

1—(Lissen Hypernick, R.I., Lewcos, Varley Slektun, Telsen, British General, Ferranti).

WIRE, SLEEVING, ETC.

6 yards thin flex (Lewcoflex).

Tinned copper wire and sleeving (Lewcos).

ACCESSORIES

120-volt H.T. battery (Lissen, Ediswan, Drydex, C.A.V., Fuller, Pertrix).

1—2-volt accumulator (Lissen, Ediswan, Ever Ready, Pertrix, Drydex).

1—9-volt grid-bias battery (Lissen, Ediswan, Ever Ready, Pertrix, Drydex).

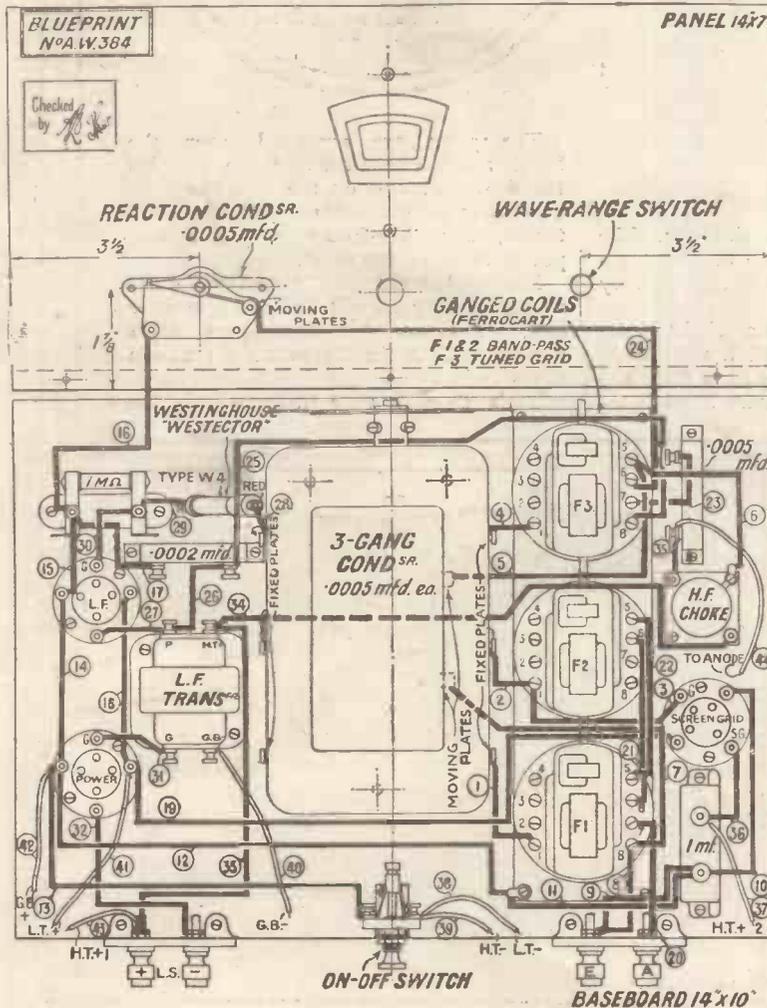
Loud-speaker (R. & A., Rola, W.B., Ediswan, Igranic).

obtained, price 1s. post free, from our Blueprint Department, AMATEUR WIRELESS, 58-61 Fetter Lane, London, E.C.4. This

received all those worth having. If the set is compared with an ordinary good three-valve set the superior results given by the new set are at once evident.

strength to noise should be the maximum. With a poor aerial the set must be forced a little and the tuning naturally becomes not so easy.

There are no tricky points in the construction or adjustment; the set is rather



The layout and wiring diagram. It will be noticed that assembly and wiring are quite simple. A full-size blueprint can be supplied, price 1/-

Take the question of selectivity. This is very good indeed and many stations which are normally hard to get are brought in easily.

Then take sensitivity. The new set has magnification to spare and there is no need to use a pentode to boost up the results.

Quality is very good. There is, in fact, no doubt that this set is easily the equal of an ordinary set in this respect.

It is easily tuned, but the gang condenser must be turned very slowly and carefully to avoid missing stations. Also, the set must be tuned accurately, that is, a station must be



A rear view of the "Up-to-the-minute Three" with the back of the cabinet removed. The whole assembly is neat and accessible and the set gives remarkable results

an exceedingly easy one to build and to get working. Next week further building instructions will be given and operating notes.

Northern listeners are to have their own vaudeville programme on April 8.

Military marches and waltzes in various styles will be played by the Belfast Wireless Orchestra on April 13.

A relay from the Ulster Hall, Belfast, of an Orchestral Concert by the Band of His Majesty's 2nd Battalion the Royal Rifle Corps, will be heard by listeners to the Northern Ireland Station on April 15.

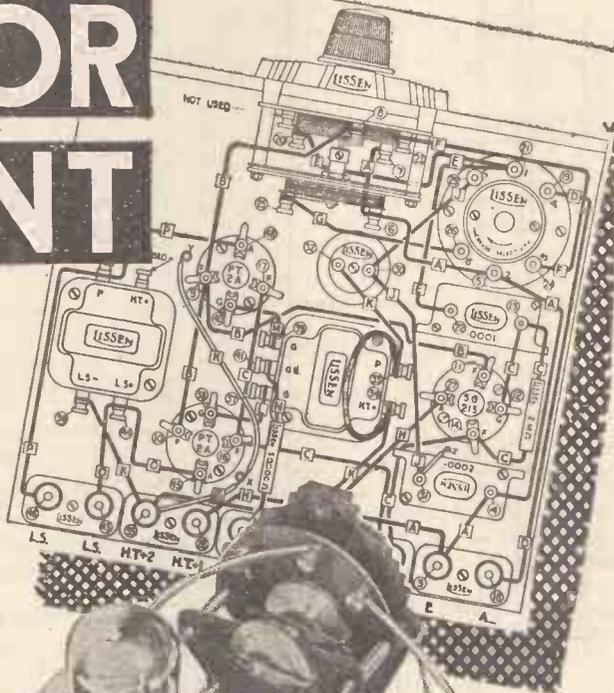
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What Our Readers Think

The Editor does not necessarily agree with the views expressed by readers and does not accept responsibility for the letters published. Letters cannot be published which do not bear the sender's full name and address



A Metallised Valve Point

SIR,—The following experience may be of interest to your readers.

I was recently called in to examine a new S.G.3 receiver, as no signals were forthcoming, and proceeded to test through the set thoroughly.

Replacing the valves still brought no response, and accidentally touching the flexible tubing, through which the anode lead to the S.G. goes, I found it to be quite hot. Instantly suspecting a short circuit from plate to earth, I replaced the wire (which, incidentally, had been burnt rubberless) with a strand of thicker flex and proceeded to try again. Switching on again, to my surprise I found that the wire was gradually warming up, and, disconnecting the batteries, I looked further into the matter. The anode lead was cut rather on the short side, and when the S.G. valve was in its holder and the lead attached, the flexible was pulled over and the bare end touched the metal coating of the valve. Upon examining the filament wiring, I found the coating was joined to L.T.+ (hence the short); the valve, not being marked as to which pin the coating was connected, had been accidentally wired wrongly.

The valve was one of the cheaper kind, and I suggest (manufacturers, please note!) that all metallised valves should have the letter E stamped against the filament pin which is connected to the coating.

F. B. (Sandown).

"Build and Be Ahead!"

SIR,—We have read with considerable interest the article on page 476 of your issue for March 18, and we feel that we cannot do better than write to you and express our agreement with your views, namely, that the constructor has very great advantages in many ways in the matter of radio.

The radio industry, although now long established, is still continually advancing from one step to another; new circuits, new valves, and new technique continually tend to make any particular year's set obsolete in twelve months.

We do not think this is likely to happen for a long time with such receivers as the superheterodyne, which this company has gone a long way to popularize; but there is no doubt that great improvements and refinements in detail in these sets are likely to take place for years to come, and it is in this respect that the constructor, by

continually being in a position to modify his set from time to time, as the occasion demands and as finance permits, is able continuously to keep his receiver up-to-date without having to buy a fresh set every minute.

Of course, the real constructor would hardly ever buy himself a complete set in any case, as the building of the set is his joy and hobby, and there is little in this world that can give greater happiness than that experienced by the constructor who has made a thoroughly good job of some sound design. Last, but not least, the fact that he has built his set in its entirety means that he knows what is inside it, and if by any chance anything should go wrong he is in a position to put the matter right.

FERRANTI, LIMITED (Hollinwood).

Balanced-armature v. Moving-coil

SIR,—I should like to be allowed to reply to E.L.G., and his criticism of M.C. speakers. He takes the worst possible operating conditions for any set and then compares a moving-coil with the certainly better results given off by a balanced-armature. Now fill the cone with wadding and that will again improve this "perfect tone." He also quotes his set as having super-regeneration when needed, thus revealing his dire need for strangulation of top notes. Let him rebuild it to look like a wireless set, buy 150 nice fat volts and a well-matched moving-coil, cut his yarn about "tremendous" output and supply himself with just one modest watt from a push-pull stage and hear what he will call a squeaky row. Then let him listen to it a few weeks and he will slowly learn what wireless can be. B. M. (London, E.).

SIR,—I have been interested by the letters from "A.W." readers on the subject of balanced-armature v. moving-coil speakers. Does not the whole question depend on the amount of output available from the amplifier, and, of course, on the class of speaker used?

With an ordinary battery-operated three-valver (and I believe this is the most common form of set in use to-day), I have yet to hear a M.C. speaker to compare with a balanced-armature (66R) unit when the latter is properly mounted with a 12-in. cone and adequately baffled.

On the other hand, with a mains-

The Editor invites letters from readers on all interesting radio subjects. For the most interesting letter published each week half a guinea will be awarded.

operated set (or where economy of current is not an essential feature), a well-designed moving-coil speaker certainly takes the prize.

I venture the opinion that each of these types give best results when matched to its particular set, and that it is advisable to consider the form of amplification and the amount of current constantly available when purchasing a speaker. In conclusion may I add my appreciation of the articles appearing in "A.W." every week?

C. R. Y. (Port Talbot).

SIR,—Re B.A. v. M.C. speaker controversy, may I suggest that E.L.G. (Hale) reads Radio Service's reply to G.E.F. (Sheffield) again, and then considers himself severely "chalked off."

I am sure that E.L.G. and G.E.F. have never heard a good moving-coil on a good set, otherwise their letters would never have been written.

E.L.G.'s American stations must be wonderful to listen to, using batteries that have run down to 60v.

SEVEN YEARS READER (Burnley).

SIR,—I was very interested in the letter from E.L.G. (Hale) re balanced-armature v. moving-coil. I have also put down four different makes of modern moving-coil speaker, in favour of 66R Blue-Spot, each of the moving-coil speakers has been of the best make, each one costing more than £3. I admit that the 66R does not perhaps reproduce bass as well as a moving-coil, but not one of the moving-coil speakers could do justice to any of the high notes.

My set is the "Amateur Wireless 65s. Four." I am using a super-power output, with 150 volts H.T., and I must say that this set is one of the best at such a low price, and with the above unit mounted on a 3-ft. square baffle it has beaten the moving-coils all ways.

I should like to mention I have no interest in the Blue-Spot Co.

R. R. T. (Tisbury).

To coincide with the first night of the new Saville Theatre play *He Wanted Adventure*, Columbia issued a miniature version of the play, songs and dialogue, on gramophone records. During the week previous to the London first night, there was a preliminary run of the play in Manchester. The Columbia mobile recording van was stationed outside the Palace Theatre, and a special performance was arranged by Mr. Jack Waller, featuring all the stars of the play, including Bobby Howes, Marie Burke, Raymond Newell, and Wylie Watson.

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Described this Week
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, £2/16/6.

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1 Mullard PM1HL valve	7	0
1 Colvern Coil, KSW	9	6
1 Eddystone .00016-mfd. var. condenser ..	9	6
1 Peto-Scott neutralising condenser ..	3	6
1 Utility micro-dial W181	7	6

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With FULL SIZE diagrams and constructional note. KIT "B" but with Valves, Cash or C.O.D., £3/17/6. Or 12 monthly payments of 7/-. (See AMATEUR WIRELESS, Mar. 25, Page 523)

CONVERT YOUR CENTURY SUPER TO Q.P.P.

As described in last week's issue
COMPLETE KIT of Author's First Specified Components for converting your Century Super to a Q.P.P. including Specified Speaker but less valves. Cash or C.O.D. Carriage Paid, £3 5 6. Or 12 monthly payments of 6/-.
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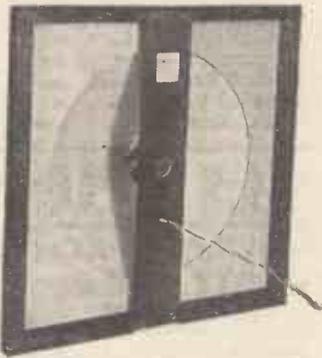


and tests of
apparatus

Conducted by J. H. REYNER, B.Sc., A.M.I.E.E.

CLEARY'S BASSO SPEAKER

WE have tested this week a loud-speaker of the moving-iron type, which is known as Cleary's Basso speaker. This employs a paper-type diaphragm 12 in. diameter. The diaphragm is suspended at its outer edge from a sheet of thick brown paper, this itself being glued



The Cleary's Basso speaker described in the accompanying paragraph

to a square wooden framework. The brown paper suspension is stretched tightly, the whole assembly thus forming a somewhat drum-like structure with a perfectly definite resonant frequency. In the case of the speaker under test this frequency was of the order of 50 cycles per second. The movement employed is of the conventional moving-iron type, two small permanent magnets with a laminated pole pieces being used.

On test the speaker gave quite pleasant results, and was definitely very low toned for this type of loud-speaker. No very marked resonances were audible over the audio range except one in the region of 800 cycles. The sensitivity of the speaker was perhaps a little below normal but not seriously so. The impedance at 512 cycles was approximately 4,500 ohms.

HELLESEN H.T. BATTERY

THE name of Hellesen needs no introduction in connection with high tension batteries, and it is with pleasure

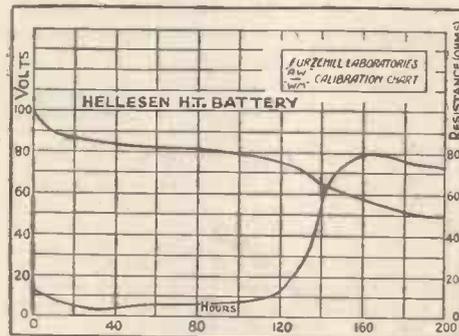


One of the new Hellesen H.T. batteries. A standard-capacity type is described here

that we are reporting on one of the "British-made" brand turned out from their Wimbledon factory. This battery was a 99-volt standard-capacity type, the overall dimensions being 5 in. by 9 in. by 3 in. high. It is contained in a distinctive cardboard carton with holes at the top through which the necessary tappings on to the battery are made.

We tested it in accordance with our usual practice, which, as readers will remember, consists in discharging it through a fixed resistance for 8 hour periods with 16 hour rest periods between. At various times during the discharge period the voltage on load and the internal resistance of the battery were measured, and these are shown plotted on the chart accompanying this report.

It will be seen that after a small initial drop of voltage the output is remarkably well maintained, until the 120 hour mark is passed when the fall becomes more rapid. At this point there is a rapid rise in the internal resistance indicating that the life of the battery is approaching its end. Up to this point, however, the internal resistance is uniform and very low. This behaviour is a very good approximation to the ideal.



Discharge curves for the Hellesen 99-volt standard capacity battery tested

The actual capacity works out at 1,400 milliampere hours which is well up to standard for single-capacity cells. The battery retails at 12s. 6d., and can be recommended.

LOEWE VARITONE SPEAKER

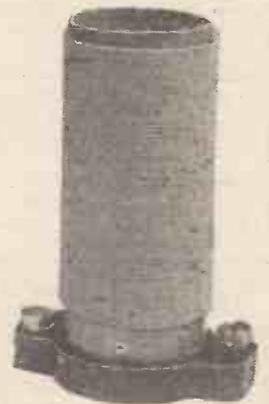
AN interesting new loud-speaker which we have tested recently is that known as the Loewe Varitone. The movement is of the balanced-armature type, an armature adjusting knob being provided at the rear of the cabinet. An interesting point in the construction of the speaker is the inclusion of an impedance-matching switch. The user of the loud-speaker is thus enabled to obtain the best possible results by altering the loud speaker impedance to match that of the output valve of the

receiver. Three positions are provided on this switch, the impedance values being approximately 9,000 ohms, 3,000 ohms and 2,500 ohms. It will be seen that these values enable the speaker to be used with all types of power valve including pentodes

On an aural test the speaker gave a good overall response, particularly in the bass. The main resonance appears to be in the region of 250 cycles, but there is still a definite response to frequencies as high as 5,000 cycles.

GOLSTONE HEAVY DUTY CHOKE

WE have received from Messrs. Ward & Goldstone, Ltd., a sample model of their type WHF heavy duty H.F. choke. This choke has been designed for use in the



A new Golstone H.F. choke, the heavy-duty type

mains supply circuit to D.C. receivers. As anyone who has had any experience with D.C. mains receivers will know, the H.F. "ripple" on such a supply is often responsible for a deal of trouble, and it is to help in the elimination of this that this choke has been designed.

The choke is wound with heavy gauge wire on a paxolin former having a diameter of 1 1/2 in. The D.C. resistance is extremely low, being under 1 ohm, while the inductance is approximately 270 microhenries. It is rated to carry .6 ampere without appreciable temperature rise. The choke is mounted on a small moulded bakelite base on which the two necessary terminals are mounted.

The retail price is 3s. 6d., and it is certainly worth consideration by all users of D.C. mains apparatus.

The first play to be adapted for broadcasting by Dulcima Glasby since she resigned from the staff of the B.B.C., will be *Escape*, which is to be given on April 11 as a tribute to the memory of the author, John Galsworthy. This play was originally projected for broadcasting at the time of the Dartmoor revolt. Its inclusion in the programmes had been decided some weeks prior to the outbreak at the prison; but almost on the eve of the proposed broadcast the Productions Director of the B.B.C., Val Gielgud, ruled that the presentation would be inopportune at that time. *Escape* will be produced for the microphone by Howard Rose, who has brought considerably more than two hundred plays to listeners.

WIRELESS MADE EASY SECTION

What's Gone Wrong?

WIRELESS TROUBLE-TRACKING SIMPLIFIED FOR BEGINNERS

AMONG broadcast listeners there can be few who have not exclaimed with reference to their wireless sets: "What's gone wrong?" You know the sort of thing that happens; you switch off one night and everything has been perfectly normal; next night you switch on and the set won't work.

Be Systematic!

What's gone wrong? No use getting excited about it. You must take your time. Be systematic. Determine first, if you can, just what has gone wrong. This you can sometimes do by a process of elimination.

There are many symptoms for the troubles sets are heir to. Dead silence is probably the most disconcerting and yet the most easily remedied fault of all.

Disconcerting it certainly is to find on switching on that nothing happens. There are so many things that may be the cause of this silence. Most of them, experience shows, are rather obvious if you take the trouble to search.

Simple External Faults

The immediate thought when dead silence greets you from a hitherto good set is that something mysterious has gone wrong inside the "works." True it is that resistances and so on do break down, but it is much more likely that the trouble is due to some simple external fault.

A connection has probably come adrift somewhere. The writer arrived home the other evening to be told that the wireless had gone wrong and *nothing* would make it work. On looking round, it was found that the mains-plug extension has come adrift. This is just one example of what often happens.

Look at the aerial lead. The earth connection. The battery plugs in their sockets.

Broken Leads?

Any one of these connections can be to blame for the silence of your set. If you have an external loud-speaker it may be one of the leads on that has broken.

Anyway, it is common sense and good advice to check up all

external extensions before you begin to suspect the set.

On looking inside the set you may find one of the valves loose in its socket. The grid leak may have come out of its holder. Vibration between the time when you switched off and the time you tried to switch on and failed to produce anything may account for an internal disconnection, either of a lead or of a component.

Apart from the mystery of dead silence, you often have to face other faults. Chief of these is a loss of quality.

get the last ounce from the battery, but you should ask yourself whether the bad quality is worth enduring for the shilling or two you are saving. *It is not!*

Sometimes a set is switched on and works for a few seconds and then dies away to silence. This may be due to an internal fault, but it is sometimes easily traceable to a run-down low-tension accumulator. It momentarily gives the required two volts and then falls in voltage as current from the cell

speaker unit may be upset and cause a rattle or other trouble.

Loss of volume is another frequent complaint among set users. This may be due to many things, chief of which are batteries and valves. The valves do not last for ever, remember, though often they give quite reasonably good service long after the maker's 1,000 hours span of life is past.

Suspect That Power Valve!

A worn-out power valve is a double penance, because it not only cuts down the volume, but affects the quality, producing a characteristic thinning of the tone.

All these faults—that is, battery and valve faults—can be cured only by getting batteries replenished and valves replaced. The only way the ordinary listener can prove whether these things are to blame is to try out known good ones—borrowed from a friend or a helpful dealer.

Crackles and Their Cause

There is a type of fault you can prove for yourself, though. We refer to crackles and other background noises that sometimes develop mysteriously where previously there was no interference.

Crackles come from such sources as electrical machines, tramway systems, and Mother Nature's "atmospherics."

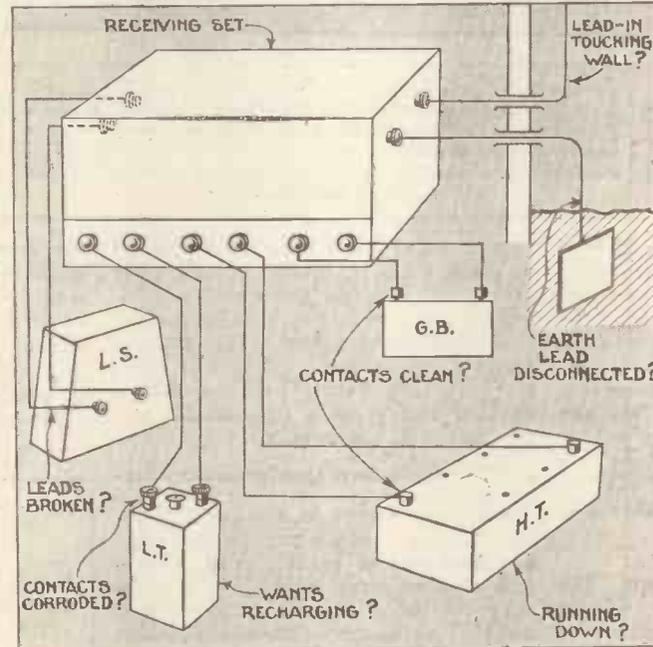
If you want to know quickly and conclusively whether an outside agency is responsible for the crackles, remove the aerial and then the earth.

If the source is external, the removal of one or both of these leads will stop the noise.

If the noise is due to something inside the set, removal of aerial and earth will not stop it. Crackles are frequently caused in battery sets by running down batteries, either high- or low-tension, and often by partial contact of the plugs and sockets.

Intermittent noises are not uncommon at this time of the year, when high winds have a playful habit of swinging the aerial down-lead against nearby walls and trees, thus causing partial short circuits to earth of the aerial.

A. H.



A quick guide to the most common faults developing in battery sets is indicated by the above diagram, showing a typical receiver with all its vulnerable accessories.

Fortunately, this is easy to remedy in most sets, because it is nearly always due to a deterioration in the power supply.

If you use a battery set you will inevitably suffer from a loss of quality, not to mention volume, if the high tension is allowed to do service when a new battery should have been installed.

"Throaty" quality is often due to a running-down high tension. It is natural to try to

is extracted by the filaments of the valves.

Loud-speaker Leads

Bad quality is sometimes due to an inadvertent mis-connection of the loud-speaker leads. With some sets it is important to connect one particular terminal of the loud-speaker to the positive terminal of the set's high-tension supply.

If connected the other way round the setting of the loud-

ELEMENTARY WIRELESS COURSE

The RADIO-GRAMOPHONE EXPLAINED

What exactly is a radio-gramophone?

A combined instrument which enables us not only to receive wireless programmes but to play gramophone records electrically.

Yes, but how? What connection has a gramophone with wireless?

In both cases we are reproducing sound waves by mechanical means and it is often more convenient and even better from the point of view of results to use the same mechanism for both requirements.

Let us consider an ordinary gramophone for a moment. The record consists of a spiral groove starting at the outside and moving slowly in towards the centre. This groove, however, is not uniform but wavers from side to side as if it had been cut by a somewhat belated reveller returning home early in the morning!

Is this waviness intentional?

Yes. You will see why in a moment. The gramophone needle, which is usually a finely pointed steel peg, is held in a suitable holder and allowed to rest in the groove. The record is now rotated so that the needle is dragged along the groove and gradually proceeds to track in towards the centre.

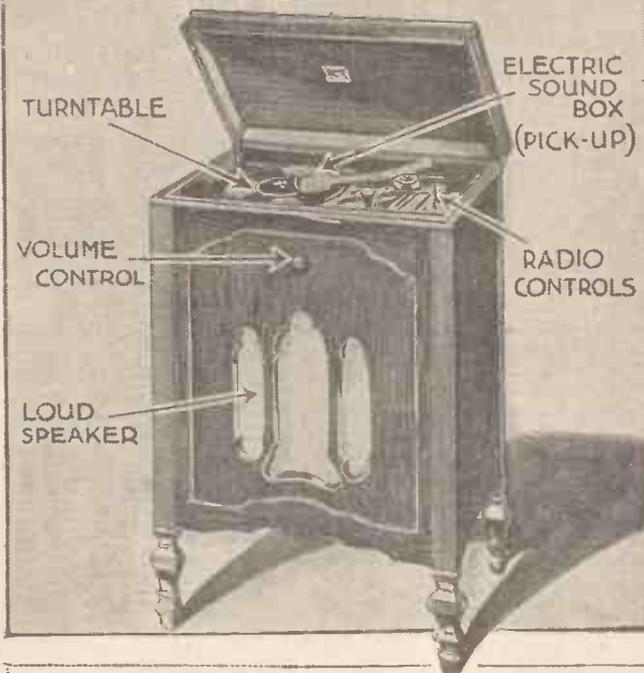
Now you see the point of the unevenness. Every time the groove wobbles the point of the needle has to wobble with it, so that the needle is kept in a state of continual "dither," and vibrates from side to side the whole time that the record is running.

What is this vibration for?

It produces sound waves for us. The other end of the needle is attached to a diaphragm so that the vibrations of the needle point are communicated to this diaphragm which is thus caused to vibrate in turn, and set up air waves. Consequently, if the variations of the groove on the record take place at the right speed, and are of the right character, they will produce air waves from the diaphragm which will give us music or speech as we require.

So that is how a gramophone works?

Yes, in principle. It is really comparatively simple, isn't it? The mechanism comprising the needle carrier and the diaphragm is called a *sound box*. The air waves produced, however, are not very large since the actual



This week J. H. Reyner and the "Amateur Wireless" Technical Staff explain in simple language how a radio gramophone reproduces not only broadcast programmes but also gramophone records, by means of what is called a pick-up, connected in the amplifying portion of the radio equipment

movement of the needle point is often only a few hundredths of an inch. We arrange to amplify the sound accordingly by connecting a horn on to the end of the sound box. This concentrates the air on the diaphragm just like the horn in the early patterns of loud speaker and gives a considerable improvement in the strength.

But I thought horn speakers were obsolete?

They are except in the larger sizes, and this is one of the reasons for the use of an electrical gramophone. Unless one goes to great length to obtain a very long horn, or its equivalent, it is not possible to reproduce the full range of musical frequencies.

Gramophone reproduction, therefore, is not as good as wireless reproduction from an up-to-date receiver because of the deficiencies of the mechanical reproducing system.

I don't see how you can connect the gramophone to the wireless set.

We do that by using an electrical sound box or pick-up. I have already explained the mechanism of a simple telephone. There is a small electro-magnet situated close to a thin steel diaphragm. Any current passing through the coils of the electro-magnet attract the diaphragm and cause it to

vibrate in time with the oscillations passing through the windings.

Now we can reverse this process, as indeed we can most of the processes in electrical practice. If we vibrate the diaphragm then we shall induce current in the coils. Consequently, if we were to connect our gramophone needle to a diaphragm of steel instead of the usual sound box, and place close to this an electric-magnet, we should obtain current in the coils.

Which you amplify, I suppose, in the set?

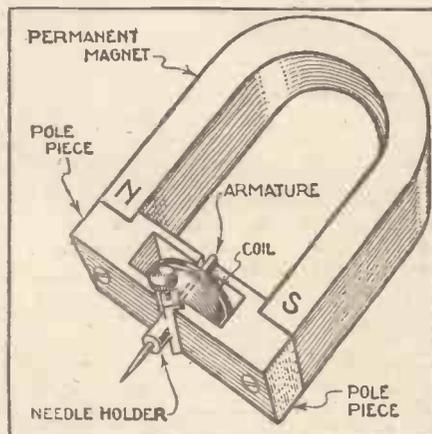
Exactly. These currents are varying at audio frequencies just like the currents which we obtain immediately following the detector or rectifier in our wireless set. We can amplify these currents, therefore, by using the low-frequency portion of our receiver, and this will magnify them to such an extent that they are capable of operating the loud speaker in the usual manner.

By a simple change-over switch we can either connect

the low-frequency amplifier and loud-speaker to the gramophone or put it back on to the H.F. side of the receiver forming a complete receiving set as originally.

Is a pick-up made in the way you describe?

No. I took a rather crude construction simply to give you a simple ex-



Typical gramophone pick-up construction, showing the coil fitted inside the permanent magnet. The needle vibrations affect the field of the magnet, and as the coil is in this field voltages are set up in the coil, similar to the energy we get from a wireless signal after the detector stage

planation. One of the great advantages of electrical reproduction, however, is that the needle has no mechanical work to do.

In the ordinary sound box the movement of the needle must vibrate a fairly stiff mechanical diaphragm in order to cause it to vibrate. This causes wear on the record.

Does an electrical pick-up reduce wear, then?

Certainly, if it is properly designed, because we have to provide practically no mechanical effort. All that is necessary is to cause a piece of iron or steel to vibrate close to a coil and it will be clear that the crude construction which I described is not by any means the best for this purpose.

Usually we have a very small and light armature of soft iron which is caused to vibrate in between or near to two magnetic pole pieces. As it vibrates it alters the distribution of the magnetic field and this induces current in the coil, as we have already seen.

The armature cannot be made too small or it becomes liable to vibrate of its own accord, and to prevent this, small pieces of damping or shock absorbing material, such as rubber, are mounted in a suitable part of the mechanism.

Quite successful electrical pick-ups have been made in which the steel needle itself acted as the armature and vibrated between two electro-magnets. Record wear with such a pick-up is almost non-existent.

Are there any other advantages of electrical reproduction?

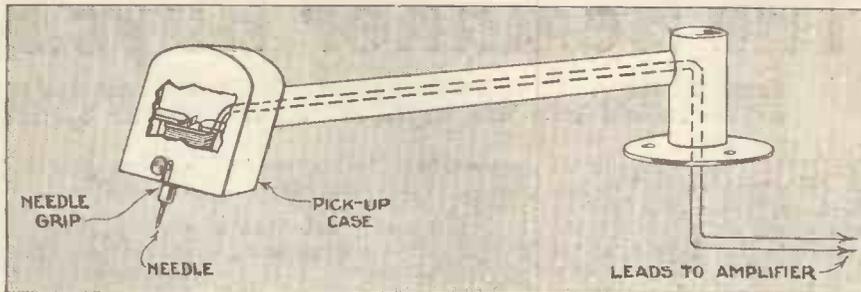
There are! We have seen two—the quality is better, and record wear is less if the system is properly designed. A third advantage is that one can very easily alter the strength of the signal. Just as we have a volume control to alter the strength of the radio transmission, so we can if we like control the reproduction obtained from the gramophone record from a mere whisper to full strength by a suitable control. The ordinary gramophone is by no means as flexible in this respect, it being necessary to use special loud or soft needles to obtain different strengths.

Finally, there is a very great advantage that the deficiencies of the record may, to a large extent, be compensated with electrical reproduction.

Are there deficiencies in records?

Yes. They are not so great now as they used to be because of the enormous progress which has been made in the past few years. However, just as it is difficult for us to reproduce air waves from a loud-speaker at all the frequencies required for satisfactory musical reproduction, so it is difficult for us to operate a cutter which will cut a groove in the wax at the requisite rate.

Generally speaking you will find that the bass and treble are apt to be lost to a varying extent depending upon the



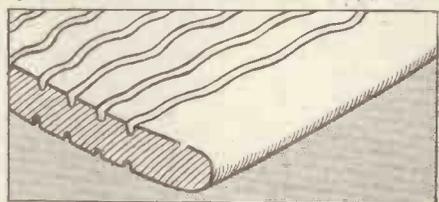
Usually, as here, a pick-up is contained in a small and lightly constructed case fitted to the end of a supporting arm, the leads from the pick-up coil passing through the arm into the base of the arm support

relative merits of the recording. In some dance records, for example, the s's are very poor, showing that the upper frequencies are not well recorded.

I never knew that before

Oh, there is quite a difference between various records. Another point which will interest you is that the clearness depends upon the needle. When the needle is new the point is very fine, and it is quite easily able to follow the rapid vibrations on the groove in the record.

As the needle gets worn, however, the point is blunted and the needle is quite unable to follow the high-frequency contours.



An enlarged view of a piece of a gramophone record, showing the wavy lines that cause the needle to vibrate in the holder of the pick-up as the record revolves beneath it

Hence the maker's injunction to use each needle once only.

Try playing a record with plenty of s's in it, firstly with a well-worn needle, and then with a new one. You will be quite surprised at the improvement.

What happens in the bass?

Here considerations of space prevent the recording of the correct values. Theoretically the deviations on the grooves in the record should get larger and larger as we reduce the frequency. If you examine a record with some heavy orchestral music on it you will notice very pronounced waves in the grooves, easily visible with the naked eye. If we try to make these waves too large the needle simply will not follow but will jump from one groove to the next. Consequently, after a certain point the amplitude has to be deliberately limited, and this means that the bass actually recorded on the record is less than it should be.

How can you get over that?

It is quite an easy matter to make an electrical amplifier have almost any characteristic you want. If you wish, therefore, you can use an amplifier which magnifies the bass very much more than the treble.

By a correct proportioning of the circuit we can arrange that the amplifier will exactly correct for the deficiencies in the bass on the record and, even to some extent, correct for any small loss which may occur in the treble.

What is even more important is that one can control the tone of the amplifier by alteration of an external knob so that the proportion of bass and treble in the reproduction can be adjusted to suit the user.

That sounds very handy

It certainly is. All told, you will see that electrical reproduction has a number of important advantages over the older mechanical method. While it is not true to say that any electrical reproduction is better than any acoustic or mechanical gramophone, there is no doubt that the electrical system is more flexible, and that, like for like, the electrical system is to be preferred.

How are electrical gramophones arranged?

Most wireless sets have provision for connecting an electrical pick-up in circuit. Anyone possessing a gramophone already can substitute an electrical pick-up for his existing sound box, and take two leads to the terminals on his receiver. Then, on changing over the switch to the proper position, the recording will be reproduced through his loud-speaker.

A radio-gramophone is a more elaborate instrument, which actually contains a motor and turntable, electrical pick-up, volume control, etc., all complete in addition to the usual wireless set. This type of instrument is usually made to operate entirely from the electric-light mains, the motor being driven electrically and also the receiving set itself.

However, I think this is a subject which we shall have to discuss in detail during the next few weeks.

NEXT WEEK!

Another Section for the Beginner, including WIRELESS FROM THE MAINS

Being another "Elementary Wireless Course" Article

The Beginner Buys New Valves

Some of the more important points to be remembered when attempting to put new valves in old sets are explained in this article specially written for the beginner

PUTTING new valves in old sets may seem, to the beginner, rather like putting new wine in old bottles. Sometimes it is, but as often as not new valves, if chosen with care, will make a big improvement in the working of the set.

This dictum applies especially to simple sets, such as two and three valvers with detector and low-frequency amplifier circuits, or sets with only one stage of high-frequency amplification.

Improving Old Sets

Let us see what can be done to make old sets better with new valves, observing where replacements are not advisable and where the alterations needed in the set to take the new valves would probably not be justified.

Shall we make a start with the power valve? In simple sets, that is the valve most likely to want replacing.

Why? Because as a power valve its filament has to emit a copious stream of electrons. In time, the filament's coating gets used up and then the emission is said to have fallen.

Distortion and loss of volume are common symptoms of emission loss. If you feel your power valve has given long enough service, and remember, the makers give such valves about one thousand hours life, consider how you can improve results by a new power valve.

The first thing you must consider is your power supply. It is no use putting in a large power valve requiring 10 to 15 milliamperes anode current if you have only a standard-capacity high-tension battery.

Power Valve and Power

In other words, remember that the power valve is the trigger releasing power supplied by the battery.

The power valve does not make the power—that has to be provided by the battery.

Do not let your desire for a larger volume output blind you to the need for economy in running the battery.

Small power valves taking 5 or 6 milliamperes at 120 volts will give moderate power output when used with a sensitive loud-speaker. If you want a little more volume and still desire to keep down the current there are what we call "economy pentodes" on the market.

The Loud-Speaker

In existing sets, the choice of the power valve will very largely determine the sort of quality

you get from the loud-speaker. Talking of loud-speakers—don't forget that a moving-coil will bring out better bass than a moving-iron if there is enough power available.

Unless there is, though, it is doubtful whether there is much advantage in the average moving-coil over the best-designed moving-iron speakers.

A New Detector

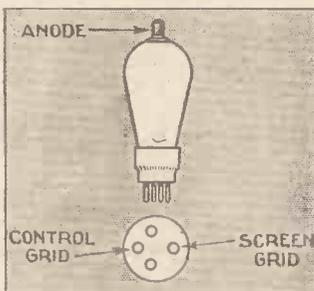
Now what about a new detector valve? Plenty to choose from! Your final choice depends on many things, not

will mean less anode voltage on the detector.

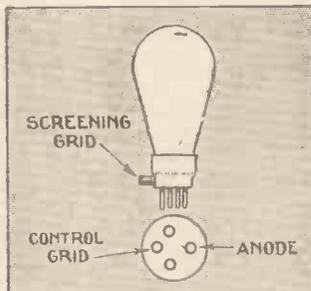
This is just one example of what can happen when you change the detector valve. Because so many different types of valve impedance seem to be used for the detector, some amateurs, run away with the idea that almost any old valve will serve.

Probably it is true that almost any old valve will work as a detector, but only when the circuit conditions are made suitable for it.

In general, therefore, the best



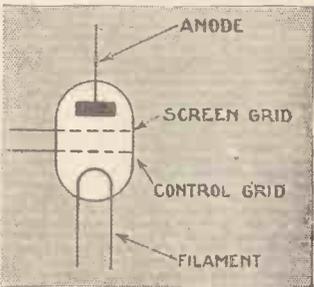
Typical screen-grid valve, as used to-day for all high-frequency amplification stages. Note the terminal on the top is for the anode connection, and that the normal anode connection on the holder is for the screen-grid of the valve, taken to high-tension positive



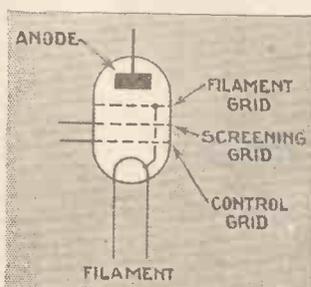
Typical pentode power valve, as used in the output stage for extra power or for economical working. Note that the terminal on the side of the valve base is the screening grid, which is taken to the positive high-tension of the battery, either to the same point as the anode or to a lower voltage

least being the type of coupling after the detector. If it is a transformer of good design, a medium-impedance valve will be suitable. If you have what is known as a resistance-fed transformer, you can take advantage of a higher magnification

plan when getting a new detector valve is to get one of approximately the same impedance as that you are now using. If, through improvements in design, this has a higher amplification, so much the better for the set's station-getting abilities.



Circuit symbol for a screen-grid valve. You will see that in addition to the normal filament, grid and anode there is a screen-grid



Circuit symbol for a pentode power valve. Note that there are three grids, one of which is internally connected to the filament

valve, with its correspondingly high amplification factor.

Remember that the lower the impedance of the valve, the greater is the anode current.

It may be that by using a lower impedance valve than at present you will cause a greater voltage drop across the anode circuit components, and that

it is quite possible that if you put in a new screen-grid valve in place of an old one, the results will be worse instead of better.

Remember that to-day there are two distinct types of screen-grid valve. There is the high-mu valve for sets with only one stage of high-frequency amplification, and there is the variable-mu valve for sets using two such valves, or for sets where a good control of volume is wanted with only one high-frequency stage.

Mu and Variable-mu

Mu means magnification, and the high-mu valve, therefore, has the advantage of very high amplification while the variable mu has the ability to vary its amplification according to the circuit constants.

If you put a variable-mu valve in place of a screen-grid valve of the old type, you would probably get less signal strength, and unless the circuit was modified to enable the grid bias to be varied you would not gain anything from the volume-controlling ability of this type of valve.

On the other hand, if you have an oldish set with two of the earlier types of screen-grid valve it is likely that with suitable modifications much better selectivity would be obtained and a good control of the volume into the bargain.

Wise Buying

General advice on buying new valves is not too easy to offer because so much depends on individual conditions. Perhaps the wisest thing is not to try to use your valves far beyond the period of time the makers intended.

Then, when you come to replace your valves, you will find corresponding types easy to find among the new ranges.

The difference between the old and the new valves, in a general way, is that the new valves have higher amplification factors for a given impedance, or lower impedances for a given amplification factor.

The "Goodness" Factor

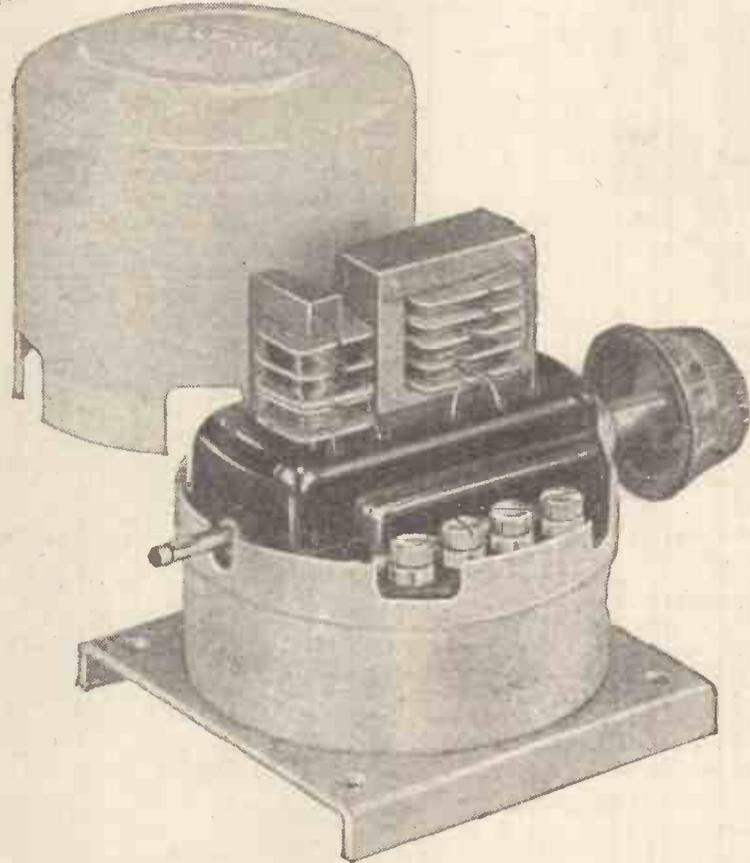
This represents an improvement in the mu or "goodness factor" of the valves.

In the power and detector stages this means that you will probably get more volume than before, whereas with the high-frequency stage it means that you must tread warily or you will upset the stability of the set's action.

A. H.

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 W. JAMES'S
"UP-TO-THE-MINUTE 3"**

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SETS OF THE SEASON

SIX-SIXTY SUPER FIVE

ONE of the strongest rivals to the super-het I have yet examined this season is this straight four-valver. It does nearly all the best super-hets can do in cutting out the locals and in some ways beats many of the super-hets I have tried in getting adjacent high-power foreigners clear of each other.

It just shows, in my opinion, what can be done with a perfectly straight sequence of valves when the coils and condensers of the tuning circuit are carefully designed. In this set the first two valves are screen-grids for high-frequency amplification, then comes a power-grid detector, and finally there is a pentode power output valve, the fifth valve implied in the title name of the set being a mains-valve rectifier.

This is all-electric, being suitable for A.C. supplies between 100 and 250 volts. The voltage adjustment at the back of the chassis is particularly well planned, and by means of a keyed disc arrangement it is impossible to make a wrong voltage connection.

The metal chassis for the set and power supply is remarkably compact and is fitted in the bottom portion of the shallow but attractive walnut cabinet. At the top is a moving-iron type of loud-speaker. This is connected to the chassis output by means of a robust plug-and-socket arrangement, and it is obvious from this that the makers intend you to use the set with an external reproducer if you have a good one on hand.

Testing for Quality

Not that the self-contained speaker is unworthy of notice. Far from it. I was agreeably impressed with the clean-cut treble response of the moving-iron speaker inside the cabinet. Although it does not bring out much bass, the overall effect is quite pleasing. Moreover, as later tests

BRIEF SPECIFICATION

Makers : Six-Sixty Radio Co., Ltd.

Price : 14 guineas.

Valve Combination : Two screen-grids, detector and pentode, with valve rectifier.

Power Supply : A.C. mains from 100 volts to 250 volts.

Type : Table-cabinet set with self-contained moving-iron loud-speaker and provision for very easy connection of external loud-speaker.

Remarks : The most selective straight set I have tested, and specially recommended for use with a good external loud-speaker.

proved, the self-contained loud-speaker is very sensitive when compared with the average moving-coil.

I tried out the chassis with an H.M.V. de-luxe cabinet loud-speaker and obtained

magnificent quality with enough volume for dancing. I strongly commend this set to those who have a really good loud-speaker they want to fit to a suitable modern chassis.

The front layout of the controls is quite simple. At the centre is one of the best dials I have come across, being notable for the delicate engraving, which makes station logging not only unusually accurate, but extremely easy.

The whole scale revolves past a centre hair line when the tuning knob actuating the gang condenser is operated. In addition to this mains control, there is a volume control on the left, which at its minimum position switches off the mains supply. On the right is a similar knob to



The Six-Sixty Super Five is of remarkably compact construction and yet accessibility is a feature

change over from medium to long waves.

At the back of the chassis, in addition to the voltage-adjustment panel already mentioned, there are sockets for the aerial and earth, two aerial connections being provided, and for a gramophone pick-up, should this be wanted.

The makers recommend an outdoor aerial wire of not less than 40 ft. for this set. I tried it out with an indoor wire of 60 ft. some twenty miles from Brookmans Park and got all I wanted from the European ether. Even with a 15-ft. piece of wire there were lots of good loud-speaker signals from abroad.

Extraordinary Selectivity

The selectivity of this set really is extraordinary. I was able to tune in Muhlacker, the high-power German station on 832 kilocycles, with very little interference from London Regional, 11 kilocycles



away. There was a faint intelligible background of the London station, but not enough to prevent me enjoying the German programme.

As for the rest of the selectivity demands I made on the set, it met them all without any difficulty. I got precise and clean-cut separation of all the adjacent foreign station giants with the single exception of Milan, which I have never yet got really clear of Poste Parisien. Yet Breslau, on the other side of the Frenchman, was absolutely clear.

Similarly, on the long waves it was just possible to hear Königswusterhausen clear of Daventry. All the other long-wavers were brought in with unwonted strength.

No Background Noises

One of the really outstanding points about reception with this set is the entire freedom from background noise. Plenty of foreigners were tuned in so clear of the usual mush that they might easily have been mistaken for home stations until announcements were made.

Another good point is the absence of mains hum. This applies with or without the earth lead.

The set is certainly worth using with a pick-up, particularly if, as I suggest, it is being used with a good quality external moving-coil.

By the way, I should have made it clear that you can use this external speaker without the internal one, which is readily taken out of circuit by the plug-and-socket arrangement.

I can strongly recommend this set for those who, living near a powerful local want to get foreigners on nearby wavelengths to the locals without interference. And for those living far from a broadcasting centre the great reserve of power in the set will commend itself. SET TESTER.

On Good Friday a religious service will be relayed to the Western Region from St. Nicholas' Church, Bristol.

On April 7 the second relay for North Regional listeners will be taken from Chester's variety theatre, The Royalty.

Part of the Manchester Vocal Society's Concert is to be relayed to the Northern Region from the Milton Hall, Manchester, on April 5.



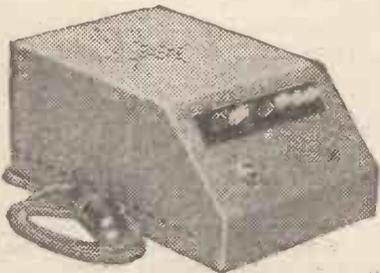
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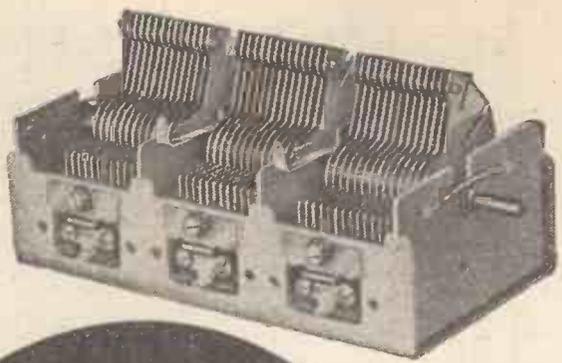
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Practical Mains Working

Continuing his complete series of articles on mains working for beginners, PERCY W. HARRIS, this week deals with the question of smoothing the output from the rectifier, making special mention of the use of the smoothing choke

SO far we have seen how, by applying our alternating voltage to the rectifying valve, we can turn the alternating current into a series of pulses of direct current. Last week I described the use of the first condenser in the smoothing unit and how the special properties of the low-frequency choke tended to

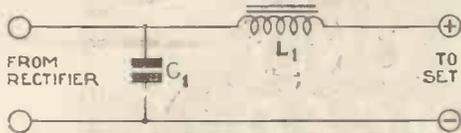


Fig. 1. Simplest smoothing circuit, consisting of a condenser across the rectifier and a choke in series with one lead

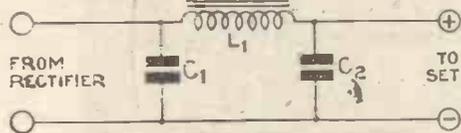


Fig. 2. Complete smoothing circuit with two condensers and a choke between them

retard both rise and fall of the current and so smooth it out. We concluded last week's article with a description of the simplest smoothing unit consisting of a large condenser and a low-frequency choke in series with one lead going to the set.

Now, although this arrangement as described as a smoothing unit, it is not satisfactory in practice, and you will see why if we consider just what happens. I am repeating the diagram as Fig. 1 this week, and I want you to imagine that the output side goes straight to a set which has considerable distortionless magnification.

It will have to supply quite a heavy current to the output valve, and when a strong signal is passing through the loud-speaker, large changes of plate current will occur. As the whole purpose of this low-frequency choke is to resist changes you can understand that it will object strongly to delivering just that extra rise of current which is necessary with a strong signal.

How can we remedy this? Quite simply—by using another large condenser on the output side, as shown by Fig. 2. The same performance will be gone through as before, so far as the initial smoothing is concerned, but this new

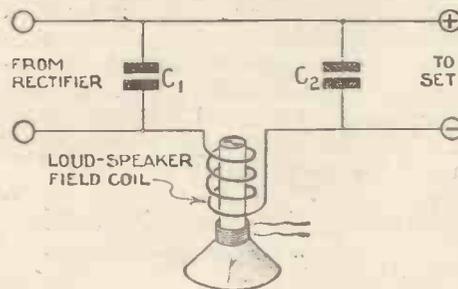


Fig. 6. In some sets the loud-speaker field winding is used as the smoothing choke, thus saving the cost of a special choke. This is done, by the way, in the latest "Home-Lover's" set

large condenser will act as a reservoir or reserve supply of voltage. Should there be a sudden call upon the unit for an extra charge it can be taken from this condenser at, so to speak, a moment's notice. The value of this condenser is important and, generally speaking, the larger it is the better.

We now come to a very important point in all-mains units of this kind. Just how perfect must we make the smoothing? It depends upon the kind of set we are using and what degree of low-frequency magnification takes place.

If, for example, you compare two sets, one with a detector and two low-frequency stages, and the other with a high-frequency valve, detector, and one low-frequency valve; and if, to make a fair comparison, both sets are designed to be just as sensitive as one another, what will happen if we work them both off the same mains unit?

In the first set there are two stages of low-frequency magnification following the detector and in the second only one, therefore any residual hum—and there is nearly always some—will be magnified to a much greater extent in the first set.

Fig. 3 shows a smoothing circuit consisting of three condensers and two chokes. C1 and C3 act in exactly the same way as C1 and C2 in Fig. 2, and for simplicity's sake we can consider that we are here using two smoothing units in series and that any slight ripple left in the supply by the time it reaches C2 is still further smoothed before it reaches C3.

In high-grade sets where there is a good deal of low-frequency magnification such a smoothing unit is frequently used, but nowadays when the great majority of sets have only one low-frequency stage the arrangement of Fig. 2 is generally adopted, particularly as the electrolytic type of large condenser is very compact and can be obtained with very high values of capacity at a reasonable price.

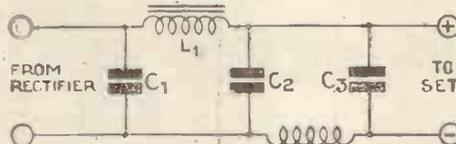


Fig. 5. This is a variation of the Fig. 3 circuit, using three condensers and two chokes, one in the positive and the other in the negative lead

Earlier in this series I dealt with the question of resistance, current, and voltage drop. You will remember that we discussed how the voltage drops through the resistance when the current is increased. If you make a comparison between a good high-tension battery of 120-volts and a mains unit giving the same output voltage, you will often find that a set quite stable or nearly stable on the battery will be unstable and howl on a mains unit.

The reason for this is that the internal resistance of the mains unit is higher than the internal resistance of the battery (at least when the battery is in good condition) and this increased internal resistance makes for increased feed-back. As a matter of fact if you were to take a first-class dry battery and insert, in the lead from it to the set, a resistance that made up the total resistance of the battery and the addition to the same figure as that of the mains unit, the feed-back effect would be the same in each case.

Now the internal resistance, of the mains unit may be high or low according to design. A good part of this internal resistance comes from the low-frequency choke, and as inductance is an important property here—for we need it to get a choking effect—the manufacturer of a mains unit who is seeking to make it as cheaply as possible, endeavours to get his inductance sufficient without making the choking too expensive.

The cheapest way to do this is with fine wire, for a choke so made is smaller and a high inductance is obtained for a low wire cost. A trouble, however, lies in the high resistance of such chokes, this making the unit very susceptible to feed-back effects and causing it to vary its voltage considerably

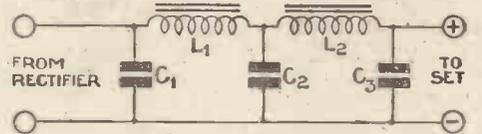


Fig. 3. Very complete smoothing can be done with three condensers and two chokes

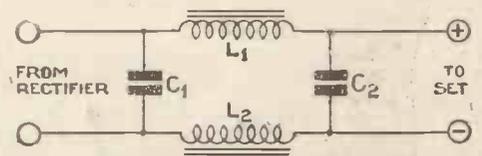
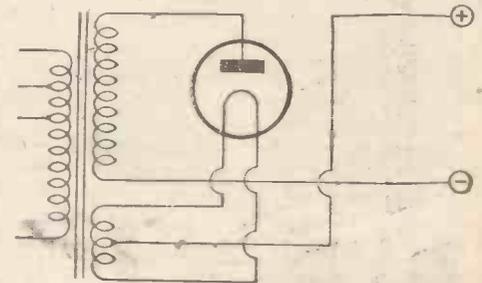


Fig. 4. Another variant on in smoothing circuits, where there are smoothing chokes in each of the output leads

with variations of current. I have occasionally come across mains units which are marked "120 volts, 20 milliamps" suggesting, of course, that with a load of 20 milliamps the unit will give 120 volts. What has sometimes happened is that with a current drain much smaller than 20 milliamperes, 120 volts is obtainable, but with 20 milliamperes the voltage is dropped to a much lower figure.

On the other hand, if a choke is made of low resistance the wire has to be thicker, the coil is therefore bulkier, and the whole choke becomes much more expensive. A unit so made will, however, be much more satisfactory in service. Generally a compromise has to be made between efficiency and cost.

In mains sets using an energised moving-coil loud-speaker (one in which the strong magnetic field necessary is obtained from an electromagnet) the field coil is often used as the smoothing choke for the mains unit. This can only be done, of course, when the total high-tension consumption of the set is of a suitable value for the particular coil, and similarly the resistance of the coil must be taken into account, so that the output voltage is satisfac-



A half-wave rectifier circuit, which needs more smoothing than the full-wave type, but is satisfactory when there is not much low-frequency amplification

tory. This method of smoothing and energising the loud-speaker certainly makes for economy.

Another variation of the smoothing circuit is that shown in Fig. 4, where, instead of having one choke in the positive lead, we have

(Continued at foot of page 592)



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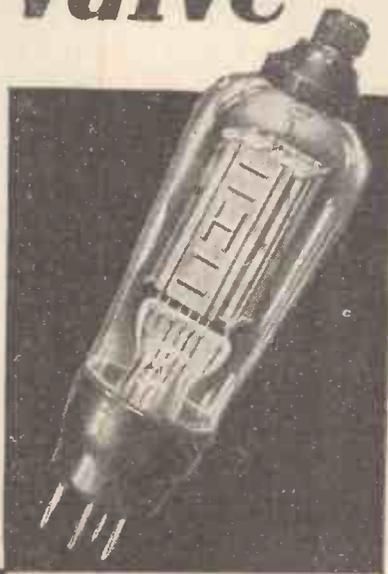
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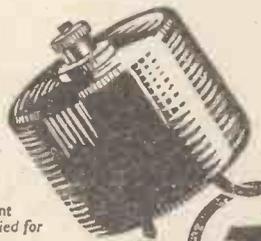


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Weekly Notes: Theoretical and Practical: by W. JAMES

REPLACING THE "HIGHS"

THE fact that when a pentode output valve is used, the strength of the top notes must usually be reduced by fitting a filter, can often be taken advantage of when arranging the detector circuit.

Very often better results, such as improved stability, can be obtained by adding a condenser to the detector circuit between the anode and earth. This condenser often prevents high-frequency currents from entering the power valve which might reach the loud-speaker and then enter one of the high-frequency circuits.

As a rule, care is taken to avoid loss of high notes in the detector, but it is not really necessary when a pentode is used. In fact, it is better to make the necessary adjustments in the detector stage to avoid having to fit a filter to the pentode.

It is, however, usually advisable to connect a resistance in the output circuit of the pentode for the purpose of protecting the valve should the loud-speaker circuit be broken with the set switched on. High voltages may be built up in a pentode circuit without a safety resistance and they may easily damage the valve.

LARGER VARIABLES

A TUNING condenser having a capacity of .0005 microfarad is looked upon as standard.

The range of wavelength covered by a circuit consisting of a coil and one of these condensers is, in fact, usually sufficient. But there are times when the stray capacities of a circuit are considerable, and then it is found that with a .0005 microfarad tuning condenser, the range is barely enough.

This will be particularly noticeable when we have to get down to say, 200 metres, and want to go as high as 560 metres.

It seems possible that tuning condensers having a greater capacity will be used in the future. A capacity of .00055 or even .0006 may be found desirable.

What really matters, of course, is the variation in the capacity of the circuit. A variation of from .00095 to .0005 or 10 to 1, is clearly much greater than a change of from .00008 to .0005, or 6 to 1.

The point here is that an addition to the minimum capacity restricts the range by quite an amount and it is always desirable to reduce the stray capacities as far as possible.

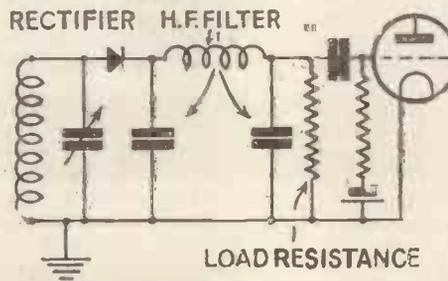
SUPER-HET DETECTORS

RECEIVERS of the super-heterodyne class are sometimes fitted with a special detector instead of the usual form of leaky-grid or anode-bend.

A diode arrangement may be used or a double diode. No magnification is obtained with these special rectifiers. They rectify only and will deal with strong signals.

The special feature is the practically distortionless rectification. In addition, when one of these special arrangements is used, it is easy to apply automatic volume control. The Westinghouse people have just issued a rectifier for radio-frequency currents having characteristics much like those of the diode and double-diode valves.

The metal rectifiers consist of the usual copper discs having an oxidised surface and lead washers, but are much smaller in diameter than those used in mains units



A simple half-wave circuit for a Westector

and sets for rectifying the mains alternating current.

Those I have seen are roughly less than $\frac{1}{8}$ in. in diameter. A rectifier of the simplest or half-wave type is connected as in the accompanying diagram. Good filtering is needed and is shown in the figure. No magnification is obtained, of course, but the curve of the rectifier, showing how the output varies with the input voltage, is a straight line for voltages of above about one-quarter volt.

It is obvious that the rectifier will be used in sets because of its good characteristics.

DO THEY MATCH?

THERE is much more in this matching business than might appear from a casual examination of the subject. Volume and quality are involved, and also the general factor of getting the most from a set with the least amount of waste.

If you have a moving-coil speaker fitted with a transformer having tapings, you can very easily make tests to show the effect of connecting the power valve to the different taps.

It can quickly be established that the quality varies with the tapping, and also the volume; but more care must be taken to determine which tap is best from the point of view of getting the most from the last stage.

When testing for power output, the grid

bias and the amount of the input must be adjusted, and it will be found that the power output can be altered by quite an amount.

The point does not arise so much in mains sets, where a more or less standard output pentode is used with a loud-speaker designed for it. But with battery sets, where every little bit of extra volume counts, and where so many varieties of output valves are used, it is well worth taking trouble to match the circuit.

"PRACTICAL MAINS WORKING"

(Continued from page 590)

two chokes, one in the positive, and one in the negative lead, and a still further variation which is self-explanatory is shown in Fig. 5.

Fig. 6 shows the smoothing arrangement used in a number of factory-built mains sets, the sole choke being the loud-speaker field winding; which, in this case, is placed in the negative lead. In one set I was handling recently the voltage drop across this choke was used to apply grid bias to the output valve, suitable smoothing being, of course, provided. In such arrangement as Fig. 6 the two condensers C₁ and C₂ are nowadays nearly always a high value electrolytic type.

So far you will have noticed I have referred only to the full-wave rectifying valve in which both halves of the wave are used. There is another system using a half-wave rectifier, as it is called, and this is shown in Fig. 7. In such a case as this we still get a series of uni-directional pulses, but there will now be only fifty a second as against a hundred with the full-wave scheme. This takes more smoothing, but works satisfactorily if there is not a great deal of magnification following the detector.

The "metal" or "copper-oxide" type of rectifier is also much used and its importance is such that I propose dealing fully with it in my next article. Meanwhile you will see we have reached the point where the output from our rectifier and smoothing scheme is quite smooth enough for all practical purposes, and can be applied to any set as desired. Only one thing is lacking, and that is some form of regulation of voltage so that it can be adjusted to whatever figure we want. This also will be dealt with in my next article.

At a recent meeting of the Croydon Wireless and Physical Society, held at Altyre Road, East Croydon, with Mr. A. J. Webb in the chair, Mr. H. W. Harris delivered a lecture on "Receiver design must give realism and super musical reproduction." Visitors are heartily welcome at any of the Croydon meetings, and particulars regarding membership can be obtained from the Hon. Sec., Mr. H. T. P. Gee, 51-52 Chancery Lane, London, W.C.2.

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A Universal Record Changer

I HEAR that the Garrard people have now produced a universal model automatic record changing unit which works on D.C. or on A.C. 25 to 60 cycles. This costs only £10 17s. 6d. and can be fitted with a volume control for only 5s. extra. This unit is entirely self-contained and enables you to convert your set to an automatic record changer. **977**

A Belling-Lee Pick-Up

I see that Belling-Lee have brought out a combined pick-up and tone arm which appears to have many sound features. This new pick-up is fully described in a Belling-Lee booklet, copies of which you can get through my free Catalogue Service. Two models are available, one having an arm, adjustable for length. A special wire-wound volume control is available and is also described in the pick-up booklet. **978**

A Shielded Down Lead

Many listeners have found how helpful and efficient is the Goltone screened air-spaced flexible down lead. This consists of a length of wire which is screened by an air-spaced flexible metal covering. A shielded lead of this type is very useful in cutting out interference. Practical details and helpful sketches are given in a Goltone folder describing this. **979**

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Five transformers for quiescent push-pull have been produced by Ferranti, Ltd., and technical details of these may be obtained free through my Catalogue Service. The inductances and ratios of these Ferranti jobs are particularly meritable. **980**

Excellent Value

I have on a previous occasion referred to the Royal four-valve radiogram, an all A.C. instrument, costing only fifteen guineas complete. I should like, however, to draw your attention to the new Royal folder describing this radiogram as well as console and table models. **981**

OBSERVER.

It should be noted that the price of the Wearite combined three-point shorting switch, mains on-off switch and 10,000-ohm potentiometer was incorrectly given last week as 9s. 6d. The correct price of this useful Wearite component is 9s. only.



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John & James Laker Co., of Kent House Lane, Beckenham, who specialise in steel aerial masts and outdoor wireless fittings, have introduced a unique aerial wire which is very highly efficient. It consists of no less than 150 separate pure copper wires, each wire enamelled and insulated from its neighbour. The actual surface area of this wire is 10 times greater than ordinary 7/22 copper wire. It consequently gives considerably greater volume, especially on distant stations, as well as being super selective. It is made in 50 ft. lengths at 3/6 for ordinary battery or mains sets and 33 ft. lengths at 2/6 for superhets. This aerial wire was selected by the Mount Everest Expedition for transmission and reception. The prices include postage. We strongly recommend this article.

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BROADCASTING STATIONS

Broadcasting Stations classified in order of wavelengths. For the purpose of better comparison, the power indicated is that of the carrier wave.

Kilo-Metres	Station and Call Sign	Power (Kw.)	Kilo-Metres	Station and Call Sign	Power (Kw.)	Kilo-Metres	Station and Call Sign	Power (Kw.)
13.97	21,470 Daventry (GSH)	15.0	282.1	1,064 Lisbon (CTIAA)	2.0	465.8	644 Lyons (PTT)	15.0
16.88	17,770 Daventry (GSG)	8.0	283	1,058 Innsbruck	0.5	472.4	635 Langenberg	60.0
19.73	15,200 Zeesem (DJB)	8.0	283	1,058 Berlin (E)	0.5	480	625 North Regional	50.0
19.82	15,140 Daventry (GSP)	15.0	283	1,058 Magdeburg	0.5	480.2	625 Ivanovo-Vosnesensk	20.0
25.28	11,865 Daventry (GSD)	20.0	283	1,058 Stettin	0.5	486.6	614 Prague	120.0
25.4	11,810 Rome (ZRO)	15.0	284.9	1,053 Radio Lyons	1.0	495.8	605 Trondheim	1.2
25.53	11,750 Daventry (GSD)	20.0	286	1,049 Montpellier	0.8	501.7	598 Florence	20.0
31.25	9,598 Lisbon (CTIAA)	2.0	288.5	1,040 Bournemouth	1.0	501.7	598 Gorky	10.0
31.3	9,585 Daventry (GSC)	20.0	288.5	1,040 Scottish National	50.0	508.5	590 Astrakhan (RV35)	10.0
31.31	9,580 Radio Nations	20.0	291	1,031 Viiipuri	13.0	509.3	589 Brussels (No. 1)	15.0
51.38	9,560 Zeesem (DJA)	8.0	293	1,022 Kosice	2.5	518.5	578.5 Vienna (tests)	120.0
51.55	9,560 Daventry (G5B)	20.0	293.7	1,021.5 Limoges (PTT)	0.7	518.7	578.3 Vienna	15.0
32.26	9,300 Rabat	0.5	296.1	1,013 Hilversum	20.0	525.4	571 Riga	15.0
40.3	7,464 Radio Nations	20.0	298.8	1,004 Tallin	11.0	532.9	563 Munich	60.0
45.38	6,611 Moscow	12.0	301.5	995 North National	50.0	537.5	558 Palermo	3.0
46.6	6,438 Moscow	12.0	304.3	986 Bordeaux (PTT)	13.0	540	5,555 Prague (tests)	10.0
48.2	6,220 Rome (ZRO)	9.0	306.8	978 Zagreb	0.75	541.5	554 Sundsvall	10.0
49.4	6,050 Skameback	0.5	307.5	975.8 Falun	0.5	550.5	545 Budapest (1)	18.5
49.59	6,050 Daventry (G5A)	20.0	309.9	968 Vitus (Paris)	1.0	555.5	542 Tampere	1.0
49.6	6,048 Vienna (UOR2)	2.0	309.9	968 Cardiff	1.0	559.7	536 Kaiserslautern	1.5
49.83	6,020 Zeesem (DJC)	10.0	312.8	959 Cracow	2.0	559.7	536 Augsburg	0.3
50.0	6,000 Moscow	20.0	313.9	955.6 Genoa (Genova)	10.0	562.9	532.9 Wilno	22.0
58.31	5,145 Odessa	0.5	315.8	950 Marseilles	1.6	564.9	531.2 Freiburg	0.25
158	1,900 Odessa	3.0	318.8	941 Naples (Napoli)	1.5	566	530 Hanover	0.3
207	1,449 Seraing	0.2	318.8	941 Sofia (Rodno) 1.0	0.5	573	523.5 Grenoble (PTT)	2.0
207.6	1,445 Liege (Wallonie)	0.3	319.7	936 Dresden	0.25	574.7	522 Ljubljana	7.0
208.8	1,437 Miskolcz	1.0	321.9	932 Goteborg	10.0	585.7	512.1 Tartu	0.5
209.7	1,430.4 Magyarovar	3.0	325	923 Breslau	60.0	678.7	453 Tessin	20.0
210	1,429 Pecs	1.25	328.2	914 Poste Parisien	60.0	719.4	416.6 Moscow (RV2)	20.0
211.3	1,420 Newcastle	1.0	331.4	905 Milan Siazano	50.0	743	404 Samara	10.0
213.8	1,403 Antwerp	0.4	332.2	902.9 Poznan	2.0	746.2	402 Ostersond	0.6
214.3	1,403 Aberdeen	1.0	338.2	887 Brussels (No. 2)	15.0	779	383 Petrozavodsk (RV29)	20.0
215.3	1,393.4 Chatelineau (EL)	0.9	341.7	878 Brunn (Brno)	35.0	824	364 Sverdlovsk	60.0
217.1	1,382 Kongsberg	0.9	345.2	869.7 Strasbourg (PTT)	11.5	833	360.1 Heston Airport	5.0
217.1	1,382 Brussels (Conf.)	0.25	348.6	860.5 Barcelona (EAJI)	8.0	845	355 Budapest (2)	3.0
218	1,373 Salzburg	0.5	351	854.7 Moscow	7.0	848.7	353.4 Rostov (RV12)	20.0
218.5	1,373 Plymouth	0.2	352.1	852 Graz	5.0	857.1	350 Leningrad	100.0
219.7	1,364.7 Beizlers	0.5	355.8	843 London Regional	50.0	882	340 Saratov (RV3)	20.0
220.3	1,362 Blinche	0.3	358	838 Tiraspol	5.0	937.5	320 Kharkov (RV4)	20.0
223.2	1,344 Swedish Relays	—	360.5	832 Muhlackner	60.0	967.7	310 Alma Ata (RV60)	10.0
224.4	1,337 Cork (GCK)	1.2	363.6	825 Algiers (PTT)	16.0	1,000	300 Moscow	100.0
226.1	1,327 Fecamp	10.0	365.5	820.7 Bergen	1.0	1,034.5	290 Klev (RV9)	100.0
227.4	1,319 Flensburg	0.5	367.2	817 Fredriksstad	0.7	1,060	283 Sheveningen-Haven	10.0
230.6	1,304 Malmo	1.2	368	815 Kharkov	10.0	1,061	282.7 Tiflis (RV7)	100.0
231.8	1,295 Kiel	0.25	368.1	815 Bolzano	1.0	1,073.5	279.4 Oslo	60.0
233.4	1,285 Lodz	2.2	368.1	815 Helsinki	13.2	1,033.9	276.7 Minsk (RV10)	35.0
236	1,279.9 Kristiansand	0.5	369	813 Seville (EAJS)	1.5	1,117.4	268.5 Moscow	40.0
236.4	1,269 Bordeaux (S.O.)	3.0	370.1	810 Radio LL (Paris)	0.8	1,153.8	260 Kalundborg	7.5
237.9	1,261 Nimes	1.0	372.2	806 Hamburg	1.5	1,171.5	256 Taschkent (RV11)	25.0
238.9	1,256 Nurnberg	2.0	376.4	797 Scottish Regional	50.0	1,190.5	252 Luxemburg	150.0
240.7	1,246 Stavanger	0.5	381.7	788 Lvov	16.0	1,200	250 Istanbul	5.0
241.3	1,243 Liege	0.3	385	779 Radio Toulouse	60.0	1,200	250 Reykjavik	10.0
242	1,238 Belfast	1.0	385	779 Stalino (RV26)	10.0	1,234.5	243 Boden	0.6
244.1	1,229 Basle	0.5	389.6	770 Leipzig	75.0	1,250	240 Vienna Exp.	3.0
245.9	1,220 Berne	0.5	394	761 Bucharest	12.0	1,266	237 Bakou	35.0
245.9	1,220 Cassel	0.25	398.9	752 Midland Regional	25.0	1,304	230 Moscow (T.U.)	100.0
245.9	1,220 Llnz	0.5	399	752 Vladikavkas	10.0	1,354.4	221.5 Motala	30.0
245.9	1,220 Swansea	0.12	403.8	743 Sottens	25.0	1,380	217.4 Novosibirsk (RV6)	100.0
247.7	1,201 Trieste	10.0	408.7	734 Katowice	16.0	1,411.8	212.5 Warsaw	120.0
249.8	1,201 Juan-les-Pins	1.0	413.8	725 Athlone	60	1,445.7	207.5 Eiffel Tower	13.5
250	1,200 Prague (Strasnice)	5.0	416.4	720.5 Radio Maroc (Rabat)	6.0	1,481	202.5 Moscow (RV1)	500.0
250	1,200 Radio Schaeerbeek	0.3	419.5	715 Berlin	1.5	1,538	195 Ankara	7.0
252.3	1,189 Barcelona (EAJ15)	6.0	424.2	709 Madrid (Espan.)	2.0	1,554.4	193 Daventry (Nat.)	30.0
253.4	1,184 Gielwitz	5.0	424.2	707 Madrid (EAJ7)	3.0	1,600	187.5 Irkutsk	10.0
255.1	1,176 Toulouse (PTT)	0.7	424.3	707 Moscow (RV39)	100.0	1,620	185 Norddelch (KVA)	10.0
256.7	1,168 Horby	10.0	430.4	697 Belgrade	2.8	1,634.9	183.5 Zeesem	60.0
259.3	1,157 Frankfurt-a-M.	17.0	431	696 Parede (CTIGL)	1.5	1,685.3	178 Kharkov	25.0
259.3	1,157 Treves	2.0	435.4	689 Makhatch-Kala	100.0	1,725	174 Radio Paris	75.0
261.6	1,147 London National	50.0	435.4	689 Stockholm	55.0	1,796	167 Lahti	54.0
263.8	1,137 Moravyska-Ostrava	11.0	441.2	680 Rome (Roma)	60.0	1,860	161.3 Sverdlovsk	50.0
265.7	1,129 Lille (PTT)	1.3	447.1	671 Paris (PTT)	7.0	1,875	160 Huizen	8.5
267.1	1,123 Valencia	8.0	447.1	671 Danzig	0.5	1,920	156 Blaj	5.0
267.4	1,122 Nyiregyhaza	6.0	450	666.5 Odessa (RW37)	20.0	1,935	155 Kaunas	7.0
268.3	1,118 Bremen	0.3	452	664 Madona	25.0	2,000	150 Craciunelu	1.0
269.4	1,112 Bari	20.0	450.3	666 Klagenfurt	0.5	2,625	119 Konigs-wuster-Hausen (press)	20.0
271	1,107 Coince-Liege	0.3	453.2	662 Odessa	10.0	2,650	113 Eiffel Tower	15.0
271.5	1,105 Rennes	1.3	453.8	661.3 Milan Vigentino	7.0			
273.7	1,098 Turin (Torino)	7.0	455.9	658 San Sebastian (EAJ8)	3.0			
276.5	1,085 Hellsberg	60.0	456.7	657 Agen	0.5			
279.9	1,071.8 Bratislava	14.0	459	653 Beromuenster	60.0			
281	1,067 Copenhagen	0.75	461.5	650 Archangel	10.0			

The conductor and the leader of the City of Birmingham Orchestra—Leslie Heward and Alfred Cave—join forces in a piano-forte and violin recital from the Midland studio on April 13.

On Good Friday the choir of St. Mary's Church, Nottingham, conducted by H. O. Hodgson, organist there, will be heard on Midland Regional in a recital of sacred music.

INFORMATION BUREAU

Will every querist please observe the following revised rules.

Please write concisely, giving essential particulars. A fee of one shilling postal order (not stamps), a stamped, addressed envelope and the coupon on the last page must accompany all queries.

Not more than two questions should be sent at any time.

The designing of apparatus or receivers cannot be undertaken.

Slight modifications of a straightforward nature only can be made to blueprints. For more serious alterations the minimum charge is 2/6.

Blueprints supplied by us will be charged for in addition, but of course, readers may send their own blueprints for alteration.

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EXIDE H.T. Accum. 120v.	53	6/7 9 of 6/7
EKCO Eliminator A.C.18	67/6	7/5 9 of 7/5
CELESTION M.C. P.-M.	35/-	4/10 7 of 4/10
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Further Notes on Operating the

"HOME-LOVER'S NEW ALL-ELECTRIC THREE"

BETWEEN the two tuning dials, at the centre, of the panel of the "Home-Lover's New All-Electric Three," you will find the combination control. This has three distinct jobs to do.

Firstly, it is a volume control, working the amplification of the variable-mu valve. Secondly, it is a mains switch, so that at the minimum point of volume the set is switched off and at all other settings of the volume control the set is of course on.

Thirdly, this control changes the wavelength range of the two tuning coils. When pulled out, medium waves are in action, and if you want long waves you simply push in the switch knob.

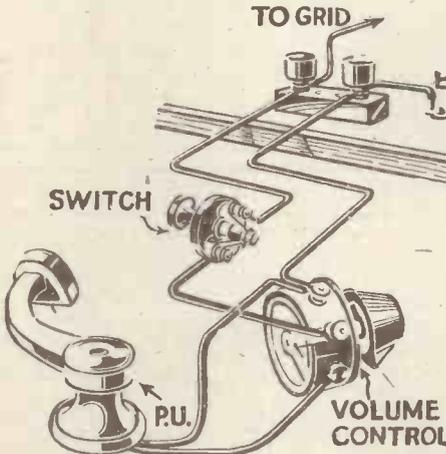
SUITABLE RECTIFIER VALVES FOR THE "HOME-LOVER'S NEW ALL-ELECTRIC THREE"

Make	Type
Mullard	DW2
Cosmor	506BU
Marconi and Osram	U10
Mazda	UU/60 250
Six Sixty	SSU462

In general, you should use the volume control to cut down the strength of the locals. This it will do without in any way affecting the quality of the reproduction. Turn towards the left to reduce volume and towards the right to bring up the strength.

Unless the locals are suffering from foreign-station interference you can usually move reaction to zero and obtain full strength on the loud-speaker with some intermediate setting of the volume control.

Do not regard the input volume control as a fixture. Use it, as indicated, with reaction to sharpen up the tuning. The coupling condenser can certainly be used



Suitable connections for pick-up, switch and volume control

as often as you like, but really there is not much need to touch it after you have decided what setting provides the best compromise between volume and selectivity.

As mentioned last week, this set has been designed to use a pick-up for gramophone
(Continued at foot of next page)

new



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29 PM MOVING COIL SPEAKER

Yes, it's another triumph for Blue Spot. A Moving Coil Speaker really worthy of the name—a performance and reliability that is truly astonishing.

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Catalogue A.W. 668 about other new Blue Spot Moving Coil Speakers post free on request.

This speaker is also obtainable in a cabinet of fine quality oak (22 P.M.) 45/-

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"HOME-LOVER'S NEW ALL-ELECTRIC THREE"

(Continued from preceding page)

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A point you must bear in mind is that the pick-up comes across the grid leak of the detector valve, so when you are not listening to records, you must disconnect the pick-up.

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