Amateur Wireless and Radiovision, September 2, 1933.

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Vol. XXIII. No. 583 Saturday, Sept. 2, 1933

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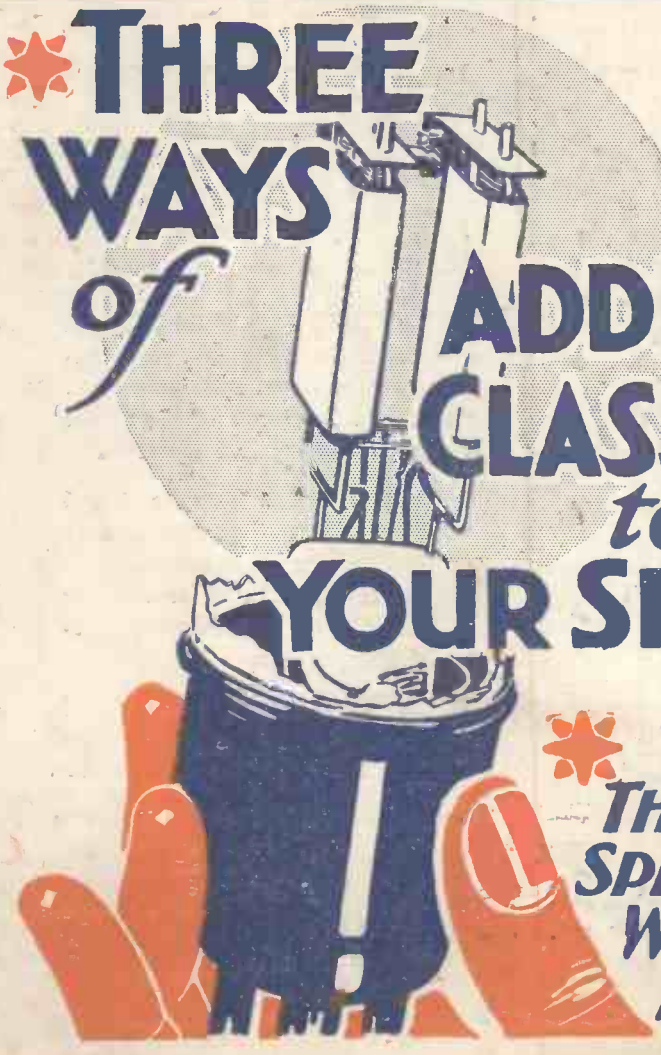

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No. 586. Vol. XXIII. SEPTEMBER 2, 1933

Amateur Wireless & Radiovision

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

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News and Gossip of the Week

Class-B Units to Build

EVERY constructor with a set not fitted for class-B amplification will welcome the three units we have produced this week. Full working details are given on pages 334 to 336, two units being of the add-on type and the third a useful plug-in adaptor complete with moving-coil loud-speaker.

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Television for Amateurs

IN the centre pages this week, H. Corbishley, our Radiovision Editor, discloses first details of his new mirror-drum television apparatus. Amateur constructors should watch this new development, because it will enable all those within the service area of the London and Midland stations to pick up and resolve into images the television signals now being sent out four times a week.

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See You at Glasgow!

OUR stand at the forthcoming Glasgow Radio Exhibition, which this year is held under R.M.A. auspices, is No. 62. All visitors will be very welcome. We shall display all the latest "A.W." sets, as well as show a film of the "A.W." staff at work.

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Big Television Race

THERE are dark doings behind the television scenes of the B.B.C. The Baird Co. and the Gramophone Co. are busy making arrangements to instal 120-line film television gear at Broadcasting House. The ultra-short-wave transmitter, which was installed some months ago by Marconi's on the roof of Broadcasting House, will soon be in great demand.

The great race between H.M.V. and Baird has already begun. The erection of the H.M.V. plant has begun on the eighth floor at Broadcasting House. Another room has been made ready for Baird's *at the other end of the building*, and, we learn, they are also very busy.

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New Saturday Night Feature

LAST week we revealed that the B.B.C. were going to broadcast a miniature vaudeville show at tea-time on Saturdays; the timing of this show has been fixed from 4.30 to 5.15 p.m. Now comes the news that another feature programme for Saturdays, which will be called *In Town To-night*, will be heard after the second news bulletin in the National programme. The show will be of a miscellaneous character in which leading visitors to London will be brought to the "mike" and told to do their stuff. The music for these stunt shows, which, by the way, will last half-an-hour, will be provided by Henry Hall's band. Henry's ambition to play on Saturday nights has probably been taken into account by the B.B.C.

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An Eight-piano Broadcast

HAROLD RAMSAY, the organist at the Tooting Granada Cinema, is assisting the B.B.C. in their big autumn drive for better and brighter programmes. On September 7, between 11 and 11.30 p.m., he is conducting an unusual concert, the soloists at which will be eight pianists playing together on eight pianos, from the stage of the Tooting Granada. This is, we believe, a unique broadcast in this form of novelty entertainment. Previous to this concert, the record was held by a team of four or perhaps five pianists.

Harold Ramsay's Choice—

HAROLD RAMSAY has carefully chosen an unusual selection of items. They include George Gershwin's masterpiece *Rhapsody in Blue*, from the film *King of Jazz*, Ravel's *Bolero* and Rachmaninov's *Prelude in C sharp Minor*, and some dance numbers. The arrangement of the score for eight pianos—a delicate job—will be made by Tony Lowry, who arranged many numbers for Jack Payne in the old days, and who frequently arranges for Henry Hall. We hope that for the dance numbers Harold Ramsay will play us those two delightful compositions of his own, *Her Name is Mary* and *That Lovely Rose*. Don't be modest, Harold.

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Harry Roy and the Mayfair

THERE has been a persistent rumour that Harry Roy's contract with the Mayfair Hotel was a short one, and that he was soon leaving, and his place would be taken by another well-known band. This rumour is untrue, and there is no reason to believe that Harry and his boys are leaving their West End home. In fact, Harry Roy has firmly established himself with the dancing patrons of the Mayfair Hotel, and from all accounts he is likely to remain there for some time.

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Adrian Boult versus Music Critics

FOR months the music critics of the Press have been sniping at the B.B.C. for their alleged bad choice of musical works broadcast in serious-music orchestral concerts. Now Adrian Boult, the Music Director of the B.B.C. is going to do the talking. When the "Prom" season is over he will invite the critics to a lunch—specially prepared, we

Those who missed seeing the Radiolympia Revue "Nine Day's Wonder" at Olympia will be interested to know that the show has been transferred for a week to the Palladium Theatre, Argyll Street, London

As a prize for inventing the winning title of the Radiolympia Revue—"Nine Day's Wonder"—Mr. J. Harris, of Wembley, chose the new Ekco model 74 receiver after a free choice at Olympia

hope!—at which he will explain his policy and tell them the reasons for his choice of music for the coming winter season. We know that Dr. Boult has worked miracles with the B.B.C. orchestra, and has done much to raise the standard of musical appreciation in this country. We hope that the critics will listen with an open mind.

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B.B.C. Producers in Big Shift

FOLLOWING the big reorganisation of the production side of British broadcasting comes the news of further shifts. This time the young producers are involved in the reorganisation scheme. "Archie" Harding is off to the North Region to take charge of the programmes with Robin Whitworth, one

Archibald Haddon, newly appointed Dramatic Critic at the B.B.C.

of the prodigies of the B.B.C. Productions Department, assisting as producer in place of Wyndham Gooden, who has retired. Charles Brewer, the bright man of Birmingham, is coming to Broadcasting House to assist Eric Maschwitz, the new vaudeville controller. Martyn Webster, another prodigy, is taking Brewer's place at Birmingham. Further changes will be made at Cardiff and Belfast. We learn that the object of this latest shift is to strengthen the Regional activities so that they will be able to compete with London on more equal terms. We do know, however, that London has got a good man from Birmingham.

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More News from Droitwich

EVERYBODY is very busy up at Droitwich. The big job done this week was the laying of the concrete lock to support the heavy machinery. Over 900 tons of concrete were made ready and were poured without a break for 18½ hours by a gang of seventy-two men. The gang started work at 7.a.m. one morning and continued with the job until 1.30 a.m. on the following day. If the concrete blocks used were made in one-foot cubes they would stretch from Broadcasting House to . . . sorry, but we cannot standardise the weight of cement!

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30-line Television to Continue

THERE has been talk of the B.B.C. suspending the present late evening television broadcasts by the Baird 30-line process. These broadcasts will continue under the charge of Mr. Campbell, an ex-Baird engineer, D. C. Birkenshaw, the B.B.C.'s television engineer, is having a busy time superintending the installation of the H.M.V. and Baird 120-line television gear in the sound-proof rooms.

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Regional Director Honoured

THE newly appointed Scottish Regional Director, the Reverend Melville Dinwiddie, will be the guest of the King and Queen at Balmoral Castle during the week-end of September 17. He will have the honour of preaching before Their Majesties at divine service at Crathie Parish Church on the Sunday.

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Dancing in September

DANCE-MUSIC programmes go back to normal in September. Many bands will be back at their West End restaurants and hotels from seaside and foreign holidays and the O.B. relays will be more evenly distributed. The outstanding attraction of the month is, of course, the week's broadcast by Jack Payne, who is playing in the week beginning September 11. After their hectic nine days at Olympia, the B.B.C. Band will not only deserve, but will need their fortnight's holidays, which they are taking in the middle of this month. Charlie Kunz heads the list of O.B.'s with six broadcasts closely followed by Harry Roy with four, all in the late evening period. The rest will be made up with broadcasts by Sid Lipton, Lew Stone, Roy Fox, Sidney Kyte, and Jack Jackson. There is enough variety, anyway!

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Old Favourite as Radio Star

SOME of our readers will remember Lorna and Toots Pounds, a pair of high-class comediennes who were very popular some years ago on the stages of London and provincial music halls. You may remember that Lorna got married, and the turn came to an end. Now Toots Pounds, who has been to Italy and Germany studying serious singing, is returning to this country as a real opera singer to play the lead in a broadcast version of Johann Strauss' *Waltz Time*, which will be one of the B.B.C.'s big autumn productions.

The leading part in the film, which was a tremendous success in town, was played by Evelyn Laye.

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Sir John Reith at Olympia

IT has been said that Sir John is a man who seldom laughs. We are able to knock this fallacy completely on the head. A member of the "A.W." Staff was fortunate in securing a seat behind Sir John when he went to the variety show in the broadcasting theatre at Olympia. Sir John applauded and laughed heartily at nearly every item, and it was evident that he thoroughly enjoyed the whole show. He was particularly enthusiastic in his applause of the B.B.C. Dance Band, Clapham and Dwyer, and Flotsam and Jetsam

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New B.B.C. Department

L. W. HAYES, the B.B.C. engineer who always accompanies Sir Charles Carpendale and Noel Ashbridge, the chief engineer, on their tours abroad, has now been put in charge of a new department at Broadcasting House, called the Empire and Foreign Engineering Department. It will be remembered that Mr. Hayes accompanied Noel Ashbridge and Sir Charles to Lucerne recently. Seven countries, by the way, are still refusing to sign the Plan, and there is more than a possibility that the introduction of the new wavelengths, arranged for January next, will have to be postponed.

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B.B.C. Film Development

THE B.B.C. is going to make the most out of the word publicity. John Grierson, who was responsible for the production of the film *Drifters*, has now submitted his scenario to the B.B.C. for the film which we revealed several months ago the B.B.C. had decided to commission. The film will depict activities at Broadcasting House, and broadcasting generally, and, like most films, will have a love interest. We learn that the work will go to a British film company.

◆ ◆ ◆

Sidelights on Broadcasting House

ALREADY Broadcasting House is in the hands of the builders again. It is only two years since the building was formally opened, and now the outside stone work is being cleaned so that the B.B.C. headquarters will keep that "spick and span" look. Inside the messenger boys have come under the eyes of the system. They have been issued small silver numbers, which they wear for identification purposes, presumably, in the buttonhole of their blue reefer jackets. How thorough the organisation of "The House" is arranged is proved by the thoughtfulness of the "chiefs" in feeding the weakly messengers on milk.

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"Prom" Popularity Spreads

WE have been told that the B.B.C. stepped in at the nick of time and saved the Promenade Concerts at Queen's Hall from fading away altogether. The continual broadcasting of the "Proms" has turned what was purely a London affair into an annual music festival for all listeners in this country. This year the "Proms" have gone one step further. Every other night a concert is broadcast to one or other of the European stations, and undoubtedly in time the "Proms" will become an annual music festival for the whole of Europe. We wonder that the B.B.C. does not relay more concerts from abroad. There is no reason why light music from Germany or operas from Italy should not form part of the everyday programmes of our own programmes. What about it, "O.B." department?

Lady Vocalist for B.B.C. Dance Band

Phyllis Robbins

FROM time to time in our news columns we have given hints of a newcomer to the vocal section of Henry Hall's B.B.C. dance band. We are now able to tell you that Miss Phyllis Robbins will join Henry Hall immediately his band returns from its holidays. We may therefore expect to hear Miss Robbins' cute little voice in the early September dance-music programmes.

Probably you have already heard Miss Robbins; she was broadcasting until a week or so ago with Charlie Kunz's band from the Casani Club.

For some time now it has been obvious that Les Allen, the popular Canadian-born vocalist of the B.B.C. dance band, was badly overworked. He has been helped out with various singers and artists, but now it looks as though he may find a permanent colleague.

Miss Robbins will certainly add variety to the vocal numbers, at least during the provisional month for which she has been engaged.

The B.B.C. Plans An Autumn Drive

Better Entertainment Than Ever for Your Enjoyment!

The B.B.C.'s "Nine Days' Wonder" show, as staged in the specially constructed theatre at Radiolympia, took the listening public by storm. Shows of this type will be frequently broadcast this autumn

SOMETHING like a revolution is timed to take place at Broadcasting House on September 1. On that date the much talked-of "Input and Output" reorganisation scheme comes into action. It is the signal for many plans to culminate in definite political change.

Perhaps from the listener's point of view the internal reorganisation matters least. Input will come under the control of Sir Charles Carpendale. What one might call the machine will have the experienced guidance of that redoubtable Vice-Admiral, much as hitherto.

Output deals with all the creative side of the B.B.C.'s activities. It covers a wide field—music, talks, all that is broadcast, in fact; and also publications.

Colonel Dawnay's Appointment

This new Output alignment is made possible by the appointment of Colonel Alan Dawnay, whom, as you will have read from time to time in the past few weeks, joins the B.B.C. on September 1 as second-in-command to Sir John Reith himself.

The Colonel with his Output on the one side, and the Admiral with his Input on the other, take Sir John Reith as their pivotal point. A well-balanced arrangement, evolved after ten years of trial and error.

From the listener's angle the more significant point about September 1 is the radical change in many of the programmes. On that date Eric Maschwitz officially takes command of the Light Entertainment department, a new department specially created to meet the ever-growing cry of the listening public for light programmes.

Much of Eric Maschwitz's outlook on this very difficult problem is already known to our readers. His views on the undesirability of too much jazz in the vaudeville programmes are likely to arouse controversy when they are interpreted in actual programmes. Yet, in his advocacy of lilting melodies and old-time comic songs, he may have struck just the right note. Or he may not.

Few will cavil at Eric Maschwitz in bringing into the broadcasting arena such famous impressarios as Andre Charlot and C. B. Cochran. Nor at the proposal to broadcast musical-comedy "hits."

Eric Maschwitz, newly appointed Director of Light Entertainment, plans to revolutionise B.B.C. vaudeville and variety programmes

The success of *Goodnight, Vienna* and the popularity of the "Songs from the Shows" series give sure indication that the public likes and wants light musical comedy broadcasting.

The autumn drive promises us new blood and old successes in practically every department of broadcasting. There will be the drama festival, a series of microphone play successes that is sure of a wide and appreciative audience.

In the new talks programme a high light will be the relaying from America of S. P. B. Mais's talks in his Modern Columbus series.

Then the decision to give political speakers full rein to party prejudices and passion will liven up Talks Department generally.

Allied to talks are, of course, the weekly criticisms. Here again we shall find "pepped-up" proceedings. Oliver Baldwin, already well known for his independent views on life in general, takes over the film criticisms.

G. K. Chesterton and Desmond McCarthy are to share the book reviewing—both will make interesting broadcasting. "Archie" Haddon will talk to us about the theatre.

Two important changes in the programme timing will also enliven the B.B.C.'s output. The much-criticised 6.30 to 8 p.m. gap in the evening programmes, introduced this summer, will be abandoned, full alternative programmes coming back once again.

On Sundays there will be a very big programme time extension. Alternative programmes will be broadcast from 6 to 7.35 p.m., a period now silent on B.B.C. wavelengths. On either National or Regional wavelengths the light-hearted listener will soon be able to tap the B.B.C. for a continuous supply of light music, or at any rate lightish entertainment, from 12.30 until the religious broadcasts in the evening.

By no means all the changes of importance are confined to the programme department. The engineers look like having a very busy time this autumn. There is ultra-short wave television to tax the keenest of brains.

Vice-Admiral Sir Charles Carpendale, in charge of Input at the B.B.C., is virtually the controller of the broadcasting "machine"

Television fever is spreading at Broadcasting House, so that there will be no lack of willing helpers in the quest for good ultra-short wave television images.

The Baird system will be used for film and real-life transmissions, while the H.M.V. film system will also play a big part in the new television drive, although these transmissions will be confined to films, with a detail of 120 lines per inch.

They will be broadcast from the roof of Broadcasting House, where the ultra-short-wave experimental transmitter designed by Marconi's is at present erected.

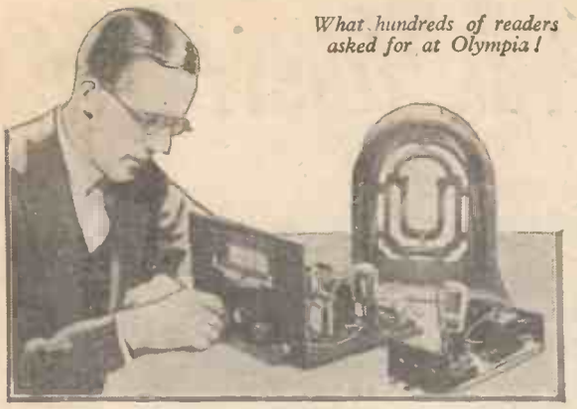
What Droitwich Will Mean

In the field of normal sound broadcasting a big development programme looms ahead. Droitwich is, of course, the biggest undertaking, with its 100-kilowatt long-wave-transmitter and its 50-kilowatt medium waver for Midland Regional.

Then there are the new Regionals to be considered. North Ireland Regional, North-East England Regional, North Scottish Regional; all these have to be planned in the near future.

These new regional centres are likely to take over the wavelengths relinquished by the doomed medium-wave Nationals. As most readers realise by now, the opening of the Droitwich high-power long-waver will be the signal to shut down London, West and North Nationals; they will not be needed.

Every sign and portent indicates that this is going to be a boom year in broadcasting. The public will certainly be ready to take advantage of the improvements in the B.B.C.'s service, if we may judge from the huge orders given for new sets at the Radiolympia Show. A. H.



What hundreds of readers asked for at Olympia!

Unit No. 1 in use with a receiver. It is easily connected

Three Ways of

The "Amateur Wireless" Technical

A blueprint with circuits and full-size layout and wiring guides for all three class-B units *described in these pages is available for* 1s., *post paid, on application to the* AMATEUR WIRELESS *Blueprint Dept.,* 58-61 *Fetter Lane, E.C.*4

BY now the advantages of class-B output are too well known to need much explanation. Enormous volume without distortion; economical working with standard-capacity high-tension batteries when the volume is normal; long life from the double-capacity batteries even when volume is consistently great—these are the outstanding attributes that have rightly come to be associated in the constructor's mind with class B.

The time is now ripe, we feel, for a series of small units that will enable owners of sets with ordinary output stages to adapt them for class-B amplification.

Three Units for All Needs

We have therefore produced three units, which are illustrated in these pages. Constructors will find the full-size blueprint of the units of great value, as it gives the layout of the components on the baseboards, and the full point-to-point wiring.

Those who do not understand theoretical diagrams, such as the circuits we include this week, need not be deterred from tackling the construction of whichever unit is most suitable for their needs, because the blueprint wiring sequence, whereby each lead is numbered, is very easy to follow and effectively dispels all risk of omitted wires, or of wrong connections.

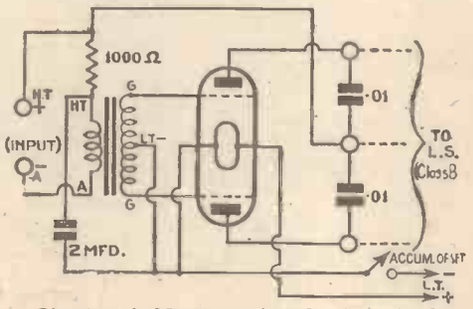
For the benefit of the more advanced readers, we give some information about the theoretical circuits. Fig. 1 is a circuit diagram of the easiest possible unit. It consists of a class-B output valve, which, as you know, is really two valves inside one bulb, with a seven-pin valve holder, and a driver transformer.

The simplicity arises from the use of a single-ratio driver transformer; also we are assuming that if you use this unit you have a loud-speaker chassis incorporating a transformer suitable for class-B working. There are plenty of such chassis to choose from this year, as you no doubt saw at the Show.

An Add-on Unit

This is definitely an add-on unit, and not meant to replace anything in the set. The existing output valve becomes the driver. Rather we should say that the existing output valve stage becomes the driver stage, because the choice of driver valve is somewhat critical with this particular unit, and the existing valve may not do.

The complete unit hooks on to the end of the present set very simply, the loud-speaker being removed and the two appropriate unit terminals connected in its place. The loud-speaker itself may not be suitable for this unit. In fact it certainly will not be unless provided with an output transformer suitable for class B.

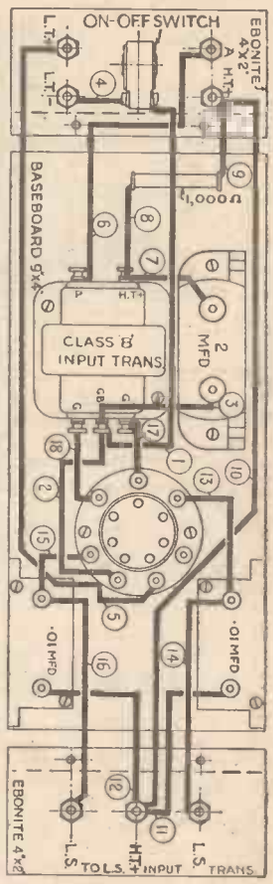


Circuit of No. 1 unit, showing simple class-B output stage

At this time of the year many constructors buy a new loud-speaker chassis for use with home-built sets, and in doing so you might as well get one for class-B work.

Simplicity in the first unit, then, is definitely paid for in terms of restricted input and output. The input is limited, in that you must carefully choose your driver valve, and output is limited in that a suitable loud-speaker must be used. The other units are more flexible, as we shall explain in a moment.

Let us look into this circuit of No. 1 unit. You will see that there is a fairly normal looking input transformer. It has one special point: The secondary is centre-tapped. In this it conforms with all push-pull types of transformers. The two ends of the secondary winding go to the grids of the class-B valve, while the centre-tap point is connected to low-tension negative.



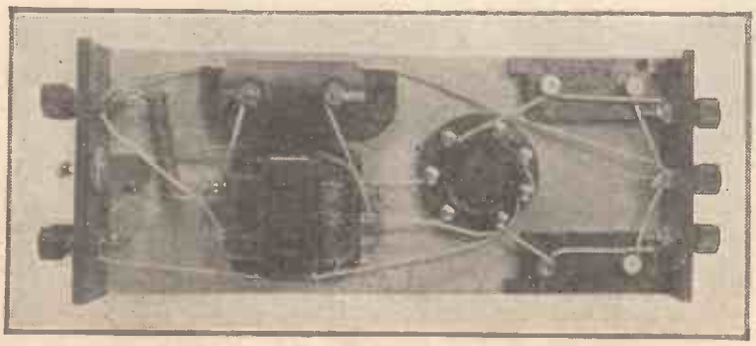
Wiring plan for No. 1 unit

With ordinary push-pull valves there must be negative bias on the valve grids, of course, but not with class B. That is why we take the grids, through the two halves of the secondary winding, straight to low-tension negative and not to a negative tapping on a bias battery.

Now look at the primary winding. It is well decoupled; in series with the primary winding is a 1,000-ohms resistance, and at the junction point of winding and resistance there is taken a 2-microfarad fixed condenser to low-tension negative.

The output transformer is not shown in the circuit of the No. 1 unit, nor is it in the unit corresponding to this circuit, because as already explained, we are assuming that this component is in the loud-speaker chassis. There is a point of special importance in this output arrangement. You will see that the anodes are taken to the outer terminals of two ·01-microfarad fixed condensers connected in series across the primary of the loud-speaker transformer.

These play an important part in suppressing undesirable "parasitic" oscillations. The centre-tap terminal, between the



Plan view of unit No. 1, showing seven-pin valve holder for class-B valve very clearly

COMPONENTS FOR UNIT NO. 1

BASEBOARD
1—Peto-Scott, 9 in. by 4 in.

CONDENSERS, FIXED
2—Lissen .01-microfarad (or Telsen, T.C.C., Graham Farish, Dubilier).
1—Lissen 2-microfarad (or Telsen, T.C.C., Graham Farish, Dubilier).

HOLDER, VALVE
1—W.B. seven-pin (or Telsen, Benjamin, Wearite).

RESISTANCE, FIXED
1—Erie 1,000-ohm (or Telsen, B.A.T., Dubilier, Graham Farish).

SUNDRIES
2—Terminal strips, 4 in. by 2 in. (Peto-Scott).
Connecting wire and sleeving (Lewcos).

SWITCH
1—Bulgin on-off toggle, type S80T.

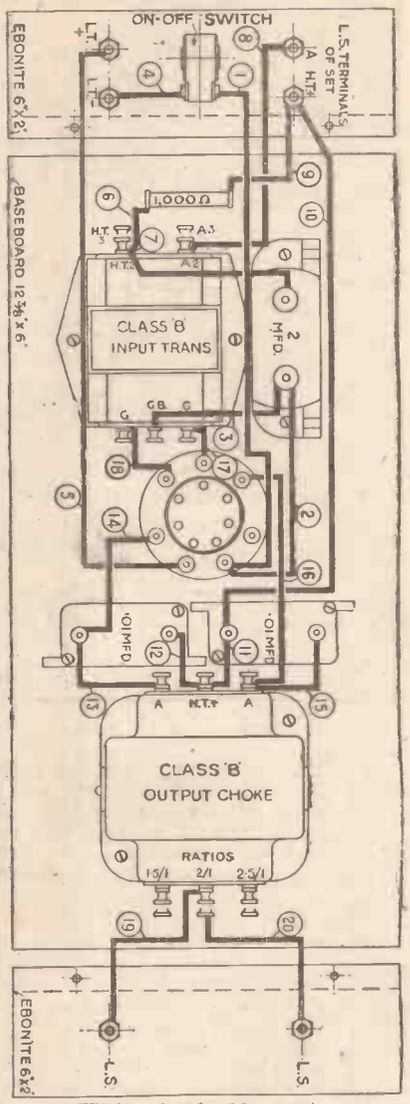
TERMINALS
7—Belling-Lee, type R, marked: L.S. (two), H.T.+, Input (two), L.T.+, L.T.— (or Clix Eelex).

TRANSFORMER, LOW-FREQUENCY
1—Lissen Hypernik class-B driver.

VALVES
1—Cossor 215P driver and Cossor 240B.

Adding Class B to Your Set

Staff Shows You How to Bring Any Battery Receiver Up-to-date



Wiring plan for No. 2 unit

two condensers and connected to the centre tap of the output primary winding, goes back to the positive side of the original loud-speaker point, to get high-tension voltage for the anodes of the class-B valve.

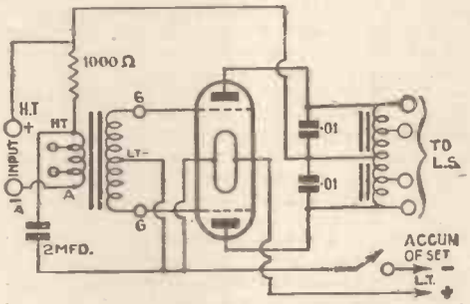
If you intend to use the loud-speaker chassis at some distance from the unit and set, we rather strongly advise you to screen the leads from the output condensers to the chassis, and to earth the outer covering. Which, believe us, will save a deal of trouble with instability.

So much for the first unit. Its construction is, of course, very easy, as you can see from the photographic views and from the reduced reproduction of the full-size blueprint.

Before leaving it we ought to tell you about the transformer ratio. If you are going to use the larger type of class-B valve, such as the Cossor 240B, a 2-to-1 ratio for each half of the driver will do, that is, a 1-to-1 overall ratio. With such a valve a fairly large driver is needed, such as a 215P valve.

If, on the other hand, you propose to use a small type of class-B output valve, such as the excellent Mullard PM2B, you will need a much smaller driver, and the PM2DX can be used quite successfully, with the advantage of great sensitivity and economy of anode and filament battery current.

For this combination you need a different



Circuit of No. 2 unit

ratio. We suggest a 3- or 4-to-1 overall ratio that is 1.5-to 2-to-1 for each half. From this you will see that the ratio of the transformer depends a good deal on the choice of driver. Before you buy the transformer, therefore, decide which arrangement of valve you are going to use and then you cannot go wrong in your ratio.

We realised when making up this unit that many constructors would like something more flexible, even if it did cost a little more. So we produced No. 2 unit, the circuit of which you can examine.

Advantages of No. 2 Unit

The advantage of this No. 2 unit is, that you can use any driver or class-B valve you like, and can work the unit with almost any kind of loud-speaker, even a high-impedance moving-iron cone not being ruled out.

Here you will find that we have incorporated a special tapped out-put choke, with which you can match the class-B valve to any loud-speaker, and so obtain maximum volume without loss of quality.

Similarly, the input side of the unit is notable for the tapped driver transformer, alternative ratios on the secondary accommodating the differing needs of all the driver valves you are likely to want to try.

Apart from these, two points the No. 2 unit is along the same lines as the No. 1 circuit unit, as you will appreciate from the blueprint reproduction.

COMPONENTS FOR UNIT NO. 2

BASEBOARD
1—Peto-Scott, 12¾ in. by 6 in.

CHOKE, LOW-FREQUENCY
1—Varley class-B output, type DP42.

CONDENSERS, FIXED
2—Lissen .01-microfarad (or Telsen, Dubilier, Graham Farish, T.C.C.).
1—Lissen 2-microfarad (or Telsen, Dubilier, Graham Farish, T.C.C.).

HOLDER, VALVE
1—W.B. seven-pin (or Telsen, Benjamin, Wearite).

RESISTANCE, FIXED
1—Erie 1,000-ohm (or Telsen, B.A.T., Graham-Farish, Dubilier).

SUNDRIES
2—Terminal strips, 6 in. by 2 in. (Peto-Scott).
Connecting wire and sleeving (Lewcos).

SWITCH
1—Bulgin on-off toggle, type S80T.

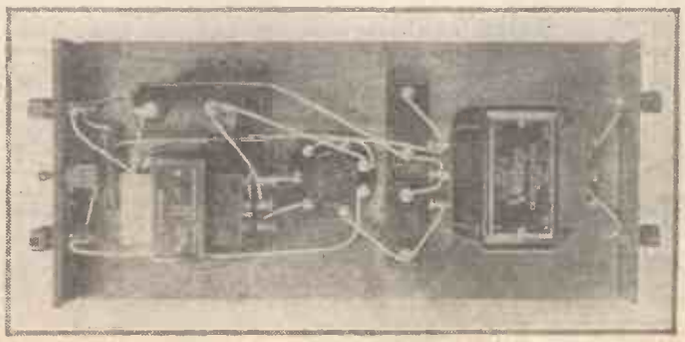
TERMINALS
6—Belling-Lee, type R, marked: Input (two), L.S. (two), L.T.+, L.T.—(or Clix, Eelex).

TRANSFORMER, LOW-FREQUENCY
1—R.I. class-B driver, type DY37.

VALVES
Mullard PM2DX driver and Mullard PM2B, (or Cossor 215P driver and Cossor 240B, or Mazda L210 driver and Mazda PD220, or Osram L210 driver and Osram B21).

You can see all these Class-B units in Selfridge's Somerset Street windows and at the Glasgow Radio Exhibition

No. 2 unit connected up to a receiver and loud-speaker



Plan view of No. 2 unit clearly showing tapped transformers

In both these units, please note, there are low-tension battery terminals, with a switch in the negative lead. This is essential for working even with a set provided with a switch, because the unit filament circuit is connected direct to the battery, even when the actual leads are taken to the corresponding terminals of the set, as you will appreciate if you think a moment.

Thus a separate on-off switch for the units must be used—a small complication when you know what a fine improvement class B means to any set without this new output system.

These first two units should

COMPONENTS FOR UNIT NO. 3

BASEBOARD
1—Peto-Scott, 12½ in. by 6 in.

CABINET
1—Camco Nutone Loud-Speaker Model.

CONDENSERS, FIXED
2—Lissen .01-microfarad (or Telsen, Dubilier, Graham Farish, T.C.C.).
1—Lissen 1-microfarad (or Telsen, Dubilier, Graham Farish, T.C.C.).

HOLDER, VALVE
1—W.B. seven-pin (or Wearite, Benjamin, Telsen).

LOUD-SPEAKER
1—Rand A. Challenger (or W.B. Microlode, Blue Spot).

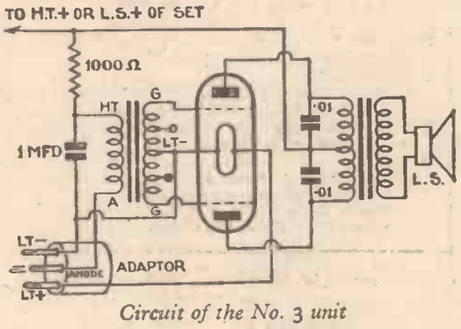
RESISTANCE, FIXED
1—Erie 1,000-ohm (or Telsen, B.A.T., Graham Farish, Dubilier).

SUNDRIES
Two yards thin flex (Lewcoflex).
Connecting wire and sleeving (Lewcos).
Terminal strip, 4 in. by 2 in. (Peto-Scott).
One Bulgin adaptor, type A12.

TERMINALS
3—Belling-Lee, type R, marked: L.S. (two), H.T.+ (or Clix, Eelex).

TRANSFORMER, LOW-FREQUENCY
1—Varley class-B driver, type DP40.

VALVES
Mullard PM2DX driver and Mullard PM2B.



Circuit of the No. 3 unit

satisfy the needs of nearly all those who have good sets and want to make them up to date with class B. There are other amateurs, though, who are of a more experimental bent, with two or three receivers on hand. For them a No. 3 unit.

This novel unit comprises a moving-coil loud-speaker, a class-B amplifier, and a plug-in adaptor. In essence the circuit is the same as No. 1, with a fixed-ratio input or driver transformer, and a fixed-ratio class-B output transformer, the transformer naturally suiting the loud-speaker incorporated.

Adaptor Valve Holder

The only difference is in the methods of deriving the high- and low-tension supply for the class-B valve. There is a four-pin plug-in adaptor valve holder, as shown.

To the filament pins are taken the two filament leads from the class-B valve. The anode pin of the adaptor is taken to the primary of the driver transformer, and the high-tension lead for the anodes of the class-B valves are taken by the only unit lead to the high-tension terminal of the set, or to the loud-speaker positive.

To use this unit you simply remove the existing power valve, plug in the adaptor, and then into the adaptor plug the driver valve—or the power valve may serve as the driver.

This plug-in unit will often come in useful when you want to boost up the volume from an existing radio-gramophone or from a short-wave set. No filament switch is needed, as the filament supply is, of course, derived for the class-B valve from the plug-in adaptor going into the power valve holder of the set.

Full-size Blueprints

Intending constructors of any of these units should note that a full-size blueprint has been prepared of the complete set of No. 1, No. 2 and No. 3 units, together with their appropriate theoretical circuit diagrams for easy reference.

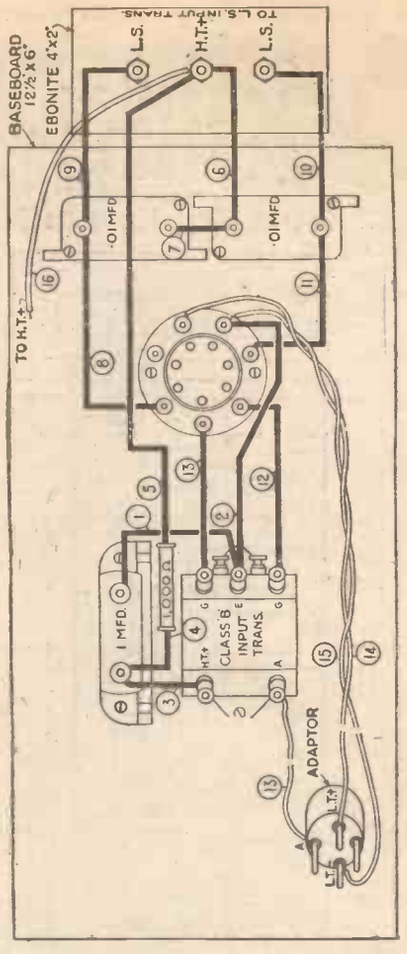
You can obtain this highly useful constructional aid for one shilling, post paid, from the AMATEUR WIRELESS Blueprint Department, of 58-61 Fetter Lane, E.C.4.; ask for No. A.W.400.

In addition to telling you the exact positions of all the components on the baseboard, this blueprint will prove invaluable to those who do not understand theoretical diagrams, and who therefore rely on point-to-point pictorial wiring for the assembly of the units.

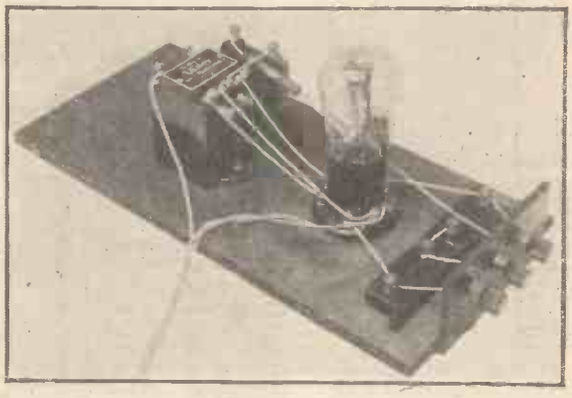
Many newcomers to wireless will find the construction of these units a good starting point, as they are very easy to make and offer no snags in operation.

Should you wish to compare your own unit with the original model, you can do so, because in the Wireless Department window of Selfridges, Oxford Street, London, W.1, we have arranged to show all the units, as indeed we show every new constructional design turned out by the AMATEUR WIRELESS laboratories.

Class-B amplification in one form or another has definitely come to stay and anyone with a battery-operated set not so fitted is definitely behind the times. In addition, class-B provides an enormous increase in the entertainment value of a wireless set, because it really does



Wiring plan of the No. 3 unit



Simple construction of the No. 3 unit, with flexes going out to adaptor

give good volume without the slightest trace of overloading distortion.

As this good quality is obtainable with quite moderate running cost, there is no reason why any constructor should any longer deny himself the undoubted advantages of class B.

This question of running cost, by the way, depends a great deal on the choice of the driver and the output valve. There are now two kinds of class B. The larger type, such as the Cossor 240B, gives about 2,000 milliwatts, while the smaller type, such as the Mullard PM2B, gives about 1,250 milliwatts.

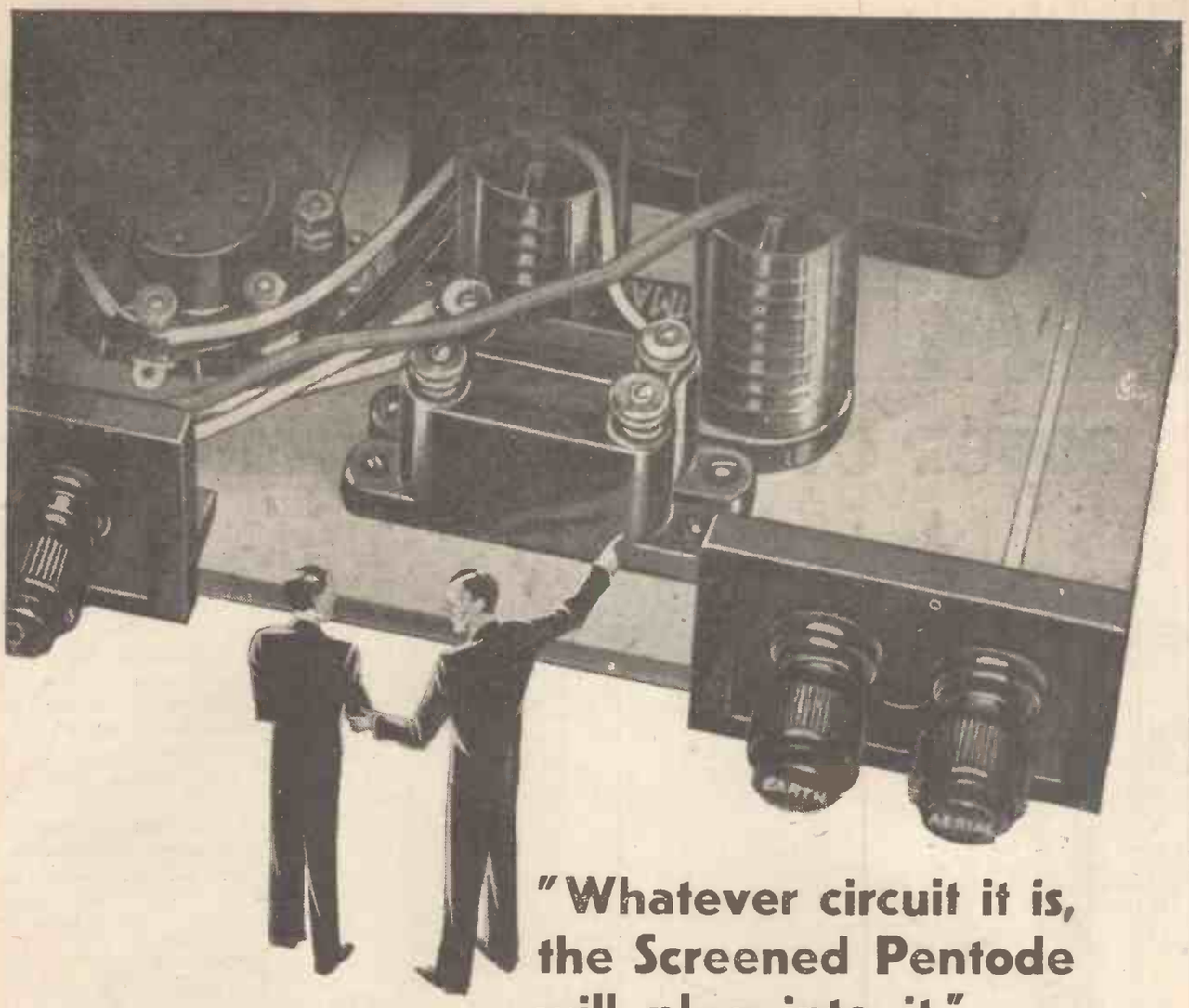
Now 2,000 milliwatts is really big volume, and many amateurs will find the smaller type of valve quite adequate for good room volume needs. Care in the choice of valve type at this point will probably save a lot of worry later on. If you know you are going to use a large amount of volume, go in for the big class B, but if you want a real economy go in for the smaller type.

You will find these units very easy to use with practically all the straight-set designs that have appeared from time to time in our constructional pages. Not only are the units easy to make, they are equally easy to use in practice.

By the way, since writing the above notes, it has occurred to us that you may experience a slight snag in connecting up, unless you realise that the input terminals of the units *can only be connected to the loud-speaker terminals of the set when these latter terminals go direct to the anode and high-tension positive—when there is no output arrangement.*

Plugging in the No. 3 unit to a receiver

A cordial welcome awaits all Scottish readers at our stand (No. 62) at Kelvin Hall, Glasgow, from Friday, September 1, to Saturday, September 9. Besides showing the Signpost Four and the A.C. Triodyne, the three class-B units described in this issue will also be on view. There will be surprises for every visitor—one of them being a special film introducing members of the AMATEUR WIRELESS *staff. If you can possibly get to Kelvin Hall, you will find many attractions to hold your interest!*



"Whatever circuit it is, the Screened Pentode will plug into it."

That is the wonderful fact about this remarkable new Mullard Valve. Whatever the A.C. circuit, however old, however new, however many valves, this new H.F. Pentode will plug into it, will modernise it, will Pentodise it. Because that's the new ideal in circuit design — complete Pentodisation. Pentode-Detector-Pentode means Pentode power in the first stage as well as in the final stage. Mullard Research first introduced the Pentode type of valve and gave Pentode Power to the L.F. stage. Now it comes along with Pentode for the H.F. stage. Ask your dealer about it. It's going to do a great deal for your receiver.

ASK T.S.D. Whenever you want advice about your set or about your valves—ask T.S.D.—Mullard Technical Service Department—always at your service. You're under no obligation whatsoever. We help ourselves by helping you. When writing, whether your problem is big or small, give every detail, and address your envelope to T.S.D., Ref. B.F.P.

THE NEW SCREENED PENTODE

Mullard

THE · MASTER · VALVE

The Mullard Wireless Service Co., Ltd., Mullard House, Charing Cross Road, London, W.C.2

Arki

Telsen
MAINS UNITS
cover every requirement

THE new Telsen Mains Units are the outcome of long research and experiment by some of the finest radio engineers in the country. No effort has been spared to achieve their perfection, every conceivable refinement being embodied in their up-to-the-minute design. Switch over to Telsen now—and rid yourself for good of the distortion and L.F. oscillation which accompany run-down batteries, and the constant expense incurred in their replacement.

TELSEN H.T. UNIT AND L.T. CHARGER FOR A.C. MAINS.

For input voltages between 200 and 250 at 40 to 100 cycles. H.T. output is 28 m.a. at 150 volts, with separate Max., Det. and S.G. tappings, at each of which a choice of high, medium or low voltages is available. Very generous smoothing equipment eliminates hum. Charges 2, 4 or 6 volt accumulators at 0.5 ampere, the use of these facilities leading to such a saving of charging costs that the unit soon pays for itself. Very solidly built, and completely screened by an artistically finished metal case. **97/6**

TELSEN H.T. AND L.T. UNIT FOR A.C. MAINS.

Similar to the "H.T. unit and L.T. charger" but, as it is intended to provide complete power for receivers employing A.C. valves, the L.T. charger is replaced by a centre tapped transformer winding capable of supplying 2.5 amps. at 4 volts. Very well made in every respect and completely screened by its artistically finished metal case. **67/6**

TELSEN H.T. UNIT FOR D.C. MAINS.

For D.C. inputs of from 200 to 250 volts. Adequate smoothing is provided to remove ripple. Output is approximately 28 m.a. at 150 volts. Max., S.G. and Det. tappings are provided, at each of which a choice of high, medium or low voltages is available. Enclosed in a well-finished metal case which provides complete screening. **35/-**

TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM

On Your Wavelength!

New Radiolympia Record

THE 1933 Radio Exhibition at Olympia smashed all kinds of records. During the first three days, for instance, the attendance was 25 per cent. greater than in the corresponding three days of the previous year. Much more business was done and I have never seen such crowds of enthusiasts round the stands containing the more striking exhibits.

On the Saturday a record was made, not only for the Radio Exhibition, but probably for any exhibition that has ever been held at Olympia. Early in the evening the building was so full that no more people could be admitted, though there were thousands waiting outside for admission.

The doors had to be closed for half an hour whilst appeals were made by loud-speaker for those who had seen the sights to make room for those who hadn't.

Old-timers of Wireless

WHILST chatting with Mr. A. F. Bulgin, head of the well-known component firm, I asked whether he remembered my visiting the stand at which he was then on duty at the very first wireless exhibition that ever was held.

He did, and we swopped reminiscences of the quaint things that were displayed in those days. He has been exhibiting ever since, and I've written reports on the show for AMATEUR WIRELESS on that and every succeeding exhibition. There can't be many other people who can show such a long and continuous connection with the show.

The First Show

HOW many of you remember the first wireless exhibition? I can't recall now whether it was purely wireless or whether it took in electrical apparatus in general. I rather think that it did, for I remember seeing Crooke's tubes and other gadgets of that sort on some of the stands.

It was held in the Horticultural Hall in Westminster, and the total floor space would probably not have accommodated more than half a dozen or so of Olympia's big stands. Compare that with the two hundred odd stands of 1933!

Better Quality of Reproduction

MY first round of the exhibition on the opening day was made, as it has been for many years now, with Mr. Percy Harris. We always make a tour lasting two or three hours, and then sit down to exchange impressions.

When we came to do so we agreed that, though there was still too much trashy, catch-penny stuff to be seen on some of the stands, the 1933 Radiolympia could safely be described as a quality show. It was clear that in both the best-finished sets and the best components a very great advance had been made in this respect on previous years.

Is Radio Too Cheap?

IT is rather sad to find that mere cheapness, irrespective of quality, is becoming a more and more potent factor in wireless.

The head of one firm showed me, for example, a mains transformer of first-rate design which lost one big contract because a rival production, clearly very much inferior, had been offered at a price of sixpence less.

I found, too, that the makers of one of the best dry-cell high-tension batteries on the market had a similar complaint. A competitor making a battery, which I know from laboratory tests to be inferior, had beaten them, *not on service hours*, but on a matter of pence in the price.

Still Buying Cheap Batteries

ONE firm that I know well has standard-capacity high-tension batteries of three qualities. All have the same nominal voltage; all are of about the same size. The best quality costs nearly twice as much as the cheapest, and these batteries give quite four times the service hours.

Clearly they are a much better investment; but do you think that the public will buy them? A few of the more enlightened do, but the sales of the cheap and low-grade batteries are vastly greater than those of genuine good quality.

* * * *

Long Waves and Atmospherics

A CORRESPONDENT hailing from East Ham takes exception to my suggestion that when 5XX goes up to 100 kilowatts it alone could easily serve the whole country with the National programme, so that the medium-wave Nationals could perfectly well be scrapped.

Miss Gertrude Lawrence, the popular actress, tuning in on a new Kolster Brandes set at the Radiolympia show

What about atmospherics, he inquires, on the long waves? It is quite true that the effects of atmospherics are usually at their worst on the long waves, but I doubt if we should experience a great deal of trouble from them when receiving the transmissions of a 100-kilowatt station.

And there's another interesting point. You will often find that atmospherics are every bit as powerful when your set is tuned to a wavelength below 300 metres as they are when a long-wave station is coming in.

The reason is that there is comparatively little damping in the tuned circuits owing to the small parallel capacity in use. All of the medium-wave Nationals have wavelengths below or only very little above 300 metres.

What Are Your Views?

THE same correspondent asks: "Did we have a say when a free and expensive service was presented to the Colonies out of our pockets?" from which I gather that he objects to the Empire broadcasting service being paid for out of the wireless licence fees. Certainly I don't, and most people that I know are of the same mind.

The new wireless-for-the-deaf receiver perfected by Mr. J. Poliakoff of Multitone Electric, Ltd. Programmes are heard on the headphones and the loud-speaker can be used as a microphone to converse with a deaf person

Surely it is up to the Mother Country to give a service of this kind to the Empire, and, after all, the annual cost of running the short-wave stations comes to but a small fraction of a penny off each licence fee. I don't think that we ought to grudge that!

* * * *

A.V.C. for Battery Sets

THE letters A.V.C. stand for automatic volume control, one of the most useful refinements that any receiving set can

have, since it prevents blasting and overloading when a powerful transmission is tuned in, and it "irons out" any but the most violent kinds of fading.

In the past there were some difficulties about fitting automatic volume control to battery sets. It could be done, but it was rather a business.

The Westector now makes matters simple and I am at present using a small but very effective device which incorporates it. The beauty of this gadget is that you can fit it to almost any set with only the smallest alterations in the wiring.

* * * *

A Big Radio Drive

AFTER the excellent send-off given by the exhibition to the new season, the authorities have undertaken a big drive to bring the total of wireless licences up to the six million mark by Christmas. I think that they will succeed, and if they do it will be a remarkable achievement.

There are only twelve million homes in this country, so that if the licences reach the total aimed at more than half of Britain's homes will have their wireless sets. Probably no other country in the world can show anything like such a record.

* * * *

Remarkable Battery-set Sales

ONE reason why I think that set owners will number six millions before the end of this year is that such remarkable business is being done in the sale of battery sets, both finished and in kit form.

This R.G.D. radio gramophone is definitely for the plutocrat. It has twelve valves and costs £150

Now that the battery set is capable of genuine mains performance, thousands of folk are rushing to buy who previously would not have wireless in the house. The possible market is enormous, for there are under three million homes with electric light and over eight million without it.

* * * *

New Use for Portables

THE latest development in what might be called short-range wireless is a compact portable set intended for use at large gatherings. It was recently tried out at an international congress in Stockholm, where each delegate was supplied with a small loop aerial to be fitted around the shoulders, a compact crystal detector which he carried in his pocket, and a pair of headphones.

With this outfit he could wander about the building at will and still keep in touch —through a central short-wave transmitter —with the principal speaker or lecturer.

The idea has also obvious possibilities for giving a rapid translation of speeches made by different foreign delegates. As each speech is delivered it is received by the various interpreters, located in separate rooms, and is then re-transmitted, each interpreter using his own language on a distinctive wavelength. In this way, the French, German, and English members of an international conference would be able to follow simultaneously the translation of the speech being delivered.

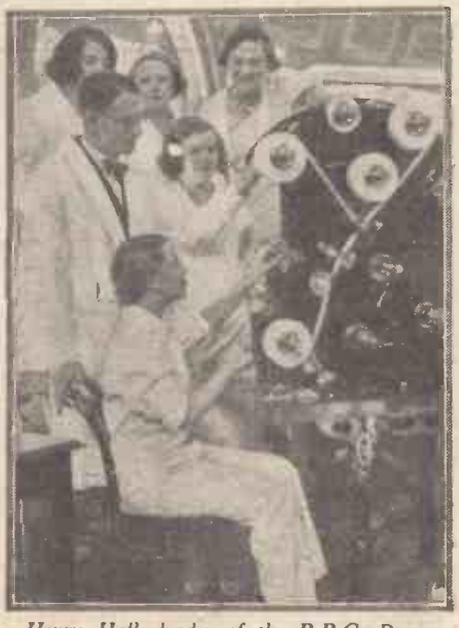
* * * *

Marconi on Micro Waves

NOW that the big event of Radiolympia is over, one may reasonably look at what has been happening on the smaller side of wireless, where I see that Senator Marconi has been setting up new records with micro waves. Using a low-powered 60-centimetre transmitter, he has been able to maintain reliable speech over a distance close on a hundred miles, between his yacht *Elettra* and the port of Genoa.

The surprising thing is, of course, that centimetre waves are supposed to be "quasi-optical," and to travel only in a straight line, like a ray of light. If this were true their maximum range would be limited to the "visible" horizon, which in the particular circumstances mentioned was well under 20 miles.

However, the Senator has just shown us that they will cover *five times* this distance, and quite reliably at that. Small as they are, I imagine that micro waves will one day bring about some very big changes in our present practice.



Henry Hall, leader of the B.B.C. Dance Band, helping Anona Winn, the well-known star, to make condensers for Columbia sets on the special stand recently arranged at Radiolympia

Making Valves More Uniform

VALVE makers, I see, are making a strong point about the uniformity of their products for the new season. I am very glad to see this, and I only hope that their promises will be realised.

The Catkin method of construction provides a method of obtaining far greater uniformity than prevails at present, and it should be possible to maintain a much higher standard than we do with glass-bulb valves of normal type.

Every set designer knows to his cost just what the present lack of uniformity in valves means. If valves of the same make were all up to the same standard he could design circuits of very high efficiency. As it is, he must always allow for the probability that some of those who make up his design will obtain valves whose performances are a good deal "below par," and to allow for this he has often to modify the design of his circuits.

* * *

"Shadow" Tuning

IT looks as if visual tuning of one kind or other is going to be a definite feature of the new season's sets. It is, of course, practically essential with automatic volume control, as there is no other satisfactory way of indicating when the receiving circuits are actually on the resonance point.

Owing to the action of A.V.C., it is impossible to judge the correct tuning point by the ear alone. In shadow-tuning —which, by the way, should not be confused with the old method of spade tuning—the indicator is seen in the centre of a brightly-lit area on the dial, the edges of the area being surrounded by a deeply shadowed portion.

* * *

Modulation Hum Troubles

MODULATION hum is an occasional source of bother in a mains set. One of the principal causes of this hum is a high impedance in the grid circuit of one of H.F. valves. I had a case the other day of a band-pass circuit of the usual mixed coupled type and across the coupling capacity was a leak of about 100,000 ohms. The set gave quite bad modulation hum until I reduced the value of this leak to 1,000 ohms.

A simple remedy like this is not always possible. In another set I had a resistance-coupled H.F. valve having a high resistance of .15 megohm across grid and filament. This valve gave me quite an appreciable step-up, but the modulation hum was most unpleasant. Here, obviously, I could not reduce the resistance to something like a few thousand ohms, or the signal strength would have dropped away considerably.

The important point is that the impedance in the grid circuit must be low at the hum frequency. What it is at any other frequency does not matter so much. When I remembered this I was able to find a solution by using an H.F. choke instead of a resistance.

At radio frequencies this choke had a high impedance quite comparable with the .15 megohm, but at the hum frequency was practically a dead short. Replacing the resistance with this choke completely cured the trouble.

THERMION.

DECOUPLING—

AND ALL THAT!

By

The Experimenters

An H.M.V. Super-het Ten Autoradiogram undergoing one of its tests at the Hayes factory. This set now has automatic volume control and a static suppressor

THROUGH our experimental work and writings we often come in contact with readers' problems. Typical of the sort of thing we have to cope with occurred only the other day. A would-be clever amateur invited us to step inside his den and he would prove decoupling was unnecessary.

He had, we found, one of our latest sets on his bench, very carefully decoupled in both the low-frequency stages. Running the set was the usual high-tension battery. Within a few minutes he had stripped most of the decoupling components from the baseboard. Turning to us with a smile—or was it a sneer?—he remarked: "You see, there is no difference at all. Why waste all that money on the extra components?"

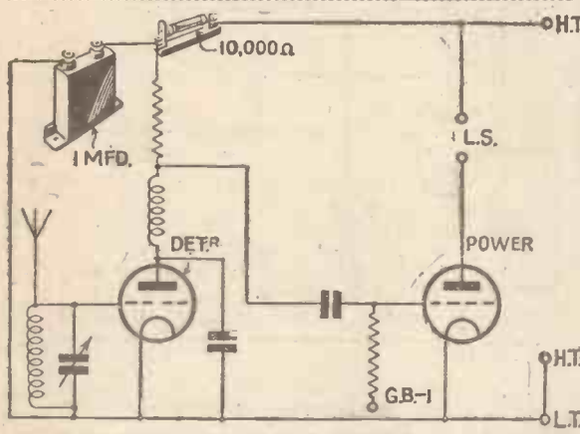


Fig. 2—Typical detector circuit with decoupling resistance and condenser

This article contains the gist of our reply to that poor deluded amateur, but while on the job we thought we might just as well go into this business of decoupling in a thorough way.

Are you one of those that really thinks decoupling is just a designer's fad? Just a method of introducing elegant variation into the usual straight-three theme?

Perhaps the first thing, then, in case you are in this category, is to explain why decoupling is not merely advisable but, under certain working conditions, absolutely essential.

Decoupling obviously has something to do with coupling, hasn't it? Undoing the effect of coupling, surely? That is really what it is all about. We have a coupling, all too often unsuspected, in the high-tension-battery's resistance. The object of decoupling is to counteract this resistance.

Before we go into the ways and means of decoupling, let us explain why decoupling is so much more necessary when the battery is old than when it is newly installed. The reason is simple: the battery when new has a very much lower resistance than when it has been in use for a month or so.

In a good-quality battery, the initial resistance is indeed only a matter of a few ohms, and, for a time, it is perfectly true that when you remove the decoupling components there is no noticeable alteration in the set's performance. But, and this is the big point, if you repeat the experiment when the battery is, say, six weeks old, a very appreciable difference is at once detected.

You would hear a high-pitched whistle, or possibly the effect would not be so marked, and you might hear only a slight motor-boating noise—a pop, pop, popping, quite reminiscent of a motor-boat engine.

Having convinced yourself that decoupling really does mean something—that it does, in fact, counteract the instability caused by run-down batteries, you will be more likely to want to know something of the mechanism of decoupling.

There is only one good way of decoupling, and that is by using a resistance and a condenser, as arranged at Fig. 1. The resistance is connected in series with the high-tension battery and the high-tension side of whatever the anode component may be—transformer primary, another anode resistance, or low-frequency choke.

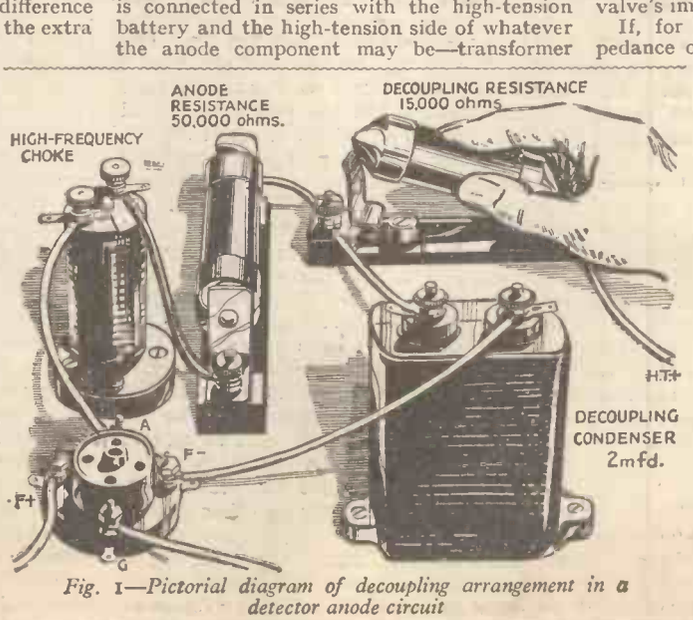


Fig. 1—Pictorial diagram of decoupling arrangement in a detector anode circuit

The condenser is connected just as simply. One side is taken to the junction of the decoupling resistance and the anode circuit component, the other side going to earth.

Often when you study a theoretical circuit diagram you must be puzzled about the choice of values for the decoupling resistance, especially in sets with resistance-fed transformer coupling, where, with the decoupling, there are, of course, two resistance in the anode circuit.

Typical Detector Circuit

Take, for example, our Fig. 2 circuit. It is a typical detector circuit, showing a resistance-capacity-coupled stage, with anode decoupling. The resistance nearer to the choke in the anode circuit of the detector is the normal anode resistance, and this is joined to the decoupling resistance whose extremity is connected to the high-tension supply.

The anode resistance controls, to some extent, the overall signal gain of the valve. There are certain formulae for working out the correct resistance here, but we will not bother you with them now. A rule of thumb may help, though. The value of the anode resistance should be roughly three times the valve's impedance.

If, for example, the detector has an impedance of 15,000 ohms, which is the figure given by the makers in their slip, you should use a 45,000-ohm resistance in the anode circuit.

Now comes the problem of determining the right value of resistance for the decoupling. Here again a formula is useful—if you understand formulae. But as the value is really not critical we usually make use of as large a resistance value as is possible without upsetting other circuit requirements.

We must have a certain minimum voltage on the anode of the detector—in the interests of quality, sensitivity, and so on. In considering the value of the decoupling resistance we must not use too high a resistance or the voltage drop across it will greatly reduce the efficiency of the valve.

Now we have found, after a good many years' experience of decoupling, that the decoupling resistance should be about one-fifth the value of the anode resistance.

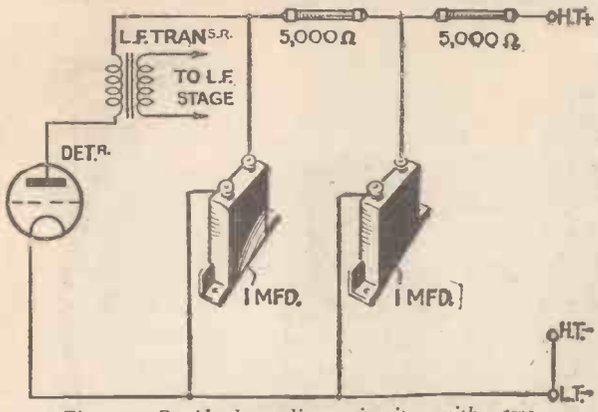


Fig. 3—Double-decoupling circuit, with two decoupling resistances in series and two decoupling condensers of one micro-farad each

With a 15,000 ohm detector valve, for example, the nearest commercial value of anode resistance would be 50,000 ohms, which will do nicely. The decoupling resistance for this should be 10,000 ohms.

Now about the decoupling condenser. Various considerations theoretically control its capacity value. In practice, again working on our wide experience, we find that for low-frequency circuits a 1-microfarad condenser is the minimum to be used.

Interdependent Values

The values of the decoupling resistance and the decoupling condenser are to a large extent interdependent. Supposing that you want to make sure of a good voltage on the anode of the detector, and to do this you reduce the decoupling resistance to the absolute minimum of 10,000 ohms. The value of the decoupling capacity should then be large.

Consider the junction point between the resistance and the condenser, see Fig. 2 circuit. Alternating current, which at all costs we want to prevent from getting into the power circuit through anode-circuit components, has two possible paths. It can, with a great effort, get through the decoupling resistance. But it has a very much easier path through the decoupling condenser.

Why? Because if the condenser has a large capacity it acts more or less as a direct conductor for alternating current, but, of course, will not let direct current through. The resistance, on the other hand, has quite a high impedance for alternating current, which, taking the path of lesser resistance, goes to earth and causes no more trouble.

Often when, for reasons already explained, you have to keep down the value of the decoupling resistance, it pays to divide the total decoupling resistance into two halves, and to use what we call double decoupling.

Fig. 3 shows this modification. The two resistances, say 5,000 ohms each, are connected in series as shown. At the junction of the first resistance and the primary of the transformer we take the usual decoupling condenser to earth.

Then at the junction of the two decoupling resistances another condenser is taken to earth, thus providing a double inducement for the alternating current to go to earth, even with quite a small barrier in the form of a fairly low decoupling resistance arrangement.

Decoupling is not *only* needed for the low-frequency stage, remember. In the screen-grid stage, for example, some form of decoupling or bypass circuit is essential.

Fig. 4 shows a typical screen-grid high-frequency amplifier circuit. In this we have included simple though adequate decoupling. The decoupling resistance has only 1,000 ohms value, and the condenser is only .01 or .005 microfarad.

Now we come to a very important point about decoupling. When we are dealing with decoupling after the detector we are, in effect, handling only low-frequency signals, which are, of course, alternating current.

Decoupling at high frequency requires different values of condenser and resistance from decoupling at low frequency, that is after detection. This is due to the behaviour of a condenser at different frequencies.

A condenser of any given capacity will offer less impedance to high frequency than it will to low frequency. Looking at it another way, as you go up in frequency a given degree of bypassing can be effected by a smaller condenser capacity.

This is why, in the Fig. 4 screen-grid circuit, the resistance and condenser values are much lower than in the preceding circuits.

A Final Summary

Let us, finally, summarise what you need to know in practice about decoupling. First, the value of the decoupling resistance should be about one-fifth the anode resistance. Secondly, the decoupling condenser should have a minimum value of 1 microfarad, but it can be higher for low-frequency work; with a value of .01 or .005 microfarad for high-frequency stages. Thirdly, when using rather low anode resistance values, double decouple with two bypass condensers.

Fourthly, decoupling is needed to overcome the coupling effect between the anodes of the valves of the set caused by the resistance of the high-tension battery, this resistance becoming appreciable only when the battery has been in use some time.

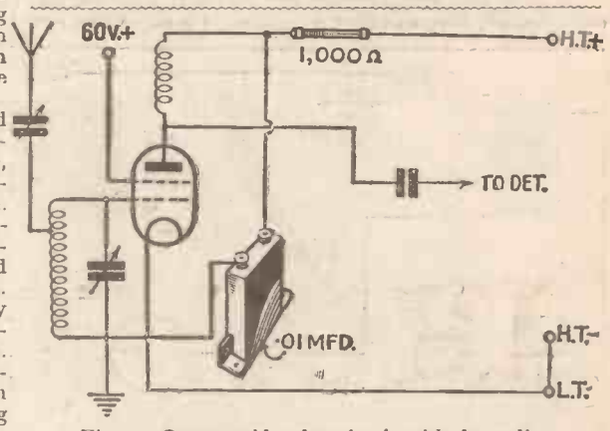


Fig. 4—Screen-grid valve circuit with decoupling. Note that low values are sufficient

And Now—Microphonic Condensers!

WE have all heard of the condenser microphone, but the microphonic condenser will come as a surprise, which fortunately is not likely to trouble us very much unless we are interested in really large receivers.

When the loud-speaker arrived many years ago, we soon had our taste of trouble with microphonicity. Inefficient as sets were, and small the output obtained, yet the sound-pressure waves were often able to set up vibrations in the filament of the detector valve, causing variations in the anode current which were amplified and passed on to the speaker to produce a sustained note. This in turn set up pressure waves which reinforced the filament vibration and so the trouble accumulated, resulting in a loud howl.

Of course, the valve makers soon began to improve matters by mounting filaments differently, but as fast as they mastered one set of conditions the amplification and output of the set increased and confronted them with a yet more difficult problem. The horn loud-speaker was directional and could be pointed away from the set. The cone came along and immediately that cure disappeared. Then we put the speaker into the cabinet and the poor valves had the full force of the output. And all the time both magnification and power went up!

The results of this are seen in the modern valve with its mica-bonded electrodes and seven-point suspension filaments. The mica prevents movement of the electrodes themselves, which would otherwise very definitely cause trouble; the breaking up of the filament into short lengths raises the natural resonance of each piece to a high frequency and also damps the tendency to vibrate. Finally, present-day filaments are of softer wire, not pulled so strongly by the supporting springs as they used to be, and so are naturally "deader."

These precautions have had to be extended from the detector to other stages, even screen-grid valves being liable to act as "microphones." Here the vibrations of filament or grid actually modulate the H.F. currents in the valves very much as the carrier wave is modulated by the speech and music currents at the broadcast station. This modulation is rectified by the detector, amplified, passed to the speaker, and so back again to the valves.

Now we can see, by extending the idea just a little farther, how a similar trouble may arise with a tuning condenser which has very thin vanes or an insufficiently rigid frame.

In a powerful set the sound waves, or even the vibration of the chassis itself, may set the condenser vanes vibrating at their natural frequency. These vibrations cause changes in capacity and so vary the tuning of the circuit. This in turn leads to a corresponding rise and fall of H.F. voltage across the tuning coil and so in effect modulates the incoming signal. If the natural period of the condenser vanes is within the audible range a microphonic howl results.

The cures adopted are to thicken up the vanes and use a softer material which is not so prone to vibrate, to stiffen up the frame and finally to mount the condenser on a tee-point rubber suspension.

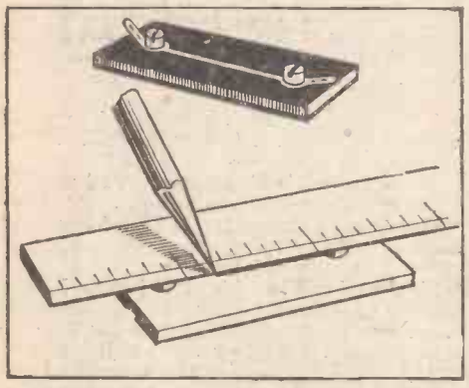
For the Beginner

Sidelights on the Grid Leak

By PERCY W. HARRIS, M. Inst. Rad. E.

THE constant fall in the prices of components, while very favourable to the pocket of the home constructor, is by no means an unmixed blessing. If anything is beyond your reach financially and you want it badly enough, there is a reasonable chance that you will look round and see whether you can *make* it, but nobody bothers to make, say, a grid leak when you can buy one for sixpence or less.

If you had to pay half a crown for one you would probably try and find out a little more about them, and perhaps make one or two, and so, in trying out different values, you would learn a great deal more than you probably know at the moment.

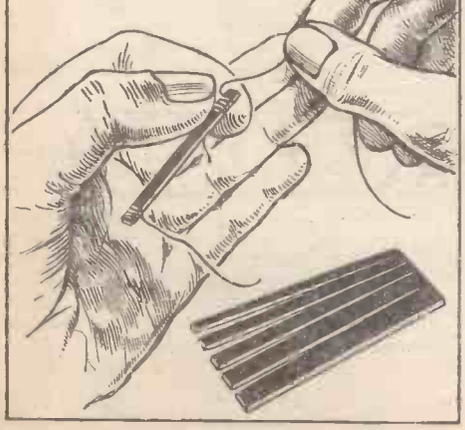


Making a pencil-line grid leak. The finer the line the higher will be the resistance

In any case, why not try your hand at it? The cost is negligible.

A grid leak is nothing more or less than a high resistance, the most popular value being about 2 megohms, which means, in plain ordinary every-day English, two million ohms. The average grid leak is about 1½ in., and this is certainly a whole lot of resistance to get into a short length.

If you want to know how it compares with ordinary No. 18-gauge bell wire, I can tell you that to get the same resistance with this wire you would have to have enough to go round the earth three times, for the resistance of No. 18 copper wire is only about 13 ohms per 1,000 yards. That makes you think, doesn't it?



Strips of Bristol board soaked in indian ink. Bind the ends with fine bare wire to make a good contact

Suppose you took No. 40 copper wire—which, as you may know, is of a hair-like fineness—you would need enough to reach from London to Rome!

If we look around we find there are many materials with a very high resistance quite suitable for the manufacture of temporary grid leaks. One of the simplest ways of making a grid leak is to take some ordinary Bristol-board and soak it in indian ink which, as you may possibly know, contains finely-divided carbon.

A little piece of indian ink soaked cardboard about the length of an ordinary grid leak and about ⅛-in. wide can be used as the starting point for your experiments, and if you take some fine copper wire and twist it round each end tightly so as to establish a good electrical contact, the two free ends can be used to make electrical connection with your circuit.

The broader the strip the lower the resistance and, conversely, the narrower the strip the higher the resistance. At one time practically all commercial grid leaks were made in this way, being enclosed in little tubes of paxolin with the end wires soldered on to the metal cap at each end. Sometimes the inside of the tube was filled with paraffin wax. Many of the cheap grid leaks are made this way now.

Another way of making a leak is to take a piece of matt-surface ebonite about 1½ in. long and ½ in. wide and drill two holes through it large enough to take a 6-B.A. metal screw with a cheese head. Before inserting the screws in the holes take a soft lead pencil such as a "B," and rub it backwards and forwards between the two holes so as to form a pencilled path.

The more you rub the pencil the thicker the graphite deposit. To establish electrical contact with it, a good way is to place a brass washer under each cheese-head screw and between the washer and the graphite surface a small disc of foil such as you find in packets of cigarettes.

When you run a nut on the other side of the ebonite to tighten it this will draw the soft tinfoil down on to the graphite and make a good contact, the protruding screw on the other side serving as a terminal.

A piece of wet cotton will act as a grid leak but, of course, as it dries the resistance will go up, and when it is quite dry it becomes an insulator.

If Signals Are Weakened

If, when substituting any of these home-made grid leaks for the professional type, you find signals are weakened, the probable cause will be that the leak has much too low a value, and it must be increased by narrowing the indian ink strip, removing some of the graphite, or lengthening the wet cotton. If signals seem all "choked up," the value is too high.

Don't think for a minute I am suggesting that you should use these leaks permanently; the object of the experiment is just to teach you something about a component you are using every day. After this you will be in a better position to appreciate the commercial article, and I venture to say that the hobby will be no less interesting to you for this reason.

An Ambitious Valve Guide

WE have received a very comprehensive guide to the new Mullard valves available for the coming season. Actually sixty-three valves are included in this booklet, but many will be deleted in due course as they are only intended for replacement purposes.

The final range will consist of thirty-three valves of different types which cover 2-, 4-, and 6-volt types, directly- and indirectly-heated mains types, valves suitable for D.C. mains, and finally rectifiers.

Copies of this comprehensive 92-page valve guide can be obtained free if mention of AMATEUR WIRELESS is made when applying to the Mullard Wireless Service Co. Ltd., of Mullard House, Charing Cross Road, London, W.C.2.

No matter what type of set you wish to design, or whether you only want to replace the valves in your existing set, you cannot but help to find just what you want in the present Mullard range, even though it is not so large—if we consider the number of valves—as it was last year.

From the figures given, it is quite obvious that in a receiver with valves that have been in use over twelve months, a new set of valves would mean an amazing improvement not only in volume and quality, but also in selectivity, which is so all-important.

In the 2-volt class, which is perhaps of greatest importance, we notice two pentodes, two power valves, two detector valves, and two screen-grid valves. It is a very useful idea having each type of valve duplicated like this, as it allows for such a wide variation in operating conditions.

The 4- and 6-volt ranges are very comprehensive, and it is rather interesting to see that the screen-grid, R.C. and detector valves require only a filament current of .075 amp.

Most Important Releases

The most important releases are to be found in the A.C.-mains range, where there is the VP4, a variable-grid-base high-frequency pentode; the SP4, a fixed-grid-base high-frequency pentode—which could be used as a detector oscillator; the TDD4, a double-diode-triode, and the SD4—both for second detection and automatic volume control—and the very new Pen4VA, which has an undistorted output of 3,600 milliwatts.

We have for a long time advocated the use of indirectly-heated rectifying valves to overcome the harmful effect of voltage surges which occur before the normal receiving valves have heated up. There are two valves of this kind in the Mullard range, designated the IW2, which gives 60 milliamperes at 250 volts, and the IW3 to give 120 milliamperes at 350 volts.

Programme Criticisms by Whitaker-Wilson

Bach's Comedy Number : : Evelyn Scotney Praised : : Henry Hall Acclaimed : : Radiolympic Games : : Explaining the B.B.C.'s Organ

ALL Proms and productions this week. It gets like that in August. Most of my time I was in the spirit at Queen's Hall or else at Radiolympia.

◆ ◆ ◆

How jovial is my laughter! Less a personal characteristic than the title of a jolly song Keith Falkner sang in a Prom. How the Promsters roared, but then the song was by that splendid comedy-song writer, *Jackie Bach*!

That reminds me. I must answer dear R. D. B. (of New Cross) who wrote so charmingly in "A.W." a week or two ago. He was delighted at my notes on the earl who broadcast (or was it a duke?) and said he could just picture me sitting in my study, stroking my long beard. (So I was!)

Do you know, when Keith sang J. S. B.'s comedy number that beard of mine went all curly with sheer merriment, and I was so excited that I went and shaved it off. I am now cleanshaven. (So I was!)

◆ ◆ ◆

Elsie Suddaby's singing would tame a tiger, but it was her sincerity that won the Promsters' hearts the other night—sincerity demanded by the words of her song: *O grant us, mighty Lord, this year, when ending, to find its closing hours, like this beginning, blest!*

If the Promsters did not applaud her to the echo Miss Suddaby can take comfort to her artistic soul because she so completely held them that they had no reply for her. My private thought at the end: *How sincere was Bach, how sincere was she!*

We have had Evelyn Scotney twice in four days—once in a Prom, once in a studio. If the B.B.C. takes to broadcasting her twice nightly I shall be there. I never mind what she sings so long as she sings it. Her voice has not the vestige of a flaw in it. Why not appoint her Soprano-in-Chief?

◆ ◆ ◆

Walter Widdop did the forging in the Forging Songs (*Siegfried*) in the Wagner Prom. He had a tough time with Wagner's scoring, but everyone does. Richard was not kind to his singers.

The second of the songs began: *Nothung! Nothung!* which exactly represents all I made of either lyric. Still, our Walter let off a few healthy top A's which came through amazingly well. Quite a thrill!

◆ ◆ ◆

Sir Edward Elgar paused in the writing of his *Third Symphony* to go to Queen's Hall and conduct his *Second*. There awaited him a tumultuous welcome and, after it was all over, another ovation. A beautiful work.

And now, sir, hurry up and let us have your *Third*. You are young yet—only seventy-six.

◆ ◆ ◆

The Tchaikovsky Promsters enjoyed Moseivitsch playing the piano concerto. So might I, had not the B.B.C. engineers gone to sleep and left the piano microphone turned full on.

Even in the softest passages the balance was all wrong. Allowing that some of it may have been the player's fault, surely someone could have had the sense to turn the piano microphone down? Give the pianists a chance!

◆ ◆ ◆

P.S. to above.—Balance much better three nights later, when Solomon played the *Emperor*. Incidentally, what a magnificent rendering!

◆ ◆ ◆

Ode, written on hearing the microphone "sight-seeing tour,"

So
That was
Blackpool?

◆ ◆ ◆

The success of the Radiolympia Shows was *Henry Hall*. He deserved the ovation he received—every yell in it—because when he first went to the B.B.C. he came in for a good deal of unconsidered censure. He has won on all points, though.

The Houston Sisters . . . "assisting with their irresistibility"

I am not too pleased about his visit to America. I am afraid the Yanks will ruin him for us. I hoped he would go to Rome because he probably existed there in ancient times. The Romans would have called him Henricus Vestibulus.

◆ ◆ ◆

Horace Kenney turned on that Trial Turn of his again—twice. Will he give another Turn a Trial—*once?*

◆ ◆ ◆

In her imitations of a child finding a worm in a pond, Mamie Soutter did not quite convince me in her rendering of dialect, whether American, Lancashire, or Scottish, but the dialogue was very amusing.

I liked her best when she refused to let Nurse take the worm from her. As she justifiably pointed out, Nurse did have the policeman to play with.

◆ ◆ ◆

Of all the horses running in the point-to-point races at Hogsnorton this season, I was most attracted to the Gas Light and Coke Company's grey mare *Clinker*, even though I lost heavily on her. Mr. Potter was himself attractively gaseous about the Directors of the B.B.C.

◆ ◆ ◆

The Rodney Hudson girls looked so sweet while they danced. Didn't you think so?

◆ ◆ ◆

Tessie O'Shea (said the programme) was the Girl with the Irresistible Humour. I resisted most of what she gave me, but liked her songs and the way she sang them.

◆ ◆ ◆

Norman Long had his little jokes. I liked the one in which a farmer asked a chemist to make up two prescriptions—one for his wife and the other for his Jersey cow. He was anxious that the right labels should be put on the bottles as he did not want anything to happen to the cow.

◆ ◆ ◆

And so the Radiolympic Games went on with Alec McGill and Gwen Vaughan chattering in their cheerfulness, and the Houston Sisters assisting with their irresistibility. Quite a good show, but I hope the next will be better.

◆ ◆ ◆

How similar in style and voice are Horace Kenney and Hugh E. Wright. A suggestion for our friend Eric Maschwitz: *put them together in a studio and see what happens!* They will be so delightfully miserable.

◆ ◆ ◆

I hear the B.B.C. has taken up my suggestion that Mr. J. Taylor, of the Compton Organ Company, should be asked to give a descriptive recital of the stops on the new organ at Broadcasting House. Mr. Taylor gave me the benefit of his knowledge of the instrument the day before it was formally opened.

He will broadcast on September 10. I suggest you hear this recital, which will give you a good idea of the capabilities of the much-talked-of organ.

◆ ◆ ◆

Another *America Calling* is being prepared. The first so convinced the Americans that we admire them that the Columbia broadcasting system is replying with a skit at us. I can understand their enthusiasm, but am left wondering how the difficulty of speaking English will be overcome.

◆ ◆ ◆

Listen to Galsworthy's *Strife* on September 4 and 5. It is about a factory strike. You will enjoy searching the mind of the chairman on the one side, and of the trade-union official on the other. Howard Rose is the producer.

At the Berlin Radio Show

A Special Article by
A. A. Gulliland

The tenth Radio Exhibition was held in Berlin from August 18 to August 27

THIS is Germany's tenth radio exhibition. It is so entirely different from all previous shows—and, in fact, so different from radio exhibitions in any other parts of the world—that one does not need to remember the fact that Germany has just passed through a revolution. This is so obvious that it is impossible not to see it.

The uniforms of the guests at this morning's opening, the Swastika flags hanging from the Berlin Funkturm, the absence of the German radio pioneers (a number of whom are in the concentration camp at Oranienburg under charge of squandering public money)—all these factors, together with the exuberant youth and fanaticism of the new chiefs of German radio, bear out my observations.

The Telefunken combined television receiver and radio-gramophone shown in Berlin. The cathode-ray tube at the top handles the latest 180-line 25-frame transmissions

At the "wish" of the German Ministry of Propaganda the twenty-eight German radio manufacturers set to work a few months ago to produce a radio set which will enable any German in any part of the country to receive the national long-wave station Deutschland-sender and at least one regional station. The patent owners sacrificed two-thirds of their usual licence money, the trade consented to a large reduction in their discount, and the manufacturers themselves found means to produce this receiver at the absurd price of 76 marks.

The Volksempfänger, as it is called, is in the centre of every manufacturer's stand at the exhibition. A special contract fixed the price for the next cheapest receiver at a minimum of 120 marks. This to give the Volksempfänger an even better market.

Dr. Goebbels, in his opening speech, stated that the German National Socialist Government would use all its long experience of propaganda to double the present number of German listeners, thus to obtain sufficient income to make German broadcasting the best in the world and to subsidise the theatre, book authors, and musical life.

The "universal" German set, the Volksempfänger. Leaning over the set is Ober Ing. Griessing, while the head of the technical committee which produced the set is seen sitting

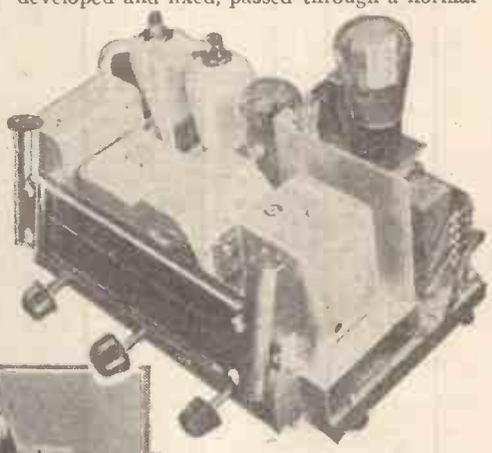
Competition among manufacturers has been reduced to the smallest measure at this radio show. Taking it as a whole, it is more of an historic exhibition than a radio show. The German radio industry only occupies one-half of the total space. The other half belongs to the different official bodies.

Technical development in Germany shows marked advance over last year. The super-het introduced last autumn has come to stay; so has automatic volume control in the higher priced sets. The radio-gramophone and the portable set have remained as unpopular as ever. Shadow tuning is incorporated in all sets costing more than 300 marks which, by the way, is close to the highest-priced receiver. The historic show, arranged by Major Schlee, formerly of the R.R.G., is highly interesting. It includes the first Hertz reflector and receivers from days long before the war, including the first German telephony station with a curious microphone which was placed in the aerial circuit to modulate the waves. There are well-designed shows arranged by the broadcasters; and the German Army has contributed a complete dug-out and numerous old wireless apparatus.

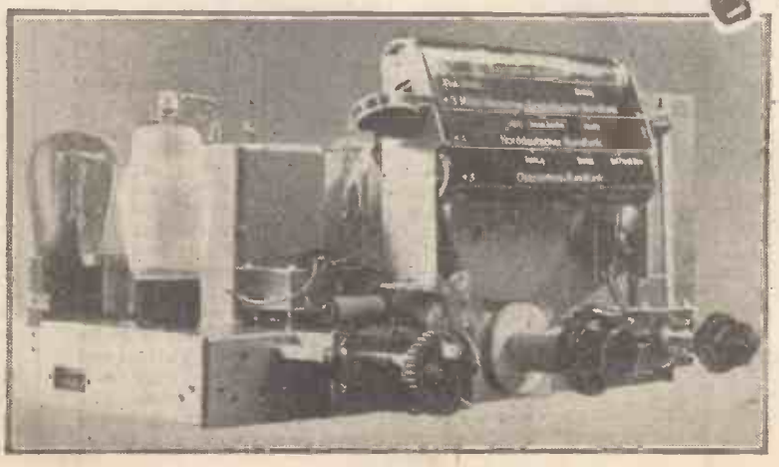
The German Navy has a large scale of the Battle of Jutland on show; also the conning tower of a submarine complete with radio cabin. The German Air Ministry is represented with highly interesting direction-finding apparatus together with a complete Luft Hansa aeroplane. The German Post Office has a very extensive show of anti-man-made-interference appliances, together with diagrams showing short-wave propagation.

Television progress in Germany is astounding. The new standard (180 lines, 40,000 picture points, 25 frames per second) is mostly received by means of a cathode-ray tube, the size of the picture being about ordinary photographic half-plate. The Fernseh A.G. have further developed their intermediate film transmitter into a receiver for large halls.

The method is briefly as follows: A continuous band of celluloid is emulsioned, exposed to the incoming television image, developed and fixed, passed through a normal cinema projector which throws an image on to a screen about 3 by 4 metres in size, is then washed off again, and then the process begins anew. The time lag between the moment the television picture is photographed and the moment it passes through the projector is only 20 seconds, or well-nigh instantaneous. The accompanying sound can be recorded and reproduced in the same way.



An interesting three-valve super-het marketed in Germany by the three firms—Siemens, A.E.G., and Telefunken



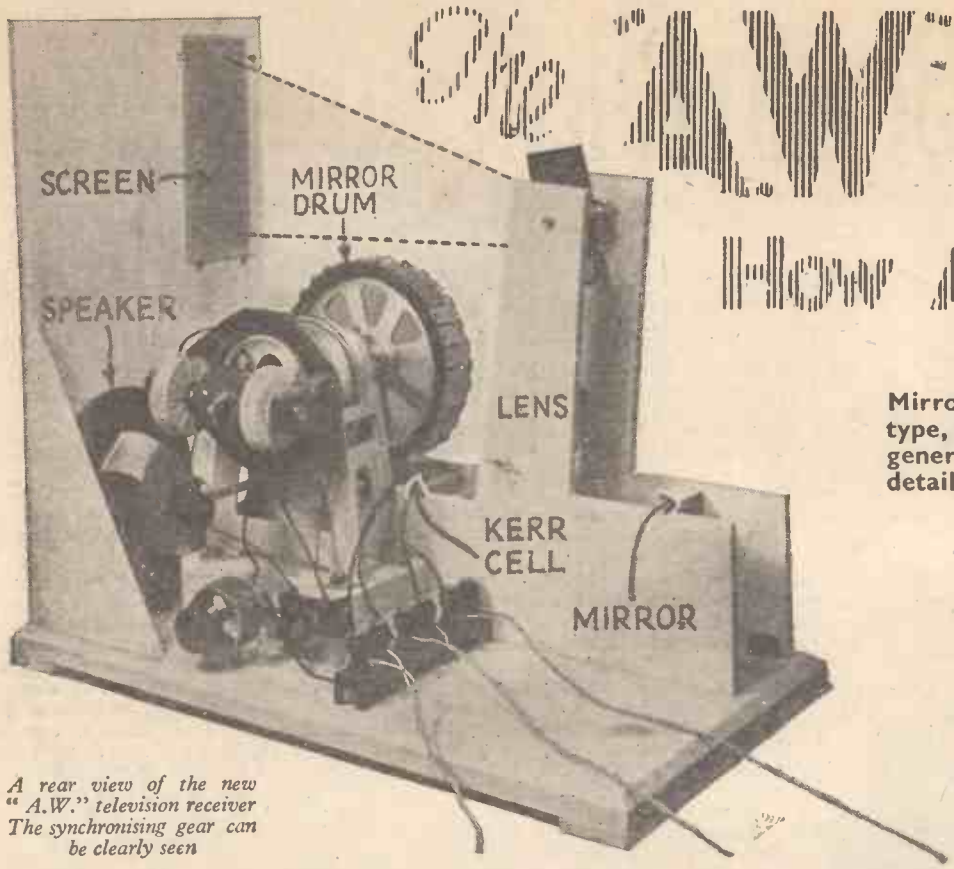
In the Siemens set a tuning film takes the place of the usual dial. The set is a super-het, costing a little over 300 marks

Se "A.W." SIMPLE

How a Mirror-Dru

By H. CO

Mirror-drum television receivers have now t type, on which they are a great improvemen general principle is the same and this is exp details of the actual receiver shown by the



A rear view of the new "A.W." television receiver The synchronising gear can be clearly seen

SIMPLE TO BUILD—CONSTRU

DO you recollect how in the early days of wireless the owner of a set was more or less a local celebrity and how the neighbours would flock to hear the latest wonder? Also, do you know that the amateur experimenter has done a wonderful amount in the furtherance of the progress of wireless reception? It looks as though history is going to repeat itself, but this time with television, for here is a wonderful field of experiment for the enthusiast.

There are, perhaps, a few people who do not really know what television is; there are many who do not know how the present-day practicable systems work; and still more who are asking such questions as "What results shall I get?"—"What will be the cost of the apparatus?"—"What amount of entertainment is there in it?"—"Can I use my present receiver?"—"Does the construction of television apparatus mean skilled mechanical work which is beyond my capabilities?" and so on.

Let us see what are the answers to these questions. First: results. Admittedly these are not perfect and may probably best be likened to a photograph which is out of focus and which, upon occasion, is apt to disappear for a few moments. Remember, though, that in a complete television equipment you have sound accompanying the picture, and this materially helps towards its realism. And again, in this respect, do not forget the experimental interest. You will almost certainly be able to effect some improvement and in your experiments you will be helping in the development of the new science.

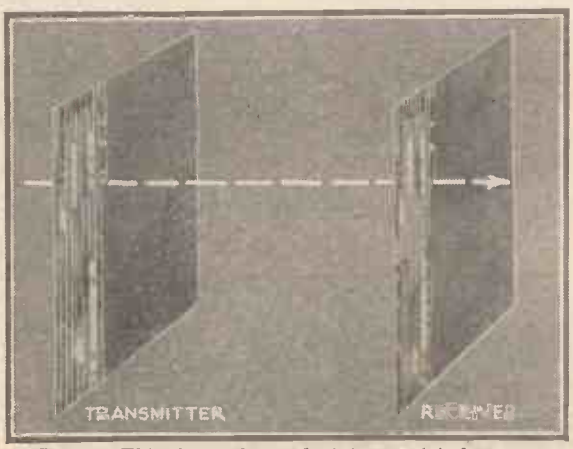


Fig. 1.—This picture shows why it is essential that perfect synchronism must be secured between the transmitter and receiver so that at any time a certain area of the picture that is to be transmitted is being scanned; similar conditions obtain at the receiving end

Next, the cost: You can *experiment* with television, as it is intended to show later, at the cost of a few shillings. True, the complete equipment may be somewhat costly, but not a great deal more so than a good wireless receiver. Moreover, much of the apparatus you can make yourself with the simplest equipment of tools, and it is work that does not require much more constructional ability than does an ordinary wireless set.

Regarding the entertainment that is to be obtained, the B.B.C. is at present putting out a half-hour programme four days in each week in which well-known artists take part. The number of television receivers that are in use at the present time does not warrant a longer programme time than this, but it will be the policy of the B.B.C. to increase this as the interest in television increases and the transmissions will then no doubt be altered to more convenient times. There has been some speculation about a possible change in the system and the number of scanning lines used, and whether these would render existing apparatus useless. It can be stated confidently that there is no immediate likelihood of this as regards the ordinary service, though experiments using a greater number of scanning lines and other systems will probably be made in the hope of advancing the science.

There are two distinctly different systems of television with both of which a fair measure of success has been obtained. Either system can be used for reception of the B.B.C. programmes and there is only one feature that is common to both; this is that the object or picture to be transmitted must be "scanned." It is not proposed to discuss the merits or demerits of either system at present, but it may be said that from the amateur point of

A POLARISATION EXPE

HERE is a simple experiment which you can try at the cost of a few pence to demonstrate the polarisation of light. Ordinarily, for this purpose Nicol prisms are used, as explained in these pages, but there is a very simple and efficient substitute which consists of a number of very thin glass plates. These plates are made as microscope-slide cover glasses and are obtainable from any optical dealer. Two piles of from fifteen to twenty are required and these are held in front of the eye with an angle of about sixty degrees between them, as shown in the illustration. It will now be found that if one pile is rotated about a line passing through the centres of the two, the light will gradually be blotted out until at one position there is almost total darkness, the relative positions of the two piles determining the amount of light that can get through.

It is quite practicable to use a substitute of

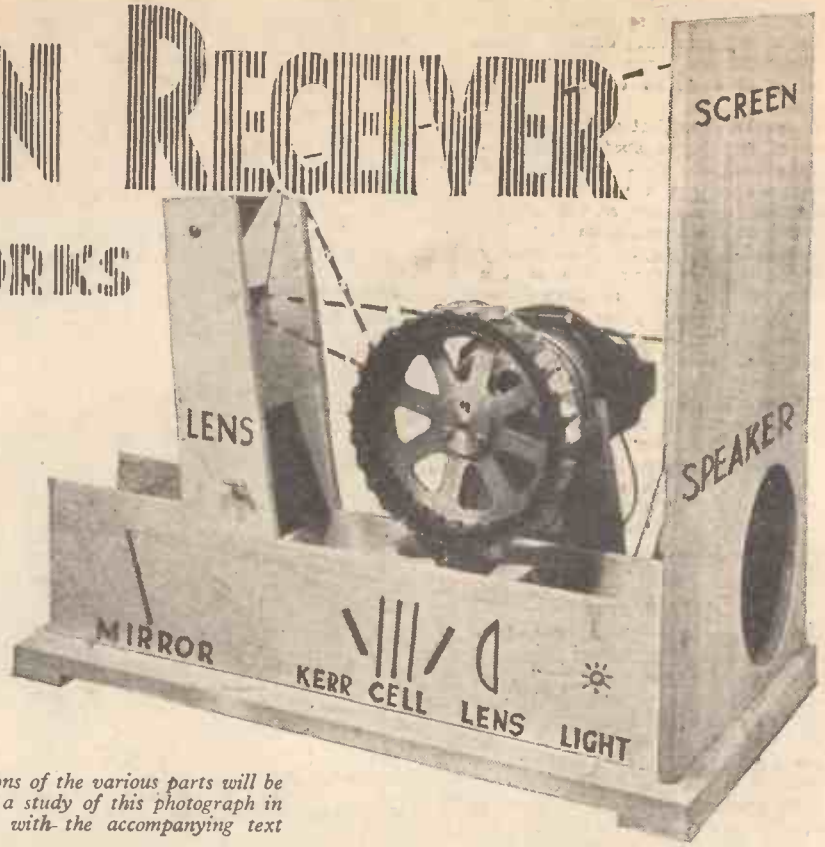
TELEVISION RECEIVER

M RECEIVER WORKS

RBISHLEY

eplaced the older and simpler scanning-disc t. Though there is a variety of designs, the ed in the following article. Constructional hotographs will be given in our next issue

CTIONAL DETAILS NEXT WEEK



The functions of the various parts will be clear from a study of this photograph in conjunction with the accompanying text

view the mechanical system is the simpler and cheaper and up to the present the results obtained by this latter system are probably the better.

Scanning

Any possible system of television according to our present knowledge must necessarily employ scanning, so it will be well to make it quite clear exactly what this means. Moving-picture reproduction, as is well known in the case of the cinema, relies upon a function of the eye termed "persistence of vision," so that if sixteen distinct pictures are thrown upon the screen in one second the picture appears continuous. For television purposes it is found that twelve and a half complete pictures per second are sufficient.

In the case of the cinema, however, each picture is thrown upon the screen in its entirety, but with television the problem is more complicated, for it is necessary first to convert the various light values which go to make up the picture into corresponding values of electricity and transmit these in sequence, and then again convert these into light values at the receiving end. An obvious way to do this is to resolve the picture into a series of lines and trace over these in such a manner that the entire picture is covered in one-twelfth-and-a-half part of a second.

The problem does not end here, however, for it is obvious that if we have a certain light value at a certain position in the picture to be transmitted, then we must be able to place this same light value in an exactly similar position on the receiving screen (see Fig. 1); and in its transposition, as it were, from the transmitting end to the receiving screen this light value must have been first converted into electricity and then have been reconverted back to light.

"Scanning" was first accomplished by means of a revolving metal disc in which there was a series of holes in spiral formation, but this simple device has been more or less superseded by the mirror drum which, although not so simple, offers certain advantages. Briefly, the mirror drum consists of a flat drum which can be mounted on the shaft of a motor and which has arranged round its periphery a series of mirrors each of which is slightly displaced relative to the one before it.

A Simple Experiment

A simple experiment will show how such a drum can be made to "scan." Take a piece of tin and pivot it at one end; bend the other end at right angles and secure a piece of mirror to it as shown in Fig. 2. If a beam of light is now directed on to the mirror and is then reflected on to a paper screen, it will be observed that a line of light is traced as the arm is swung on its pivot. Now bend the end of the tin slightly and it will be observed that as the arm is again swung, another line of light is drawn at the side of the position occupied by the first. We can continue bending the tin, and each time this is done the line of light will be displaced to one side. This is exactly what takes place in the case of the differently-tilted mirror drum as each mirror comes opposite the screen until finally the whole thirty mirrors have occupied this position, and so it is repeated with each revolution of the drum.

As mentioned before, it is essential that any mirror on the receiving drum with a certain

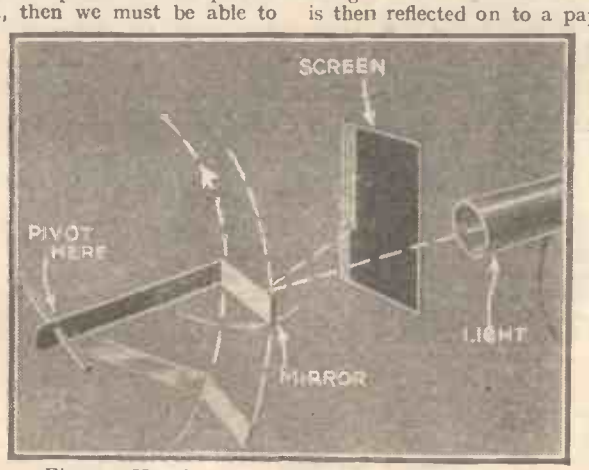


Fig. 2.—Here is a simple experiment showing how the mirror drum functions. A single mirror is shown, of which the angular position can be altered in order to cause it to scan any part of the screen

RIMENT YOU CAN TRY

this nature for television purposes, the only disadvantage being that a greater intensity of light is required and that not quite all the light is blocked out. As explained in these pages, the plane of polarisation can also be rotated by means of a Kerr cell so that, if desired, the experiment can be carried a step further.

angular displacement must occupy exactly the same position as the corresponding mirror on the transmitting drum, so it is necessary that perfect synchronism be secured between both transmitting and receiving drums. How this is accomplished need not be entered into here, for it is a detail of the actual apparatus.

It will now be clear that so far we have a means of causing a spot of light to travel in successive lines in a vertical direction up or down a screen so that when the motor is running at the correct speed, owing to the persistence of vision effect, the screen appears almost evenly illuminated. The next problem is the modulation of this light in accordance with the varying input signals which we receive from the transmitting station. There are three general methods of doing this.

We can use a flat-plate neon lamp which will respond instantly to current variations; we can use a neon crater lamp which has been specially developed for the purpose; or, thirdly, an ordinary lamp and modulate the light which comes from this by passing it through a special combination of polarising prisms and a Kerr cell.

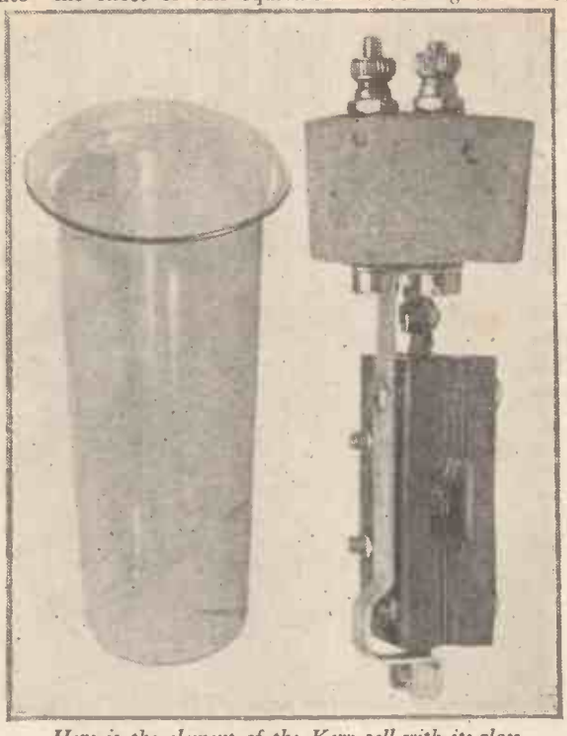
The Light Source

The glow produced by a flat-plate neon lamp is not of sufficient intensity to allow of its being used for projection purposes, though this source of light is used in the scanning-disc type of television receiver in which an intense beam of light is not required. With the mirror-drum receiver, therefore, use is made of either the crater lamp, which can be modulated directly, or light from an ordinary lamp which is modulated at some point in its path to the drum. With this last, modulation is effected by passing the light through an Iceland spar prism, then between a series of metal plates (somewhat resembling a miniature condenser) immersed in nitro-benzole, and then through a second Iceland spar prism.

It is not intended to go fully into the action of this combination, but it will suffice to say that an Iceland spar prism has the property of plane polarising light so that only wave motion vibrating in one direction can get through. A second prism placed in a certain position will polarise the wave motion in the other direction so that no light whatever will get through under these conditions. Nitro-benzole has the peculiar property of rotating the plane of polarisation of light which is passing through it if it is subjected to either electrostatic or electromagnetic stress and the effect of this equivalent to moving one of the prisms relative to the other so that the light is polarised, to a greater or a lesser extent, according to the amount of stress imposed. This electric stress can be applied to the nitro-benzole via the small metal plates between which the light passes. The Iceland spar prisms are usually termed Nicols, and the combination of metal plates and nitro-benzole a Kerr cell.

With this arrangement we have, therefore, what is in effect a light shutter which has no moving parts, no inertia, and which will therefore act instantly and in a degree corresponding exactly to the values of the electrical stresses applied to the plates of the Kerr cell.

If a crater lamp be used then there is no necessity for either the Kerr cell or the Nicol prisms for, as stated before, this can be modulated directly, the light being produced by the amplified signal currents and varying in intensity in accordance with the variations of these. The Kerr cell combination, however, offers certain advantages, and this system has been used in the receiver shown by the photographs.



Here is the element of the Kerr cell with its glass container which is filled with nitro-benzole. The element consists of two fibre blocks between which are clamped a series of thin steel plates, the plane of polarisation of the light being rotated as it passes between them

The Optical System

Finally, there is the optical system of the receiver to consider. It is of quite a simple nature. We start off with the source of light, which is a projection lamp of the type used for small cinema machines. The light from this falls upon a condensing lens which is so positioned that the beam is concentrated upon the plates of the Kerr cell, it having passed through the first Nicol prism in the meantime. After leaving the plates of the Kerr cell it tends to spread as it passes through the second Nicol prism. It next falls upon a mirror set at an angle which reflects it through a lens which focuses it on to the mirror drum from which it is once more reflected either directly on to the screen or, in the case of the receiver shown by the photographs, on to another mirror and thence on to the screen.

Mention must be made of an adjustable diaphragm which is placed between the Kerr cell and the second Nicol prism. This is for the purpose of adjusting the light spot to any desired size. Actually the size of the aperture in this diaphragm is about one-tenth of an inch and this is the approximate size of the spot which is thrown on the viewing screen when the drum is stationary.

Although but a brief description has been given of the action of a mirror-drum receiver, it will be clear that really it is quite a simple piece of apparatus and one which can easily be constructed by the average amateur, using parts that are now on the market. Alternatively, it is quite within the capabilities of anyone skilled in the use of tools to construct the entire apparatus. Sufficient information will be given for either course to be followed in succeeding articles in which the construction will be dealt with.

Loud-speakers with Twenty-one Output Ratios!

WITH such a variety of output valves, the standard type of output transformer is becoming obsolete. With class-B, Q.P.P., and pentode outputs, at least three different ratios of output transformer will be necessary, even assuming that the valves of different manufacture require similar output loads—which is very unlikely.

Integral Multi-ratio Transformer

W.B. have branched out in quite a new direction by supplying all their loud-speakers with multi-ratio output transformers as an integral part. This may not sound a very important development, but this transformer has seventeen different ratios for matching the speaker to any power or pentode valve and four different ratios for matching up with class B and Q.P.P.

It will be realised that there is absolutely no need to buy any additional output transformers should the output valve be changed, and at the same time it is now possible to match up the loud-speaker to the output valve to a very fine degree.

The quality of a moving-coil speaker is not always of the highest class, due to incorrect matching between the speaker and the valve. If the results are moderately good, nothing further is done, so a good moving-coil speaker is not, perhaps, heard to its best advantage. The Microlode speakers will definitely overcome this haphazard matching, so that reproduction generally should be greatly improved.

The W.B. speakers this year have been considerably improved, the magnetic system developed last year still being retained, but in an improved form. This system is unique, for instead of the flux density being equally spread it is concentrated in the "gap," where the extra efficiency is required. The effect is that the efficiency is approximately 30 per cent. higher than a cobalt-steel magnet of equal weight.

The multi-ratio transformer is built into the base of the speaker, and by rotating two switches practically any transformer ratio can be obtained. There is absolutely no need to work out the ratio necessary for any particular valve as the correct ratio is easily discovered by ear—the correct ratio giving much better bass and a generally more level response.

The W.B. range is very complete, the speakers ranging in price from 32s. 6d. up to £8 5s. The PM6 at 32s. 6d. will handle 3 watts undistorted output without a trace of any "chatter" and considering the diameter of the cone—only 6½ in.—it says much for the design for this loud-speaker to give such uniform results.

The PM2A is an ideal unit for the average family receiver, and will handle an output of 6 watts. The bass response is definitely better than the majority of speakers at this price, and altogether the reproduction is extremely pleasant.

For Small Dance Halls

For small dance halls and outdoor work the PM1A stands alone in its class, at any rate in the £6 class. This speaker has a cone 7¾ in. in diameter, and is sufficiently sensitive to work from a two-valve receiver giving 350 milliwatts output or, at the other extreme, will handle 12 watts undistorted output without showing any signs of distress.

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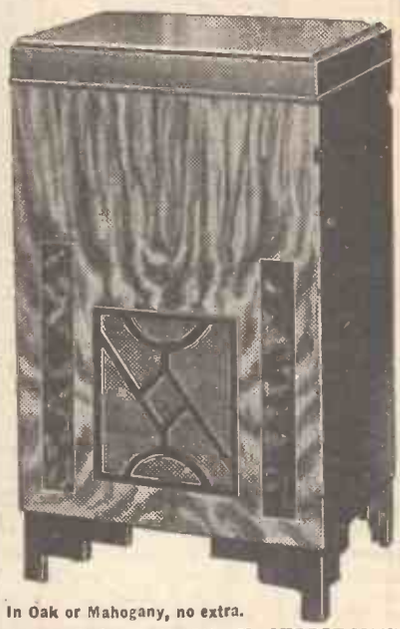

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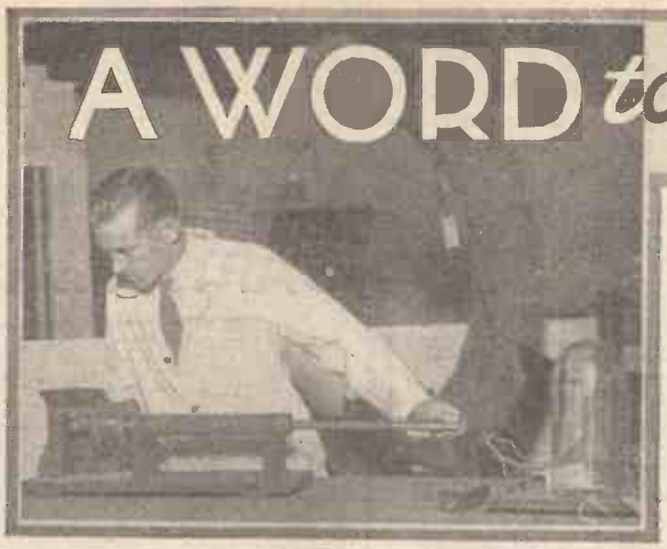
A WORD to INVENTORS



The apparatus by which Michael Faraday proved the possibility of converting mechanical force into electrical energy—and thus paved the way for wireless

By R. W. Hallows, M.A.

JUST how many patents in matters wireless are taken out in the average year between January 1 and December 31 I do not know; but of one thing I am quite certain, and that is that only a very small percentage indeed of them are of any real value.

An enormous amount of money is wasted annually by people with ideas in taking out patents which can never hope to be successful commercially. I have known, too, not a few men who brought themselves to the verge of ruin by neglecting their proper work in order to try to find a market for patents which they believed in, though nobody else could be found to do so.

What is Required ?

Before anyone starts to invent he should think very carefully over the question: "What inventions are required in wireless?" Very little is to be gained by inventing things which are luxuries rather than necessities. To be a commercial success an invention must consist of something which is such a tremendous improvement on anything existing that everyone must have it or be out of date.

Don't bother about trying to improve things which are already perfectly satisfactory. Let me give a concrete instance. There are many excellent makes of low-capacity spring-mounted valve holders on the market. They carry out the work for which they are intended perfectly well and users are quite satisfied with them. If you invented a valve holder of this kind that was just a little better than any now available you could not hope to obtain a large sum of money for your idea. The man in the street would say: "Why should I change my valve holders when those that I have got already work well?" To make such a holder a success an enormously expensive advertising campaign would be needed to convince the user that it was really worth while to make a change.

And then there is the manufacturer's point of view. He is already turning out a valve holder which meets all requirements. He has installed repetition machines for making these. If he were to adopt your idea he would have to scrap the whole of his machinery or, at all events, make large and costly alterations in it. You will see, then, that there is no great field for the inventor in this particular line. I have mentioned the valve holder especially because this is one wireless component which seems to have an irresistible attraction for the man of ideas. Large numbers of valve-holder patents which can never come to anything are filed every year, and I am always meeting with or hearing from people who are wasting their time in inventing still more.

Unless it is absolutely revolutionary, there is no money in patenting a wireless circuit. For one thing, the odds are that it has already been patented by someone else or that it is covered by some basic patent. Again, don't forget that there must be something outstanding about your circuit before any manufacturer will take it up and pay for it.

I mentioned in the last paragraph that the patentee of what was thought to be a new circuit was quite likely to find that it was really an old one. It must be remembered that when the Patent Office issues a patent it gives no guarantee that this does not infringe one previously granted. The records of patents granted in previous years are available for inspection at some public libraries or they can be bought at no great expense. Even, therefore, if a revolutionary idea occurs to you, you should conduct a most careful search through the files to see that no one has had it before.

It may even have been invented prior to the days of wireless or, at any rate, those of broadcasting. Sir Oliver Lodge actually patented the principle of the moving-coil loud-speaker in 1898, and there is, I believe, a still earlier patent on similar lines granted to the Siemens-Halske Company.

There is undoubtedly money in ideas, even though it may not be always the huge amounts of money that the inventor expects. If you have ideas which, though useful, are not absolutely revolutionary it is often best to dispose of them without taking out a patent. Here is an example of what I mean. A good many years ago, when basket and honeycomb coils were almost the only types in general use, I devised a simple coil holder, quite different from any on the market, which allowed extraordinarily fine tuning to be done. There seemed to be a market for the idea, for the design was easy and cheap to manufacture. But I came to the conclusion that it was not worth while taking out a patent, since somebody else might bring out something very nearly as good by using slightly different methods which would not be an infringement. I therefore took the model to a wireless manufacturing firm and gave, in confidence, particulars of it.

Cash for an Idea

The idea appealed to them, and I disposed of it for cash down. I did not make a fortune, but I received quite a nice little sum—probably far more than I should have had if I had gone to all the expense of searching the files and of taking out a patent. Since then I have generally disposed of ideas in the same way.

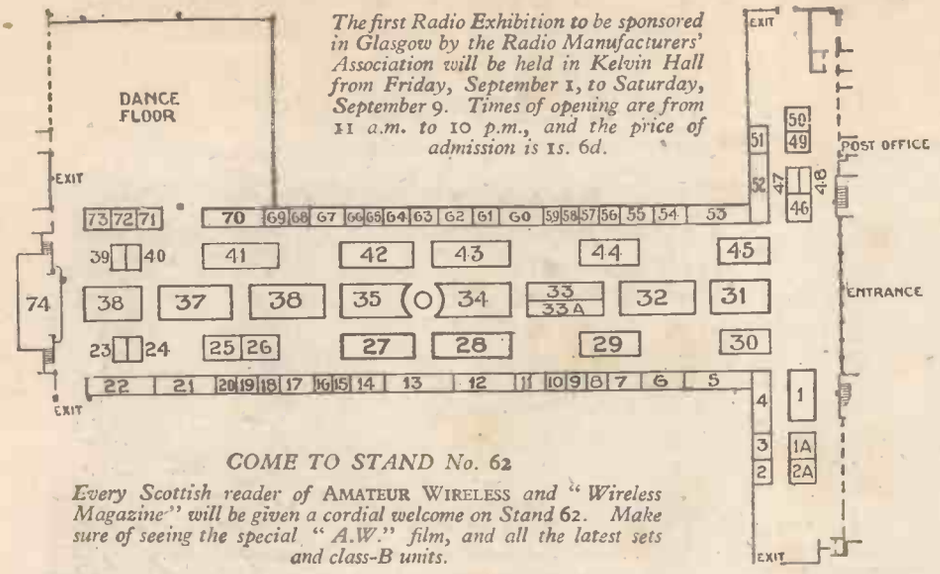
The inventor who has really workable ideas for improving wireless sets or wireless components will, I think, be well advised to consider this line of action before he rushes to the Patent Office. If he puts himself in the hands of a firm of repute he need have no fear that his idea will be filched. Either they will take it up and pay him for it, or they will tell him that they cannot use it.

He must not, however, be surprised or accuse them of stealing his idea if he finds that they have already under consideration something almost, if not exactly, the same as what he offers. This has happened to me on many occasions, and when one comes to think of it is is only natural that it should. When thousands of people are engaged upon thinking out wireless ideas it is by no means unlikely that two of them will hit simultaneously upon the same thing. In the history of invention thousands of such cases are to be found.

If You Can Invent . . .

If you can invent an entirely new filament that will give full emission with a minute amount of heating current; if you can think out a form of reaction which is fixed and constant for all wavelengths; if you can find a way of obtaining knife-edge selectivity without distortion; if you can produce something that will give the same results with but a fraction of the high tension that we have to use at present, then you have an invention which is worth patenting and worth money

Your Guide to Kelvin Hall



The first Radio Exhibition to be sponsored in Glasgow by the Radio Manufacturers' Association will be held in Kelvin Hall from Friday, September 1, to Saturday, September 9. Times of opening are from 11 a.m. to 10 p.m., and the price of admission is 1s. 6d.

COME TO STAND No. 62

Every Scottish reader of AMATEUR WIRELESS *and "Wireless Magazine" will be given a cordial welcome on Stand 62. Make sure of seeing the special "A.W." film, and all the latest sets and class-B units.*

Exhibitor.	*Stand No.*
Amalgamated Press, Ltd.	26
AMATEUR WIRELESS	62
Balcombe, Ltd., A. J.	29
Ballantine, Robert	65
Belling & Lee, Ltd.	56
Biggar, Ltd., Alexander	18
Black, Ltd., Michael	28
Blackadder, William	60
Block Batteries, Ltd.	67
Britannia Batteries, Ltd.	69
British Blue Spot Co., Ltd.	4
British Broadcasting Corporation	74
British Rola Co., Ltd.	19
Broadcaster	51
Brown & Co. (Simplex), Ltd.	24
Bulgin & Co., Ltd., A. F.	72
City Accumulator Co., Ltd.	2A
Clarke & Co. (M/c), Ltd., H.	44
Cohen, S. W.	15
Cole, Ltd., E. K.	32
Columbia Graphophone Co., Ltd.	33A
Cossor, Ltd., A. C.	31
Cuthbertson & Co., Ltd.	66
Denholm, J. Stuart	49
Dulcetto-Polyphon, Ltd.	7
Econasign Co., Ltd.	2
Edinburgh Rubber Co.	8
Edison Swan Electric Co., Ltd.	37
Epoch Radio Manufacturing Co., Ltd.	61
Ever Ready Co. (G.B.), Ltd.	30
Ewing & McIntosh	1
Ferranti, Ltd.	38
Forbes Bros., Ltd.	71
General Electric Co., Ltd.	34
Gramophone Co., Ltd.	33
Harper & Co., William	40
Hellesens, Ltd.	45
Houghtons the Wholesalers (Ensign, Ltd.)	47
Hunter, James R.	10
Hustler, Simpson & Webb, Ltd.	12
Hutchison, E. W.	58
Igranic Electric Co., Ltd.	23
Iliffe & Sons, Ltd.	52
Itonia, Ltd.	39
Johnson Talking Machine Co., Ltd.	54
McMichael Radio, Ltd.	27
Machell & Sons, Thomas	48
Marconiphone Co., Ltd.	35
Muire & Bryden	57
Mullard Wireless Service Co., Ltd.	36
Murdoch, McKillop & Co., Ltd.	21
Newnes, Ltd., George	17
North British Machine Co., Ltd.	16
Partridge, Wilson & Co.	14
Paterson, Sons & Co., Ltd.	46
Philips Lamps, Ltd.	43
Portadyne Radio	64
Pye Radio, Ltd.	41
Radio Gramophone Development Co., Ltd.	13
Radio Instruments, Ltd.	63
Robertson, James	22
Ross & Adam	73
Scottish Radio Retailers' Association	59
Siemens Electric Lamps & Supplies, Ltd.	11
Thompson, Diamond & Butcher	55
Thomson & Brown Brothers, Ltd.	53
Turner, James	20
Ultra Electric, Ltd.	42
Varley (Oliver Pell Control, Ltd.)	25
Vinces Dry Batteries, Ltd.	1a
Westinghouse Brake & Saxby Signal Co., Ltd.	6
Whiteford & Co., James	9
Whiteley Electrical Radio Co., Ltd.	70
WIRELESS MAGAZINE	62
Wireless & Gramophone Trader	3
Woolfson, Ltd., Philip	50
Wylie, Hill & Co., Ltd., R.	5
Young's (Glasgow), Ltd.	68

My Impressions of Radiolympia

By THERMION

THE 1933 Radiolympia was a gigantic affair. Estimates of the distance that must be walked in order to inspect every stand varied from six to nine miles. If the Exhibition goes on increasing in this way the authorities will have to run a passenger trolley service in future years! Still, healthy exercise is always a fine thing and there cannot be many more interesting ways of spending a day than devoting it to a tour of the Radio Exhibition.

Half a Dozen Days

Myself, I spent half a dozen days in this fashion between August 15 and 24, and my only regret is that I cannot manage to visit the Show again when it moves to Glasgow and Manchester.

There were a host of important features at the Exhibition, but two of them are outstanding. The first is the coming into its own of the battery set; the second, the way in which the super-heterodyne type of receiver has forged ahead.

Let's take the battery set first, for battery users must outnumber "all-mainsites" for many a year. There were plenty of small simple two- and three-valvers on view for those who want effective receiving sets at the lowest possible price. But the battery set of real mains performance was in evidence on many stands. Q.P.P. and class-B are the greatest boons that have yet descended upon the battery user.

It was their coming that made eminent designers realise that the battery set could be something well worth their august attention. And some excellent models they have given us in the 1933 three- and four-valvers of high quality. A year ago few people would have believed that it would ever be possible to obtain a full watt of output from a battery set requiring no more than 10 milliamperes from its high-tension battery.

A fine example of what batteries can do nowadays is the Columbia Battery Radiograph. This is a four-valve set which gives an excellent account of itself on wireless combined with a clockwork-driven turntable and pick-up. Its reproduction is so good that it is hard to believe that you are not listening to mains apparatus.

The battery super-het owes no small debt to AMATEUR WIRELESS which, by publishing a home-constructor's design that was an outstanding success, was the first to demonstrate the wonderful possibilities of this type of apparatus. At the Exhibition there were several battery super-hets of real merit in both ready-made and kit form.

Among the kit super-hets the Lissen is particularly interesting. There are seven valves, though two of them work in double harness for class-B output. Single-knob tuning, a band-pass circuit, calibration in wavelengths and automatic volume control are amongst its good points. I have one of these sets under test at the moment and it is proving satisfactory in every way.

Mains super-hets this year are of three kinds. There are first of all the midgets with four or five valves; then come the big fellows with from six to eight valves; lastly there are the giants with ten or twelve valves.

Amazing Power of Midget Sets

The powers of the midgets are actually much greater than might be suggested by a mere four or five valves. It must be remembered that you can use to-day a two-in-one valve as combined first detector and oscillator and a three-in-one second detector, amplifier and automatic volume controller. Add intermediate-frequency and output valves and though you are using but a quarter, they are really doing the work of seven valves.

Many of the midgets have automatic volume

control and this is now almost universal in the bigger super-hets. The giants incorporate almost every modern refinement.

I must say that I was rather surprised at being unable to find any set in the Show with quiet automatic volume control, or Q.A.V.C. as it is called by the initiated. Q.A.V.C. means that as you leave the setting of one station in order to turn to the next the set is automatically silenced. You hear absolutely nothing until you reach the setting of the next station.

It was very interesting to notice that in mains sets this year, with very few exceptions, you pass from the three-valve straight directly to the super-heterodyne. Four- and five-valve straights are comparative rarities amongst all-electric sets. There were rather more of them to be seen at Olympia amongst the battery sets, chiefly because the filament-current supply for a large number of valves is now amongst the battery user's greatest problems.

S.O.S. Regarding Low Tension

On this account I should not be at all surprised to see a return made to the ".06" type of valve filament which was in vogue some years ago. High-tension supply no longer presents a difficulty to the battery user; but he is very definitely sending out an S.O.S. regarding his low-tension current.

Speaking of high tension, I was rather aghast to see the latest development in high-tension batteries. For years I have been endeavouring to show readers the folly of trying to obtain current quarts from battery pint pots or, in other words, of running sets containing more than two, or at the outside three, valves from standard-capacity high-tension batteries. And now comes the *midget* high-tension battery made up of cells little bigger than cigarettes.

Not everybody realises that the iron-cored coils, of which some admirable examples were on view, tune so sharply that you must have particularly good ganged condensers to do them justice. With ordinary air-cored coils the precise matching over their whole range of the different units of a ganged condenser is not of paramount importance, but it does become of real moment with iron-cored inductances.

Many of the 1933 ganged condensers are beautiful pieces of work—and even a four-gang nowadays costs a great deal less than the .001-microfarad "straight-line capacity" variable condenser with which my first single-valve set was tuned!

I had expected to see permeability tuners more in evidence. There were one or two to be seen, but we have some way to go before the ganged tuner of this type is generally available.

Loud-speakers Were Legion!

Loud-speakers—mostly of the moving-coil type—were legion. The good moving-coil of 1933 is a magnificent instrument, but do not forget that there are moving-coil speakers *and* moving-coil speakers. It is of little use to arrange your set for an output of one watt or so by means of class B or push-pull or power pentode if you provide it with a cheap, light loud-speaker utterly incapable of dealing with any such output.

You could have spent a whole day at the valve makers' stands alone, so much was there to see there. The beautiful giant models deserved careful examination—and they were certainly receiving it. The displays of normal-sized "toobs" on the stands helped one to realise the magnitude of the advance that has been made this year.

Yes, it was a wonderful show. There was, of course, a certain amount of rubbish, but that is probably inevitable. Certainly there was far less than in any previous year, and there is no question that the general standard of both components and finished sets is very much higher. Let us hope that the record exhibition will inaugurate a record season.

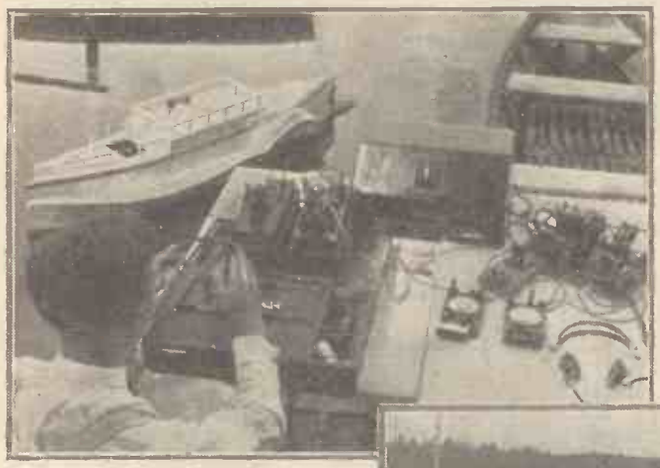
When "Improvements" Are Worth While

By S. Rutherford Wilkins

MOST of the queries asked by visitors to the AMATEUR WIRELESS stand at Olympia were with regard to the incorporation of one or other of the latest improvements in old sets. Components which caused much comment in this connection were the new iron-cored tuning coils.

Although it is fairly true to say that iron-cored coils generally give a greater magnification and a higher degree of selectivity than their air-cored counterparts, the mere substitution of iron-cored coils in a set which is already fitted with air coils will not always lead to improved results.

For one thing, stray wiring capacities which pass unnoticed when air-cored coils are used will often cause much trouble with iron-core tuners. Incorrectly lined gang condensers have a peculiar effect when associated with iron-cored coils, especially if band-pass tuning is employed. The rather sharp tuning peak that these coils give is very much in evidence, and results in a very high apparent selectivity with rather bad sideband cutting. The normal square-top characteristic that is associated with band-pass tuning is almost impossible to obtain unless the gang condenser is lined up with great mechanical accuracy.



Will it work? Rudolf Weber, a young German schoolboy, making a preliminary test with his radio-controlled model ship

The use of iron-cored intermediate transformers in super-hets is also not always advisable, although astounding results can be obtained with a super-heterodyne specially designed for the use of these components. As a general rule, though, an increase in magnification can be obtained, though the effect of iron-dust cores does not seem to be very noticeable at intermediate frequencies.

Another bone of contention is the dry high-frequency rectifier recently introduced by Westinghouse. The Westector acts as an almost distortionless rectifier for inputs over about .25 to .5 volt, and in this respect is excellent in multi-stage high-frequency sets or as a second detector in super-heterodynes.

In the smaller type of set (which would normally employ a leaky-grid detector), however, a noticeable falling-off in sensitivity is often experienced when a Westinghouse rectifier is used. For instance, a battery three-valve set (screen-grid, detector and power) will give more stations than a set consisting of a screen-grid high-frequency valve, Westector, low-frequency and power valve, built on similar lines.

This is because in a small set of this type the input to the detector is often much less than .25 volt, except on the local stations, and at small inputs like this the sensitivity of the Westector falls off rapidly.

In addition to this drawback, the dry rectifier throws back a considerable load on the preceding tuned circuit. This load gets worse as the wavelength is decreased and at 300 metres is equivalent to a parallel resistance of about 20,000 ohms. This has the effect of making the tuned circuit much less efficient, and will still further decrease the small signal sensitivity of the set.

This damping, however, is almost negligible at intermediate frequencies. Thus, as second detector in a super-heterodyne the Westector does not appreciably load the preceding intermediate transformer, and as it is invariably preceded by a high-gain high-frequency amplifier, the question of sensitivity to small signals does not arise.

As a matter of fact, the problem with super-heterodyne second detectors is to avoid overloading owing to the large signal voltage obtained from the last intermediate-frequency valve. In this respect the Westector is excellent, as it will handle inputs of 20 and 30 volts without departing from linearity.

Another use of the Westector is to provide a simple form of automatic volume control; although it is not perfect in this respect, it provides quite a fair control if preceded by a high-gain high-frequency amplifier.

Whilst on the subject of automatic volume control, a few words on the right type of set to have automatic control seem advisable. It is of very little advantage—and in some cases it is a definite disadvantage—to employ automatic volume control on any set that has *less* than two high-frequency stages. With stations of such varying powers as are at present on the ether, the amount of automatic control provided when only one stage of high-frequency amplification precedes the rectifier is practically nil, and at the same time the maximum sensitivity of the set is impaired.

Two High-frequency Stages Needed

This is, perhaps, not strictly correct if we take into account delayed amplified A.V.C., but even in this case two high-frequency stages are really necessary to obtain any appreciable control—one a short grid-base valve to be controlled, and the other to provide the high input voltage that is necessary to the A.V.C. valve.

In any case, the circuit for delayed amplified A.V.C. would make a three-valve set a very complicated affair.

This, however, does not prevent use being made of the new multiple valves in a simple set. Indeed, a definite improvement in quality and sensitivity is noticed if the new duo-diode-triode is used in place of the normal detector valve. This combination enables the diode portion of the valve to be used for either half- or full-wave rectification and the triode for amplification of the rectified signal. Distortion due to operating the detector valve on the wrong portion of its characteristic is avoided.

Class-B amplification is not always the advantage it appears to be at first sight. Although it will give volume from a battery set that has hitherto seemed unobtainable, the magnification obtained from the class-B output stage is negligible. A good screen-grid, detector and pentode three-valve set will give as many or more stations than a four-valve set employing class-B output.

The question to be considered is whether the extra expenditure involved is justified by an increase in power output. Most music lovers will answer definitely "Yes," but there are many fans who would think the money much better spent on something that would enable their sets to bring in more foreign stations.

A final inspection before sending the ship out on its first voyage across the lake—a great adventure for a small model

At last all goes well, and Rudolf Weber directs the motion and direction of his radio-controlled ship from the lakeside!

TELSEN

cover every COIL requirement

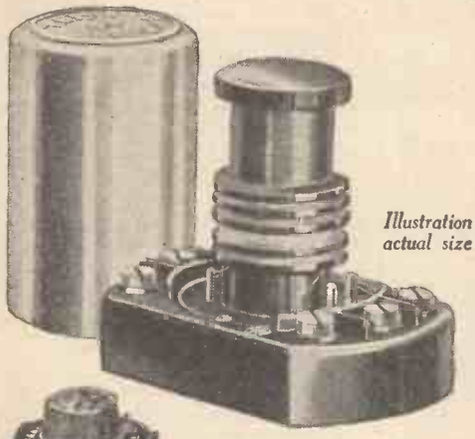


Illustration actual size

At the new reduced prices, the wonderful Telsen range of components represents more than ever radio's finest value. Whatever your coil requirements, be sure and insist on Telsen for lasting efficiency at the lowest cost consistent with quality.

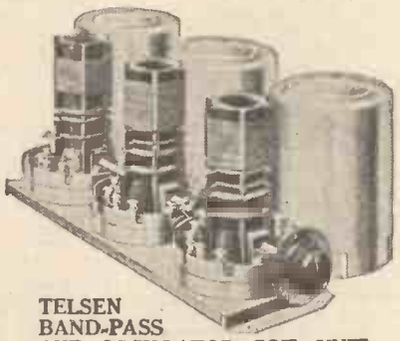
TELSEN IRON-CORED SCREENED COILS

The result of extensive research, these Coils employ an iron-dust core, achieving greatly reduced size, with considerably higher efficiency than that of the majority of air-cored coils. Magnification and selectivity are correspondingly improved, the metal screening also preventing inter-action. For use either as aerial tuning coils or H.F. transformers, a reaction winding being included.

		Price
No. W.349	Single Coil	8/6
No. W.422	Twin Matched Coils	17/-
No. W.423	Triple Matched Coils	25/6

TELSEN DUAL-RANGE AERIAL COIL.

Incorporates a variable selectivity device, making the coil suitable for widely varying reception conditions. This adjustment also acts as an excellent volume control, and is equally effective on long and short waves. The wave-band change is effected by means of a three-point switch and a reaction winding is included.
Price **5/6**

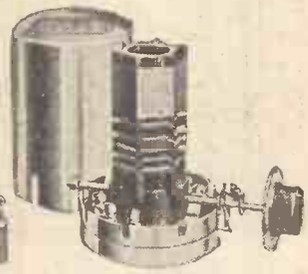


TELSEN BAND-PASS AND OSCILLATOR COIL UNIT

Comprises the Band-Pass Coils and Oscillator Coil combined into a single compact unit. All wave change switches are ganged, with single knob control. Ideal for any Superheterodyne circuit.
Price **21/6**

TELSEN INTERMEDIATE FREQUENCY TRANSFORMER COIL

Consists of two tuned circuits comprising a Band-Pass intermediate frequency filter tuned to 110 kc. by two pre-set balancing condensers. Adjustable for different values of stray capacities, with variable filter coupling. Price **7/6**



TELSEN SCREENED TUNING COILS

With separate coupling coils for medium and long waves. Highly suitable for use as aerial coils or as anode coils following a screened grid valve, giving selectivity equal to that of a well-designed band-pass filter. Price **7/-**
Twin Matched 14/6
Triple Matched 21/6

TELSEN H.F. TRANSFORMER COIL

May be used for H.F. amplication with Screened Grid Valve, either as an H.F. Transformer, or, alternatively as a tuned grid or tuned anode coil. It also makes a highly efficient Aerial Coil where the adjustable selectivity feature is not required. Price **4/6**

TELSEN SUPER-HET. COILS (TYPE No. S 330)

For Superhets which do not employ band-pass tuning in their pre-detector H.F. stages. Mechanical construction and wave-change switch assembly almost identical with standard Telsen Screened Coils .. .. .. Price **21/6**

TELSEN BAND-PASS COIL UNIT

Comprises two accurately matched Screened Band-Pass Coils, on a single rigid plinth base. The coils are independent of each other and can be wired for any of the three types of Band-Pass Filter to give exceptional quality with selectivity. Price .. **14/6**

TELSEN OSCILLATOR COIL

Particularly suited to Superheterodyne circuits in conjunction with the Telsen Band-Pass Coils. Operates at a frequency separation of 110 kilocycles from the Band-Pass tuning range. Price .. **7/6**

TELSEN FOR EVERYTHING IN RADIO

ANNOUNCEMENT OF THE TELSEN ELECTRIC CO., LTD., ASTON, BIRMINGHAM

Broadcasting Stations

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

Metres	Kilo-cycles	Station and Call Sign	Country	Power (Kw.)
16.88	17,775	Eindhoven (PHI)...	Holland	20.0
19.56	15,330	Schenectady (W2XAD)	United States	20.0
19.73	15,200	Zeesen (DJB).....	Germany	8.0
25.4	11,810	Rome (2RO)	Italy	15.0
25.51	11,760	Zeesen (DJD).....	Germany	8.0
25.53	11,750	Daventry (GSD)...	Great Britain...	20.0
25.63	11,705	Paris (Coloniale)	France	15.0
30.0	10,000	Madrid (EAQ).....	Spain	20.0
31.25	9,598	Lisbon (CTIAA)...	Portugal.....	2.0
31.3	9,585	Daventry (GSC)...	Great Britain...	20.0
31.38	9,560	Zeesen (DJA).....	Germany	8.0
31.55	9,510	Daventry (GSB)...	Great Britain...	20.0
37.33	8,036	Rabat (CNR)	Morocco	6.0
38.47	7,799	Radio Nations (HBP)	Switzerland*...	20.0
45.38	6,611	Moscow	U.S.S.R.	12.0
46.67	6,426	London (Ontario) (VE9BY)	Canada	0.5
46.69	6,425	Boundbrook (W3XL)	United States	1.0
48.86	6,140	Pittsburgh (W8XK)	United States	40.0
49.02	6,120	Wayne (W2XE)...	United States	1.0
49.18	6,110	Chicago (W9XF)	United States	5.0
49.34	6,080	Chicago (W9XAA)	United States	0.5
49.4	6,073	Skamlebaek.....	Denmark	0.5
49.5	6,060	Nairobi (VQ7LO)	Kenya Colony	0.5
49.59	6,050	Daventry (GSA)...	Great Britain...	20.0
49.83	6,020	Zeesen (DJC).....	Germany	10.0
50.0	6,000	Moscow	U.S.S.R.	20.0
50.26	5,969	Vatican (HVJ).....	Italy	10.0
58.31	5,145	Prague	Czechoslovakia	0.5
203	1,477	Kristinehamn	Sweden	0.25
205.3	1,461	Liege (Exp.)	Belgium	0.3
206	1,456	Seraing.....	Belgium	0.2
209.8	1,429	Miskolcz	Hungary.....	1.25
209.8	1,429	Magyarovar.....	Hungary.....	1.25
209.8	1,429	Pecs	Hungary.....	1.25
211.3	1,420	Newcastle	Great Britain...	1.0
214.3	1,400	Aberdeen	Great Britain...	1.0
214.9	1,396	Antwerp	Belgium	0.4
215.6	1,391	Chatelineau (EL)	France	3.0
217.1	1,382	Konigsberg	Germany	0.9
217.1	1,382	Dublin	Irish Free State	1.2
218.5	1,373	Salzburg	Austria	0.5
218.5	1,373	Plymouth.....	Great Britain...	0.2
220	1,363.8	Beziers.....	France	0.5
224.4	1,337	Cork (6CK).....	Irish Free State	1.2
225.9	1,327.3	Fecamp	France	10.0
227.4	1,319	Flensburg	Germany	0.5
231	1,301	Malmo	Sweden	1.2
231.7	1,294.6	Kiel	Germany	0.25
235	1,283	Lodz.....	Poland	2.2
235.5	1,274	Kristianssand	Norway	0.5
236	1,271	Bordeaux (S.O.)...	France	3.0
238.2	1,259.5	Nimes	France	1.0
238.9	1,256	Nurnberg	Germany	2.0
240.6	1,247	Stavanger	Norway.....	0.5
242.3	1,238	Belfast	North Ireland	1.0
242.7	1,236	Liege	Belgium.....	0.3
244.1	1,229	Basle.....	Switzerland ...	0.5
245.9	1,220	Berne	Switzerland ...	0.5
245.9	1,220	Cassel	Germany	0.5
245.9	1,220	Linz	Austria	0.5
245.9	1,220	Schaerbeek	Belgium	0.25
247.7	1,211	Trieste.....	Italy	10.0
249.7	1,201.5	Juan-les-Pins	France	1.0
250.9	1,195	Barcelona (EAJ15)	Spain	6.0
253	1,184	Gleiwitz	Germany	5.0
254.7	1,177.6	Toulouse (PTT) ...	France	0.7
257	1,166	Horby.....	Sweden	10.0
259.3	1,157	Treves (Trier).....	Germany	2.0
259.3	1,157	Frankfurt A/M ...	Germany	17.0
261.6	1,147	London National	Great Britain...	50.0
261.6	1,147	West National ...	Great Britain...	50.0
263.8	1,137	Moravska-Ostrava	Czechoslovakia	11.0
265.4	1,130	Lille (PTT)	France	1.3
267.4	1,121	Nyiregyhaza	Hungary.....	6.3
267.6	1,121	Valencia	Spain	6.0
267.8	1,119.8	Bremen	Germany	0.3
269.8	1,112	Bari	Italy	20.0
271.5	1,105	Rennes (PTT).....	France	1.3
273.7	1,096	Turin (Torino) ...	Italy	7.0
276.5	1,085	Heilsberg.....	Germany	60.0
279	1,076	Bratislava.....	Czechoslovakia	14.0
281.2	1,067	Copenhagen	Denmark	0.75
282.2	1,063	Lisbon (CTIAA)...	Portugal.....	2.0
283.6	1,058	Innsbruck	Austria	0.5
283.6	1,058	Berlin (E).....	Germany	0.5
283.6	1,058	Magdeburg	Germany	0.5
283.6	1,058	Stettin	Germany	0.5
284.7	1,053.4	Radio Lyons	France	1.0
286	1,049	Montpellier.....	France	0.9
288.5	1,040	Bournemouth.....	Great Britain...	1.0
288.5	1,040	Scottish National	Great Britain...	50.0
291	1,031	Viipuri.....	Finland	10.0
293	1,022	Kosice	Czechoslovakia	2.5
293.7	1,021.5	Limoges (PTT) ...	France	0.7
296.1	1,013	Huizen.....	Holland	20.0
298.8	1,004	Tallinn	Estonia	11.0
301.5	995	North National...	Great Britain...	50.0
304.3	986	Bordeaux (PTT)...	France	13.0
307	977	Falun	Sweden	0.5
308.6	972	Vitus (Paris)	France	1.0
309.9	968	West Regional ...	Great Britain...	50.0
312.5	960	Genoa	Italy	10.0
312.8	959	Cracow	Poland	2.0
315	950	Marseilles	France	1.6
318.8	941	Sofia (Rodno Radio)	Bulgaria.....	0.5
319.5	939	Naples	Italy	1.5
319.7	936	Dresden	Germany	0.25
319.7	936	Naples	Italy	1.5
321.9	932	Goteborg	Sweden	10.0
325	923	Breslau	Germany	60.0
328.2	914	Poste Parisien.....	France	60.0
331.5	905	Milan (Siziano) ...	Italy	50.0
335	896	Poznan.....	Poland	2.0
338.2	887	Brussels (No. 2)...	Belgium	15.0
342.1	877	Brunn (Brno).....	Czechoslovakia	32.0
345.2	869	Strasbourg (PTT)	France	11.5
350	857	Barcelona (EAJI)	Spain	8.0
352.1	852	Graz.....	Austria	7.0
355.9	843	London Regional	Great Britain...	50.0
360.6	832	Muhlacker	Germany	60.0
363.6	825	Algiers (PTT).....	North Africa...	13.0
364.1	824	Bergen.....	Norway	1.0
368.1	815	Bolzano	Italy	1.0
368.1	815	Helsinki	Finland	13.2
368.1	815	Seville (EAJ5).....	Spain	1.5
368.1	815	Santiago (EAJ4)...	Spain	0.2
369.5	812	Radio LL (Paris)...	France	0.8
372.2	806	Hamburg.....	Germany	1.5
376.4	797	Scottish Regional	Great Britain...	50.0
381.7	788	Lwow	Poland	16.0
384.6	780	Radio Toulouse ...	France	8.0
389.6	770	Leipzig.....	Germany	120.0
394.2	761	Bucharest	Roumania	12.0
398.9	752	Midland Regional	Great Britain...	25.0
403	743	Sottens	Switzerland ...	25.0
408.7	734	Katowice.....	Poland	12.0
413	725	Athlone	Irish Free State	80.0
416	721.1	Radio Maroc (Rabat)	Morocco	6.0
419.5	715	Berlin	Germany	1.5
424.3	707	Moscow (Roz) ...	U.S.S.R.	100.0
424.3	707	Madrid (EAJ7) ...	Spain	3.0
424.3	707	Madrid (Espana)...	Spain	2.0
430.4	697	Belgrade	Yugoslavia	2.8
441.2	680	Rome (Roma).....	Italy	60.0
447.1	671	Paris (PTT).....	France	7.0
449.8	667	Danzig.....	Dantzig	0.5
451.8	664	Madona	Latvia.....	25.0
451.8	664	Milan (Vigentino)	Italy	7.0
453	662	Agen	France	0.25
453.2	662	Odessa.....	U.S.S.R.	10.0
453.2	662	Klagenfurt	Austria	0.5
456.6	657	San Sebastian.....	Spain	5.0
459.4	653	Beromuenster ...	Switzerland ...	60.0
465.8	644	Lyons (PTT)	France	15.0
465.8	644	Tartu	Estonia	0.5
472.4	635	Langenberg.....	Germany	60.0
480	625	North Regional...	Great Britain...	50.0
488.6	614	Prague	Czechoslovakia	120.0
495.8	605	Trondheim	Norway	1.0
500.8	599	Florence	Italy	20.0
509.3	589	Brussels (No. 1)...	Belgium	15.0
517	581	Vienna.....	Austria	100.0
525	572	Riga	Latvia.....	15.0
532.9	563	Munich.....	Germany	60.0
537.6	558	Palermo	Italy	3.5
550.5	545	Budapest (I).....	Hungary.....	18.5
559.7	536	Tampere.....	Finland	1.3
559.7	536	Augsburg.....	Germany	—
562.7	533.1	Freiburg i/B	Germany	0.2
565	531	Hanover	Germany	0.5
565	531	Wilno	Poland	22.0
570	527	Grenoble (PTT)...	France	2.0
577.6	519.4	Ljubljana.....	Yugoslavia.....	7.5
720	416.7	Moscow (RMO)...	U.S.S.R.	20.0
743	404	Ostersund	Norway.....	0.6
750	400	Geneva	Switzerland ...	1.25
819.7	366	Rostov (Don).....	U.S.S.R.	35.0
833	360.1	Heston Airport...	Great Britain...	5.0
840	357.1	Budapest (2)	Hungary.....	3.0
857.1	350	Leningrad	U.S.S.R.	100.0
937.5	320	Kharkov (RV4) ...	U.S.S.R.	20.0
967.7	310	Alma Ata (RV60)	U.S.S.R.	10.0
1,000	300	Moscow (ROZ) ...	U.S.S.R.	100.0
1,034.5	290	Kiev (RER).....	U.S.S.R.	100.0
1,071.4	280	Tiflis (RDK).....	U.S.S.R.	35.0
1,083	277	Oslo	Norway	60.0
1,105	271.5	Minsk (RMG).....	U.S.S.R.	35.0
1,153.8	260	Kalundborg.....	Denmark	7.5
1,171.5	256	Taschkent (RVII)	U.S.S.R.	25.0
1,190.5	252	Luxembourg	Gd. Dutchy of Lux.	200.0
1,200	250	Istanbul	Turkey	5.0
1,200	250	Reykjavik	Iceland	21.0
1,229.5	244	Boden	Sweden	0.6
1,239.7	242	Kiev (RAG)	U.S.S.R.	10.0
1,247	240.5	Vienna (Exp.).....	Austria	3.0
1,304	230	Moscow (RCY) ...	U.S.S.R.	100.0
1,354.4	221.5	Motala	Sweden	30.0
1,411.8	212.5	Warsaw	Poland	120.0
1,445.8	207.5	Eiffel Tower	France	13.5
1,481	202.6	Moscow (RTC) ...	U.S.S.R.	500.0
1,538	195	Ankara.....	Turkey	7.0
1,554.4	193	Daventry National	Great Britain...	30.0
1,620	185	Norddeich (KVA)	Germany	10.0
1,634.9	183.5	Zeesen.....	Germany	60.0
1,725	174	Radio Paris.....	France	75.0
1,760	170.45	Moscow (RAX)...	U.S.S.R.	30.0
1,796	167	Lahti	Finland	40.0
1,875	160	Kootwijk.....	Holland	50.0
1,875	160	Moscow (RCZ) ...	U.S.S.R.	100.0
1,910.8	157	Sverdlovsk (RHX)	U.S.S.R.	40.0
1,935	155	Kaunas.....	Lithuania	7.0

Multi-valve Sets

HOW far can we go in the direction of sensitivity now that valves have become so efficient? Why can't we build up nine- or ten-valve receivers which will bring in, in broad daylight, all the stations which now we only get after dark, even on the best sets? The answer can be given by considering a few facts relating to long-distance reception and valve magnification generally.

Successful reception depends upon something more than actual signal strength—we must have a good ratio of signal to background noise and statics. With a clean background a comparatively weak signal will sound good and pure, but if there is the constant rushing noise or rumble of statics, the signal will seem so weak as to be useless for reception purposes. Unless the signal is well above the background noise level, satisfaction cannot be obtained at any degree of strength.

You often hear people say that the only stations worth listening to on their receivers are the locals, and that if they try for what we may term "programme receptions" from the distant ones, they get noise and distortion. The reason for this is that magnifying the signal means magnifying the background noise and static.

In receiving distant stations the set is made to give its maximum magnification and by the use of reaction a certain amount of distortion is often introduced as well.

Valve Hiss

A HIGH-POWERED multi-stage amplifier will produce anything up to 30 or 40 milliwatts of "noise"—when no signal is being received—due to the irregular emission of electrons from the filament. The first H.F. valve is, of course, the chief offender, since any hissing at this point is greatly magnified in the succeeding stages. The trouble is due to the fact that the electrons do not leave the filament smoothly, but come away in small gusts or bubbles—very much as steam is given off from boiling water. Owing to the comparatively long length of the filament this initial jerkiness is more or less smoothed out by the time the stream reaches the plate of the valve, though not entirely.

Short-Wave Notes

By Kenneth Jowers

THAT letter last week from R. J. (Liverpool) naturally put me on my mettle. I hereby justify short-wave reception, short-wave sets and short-wave fans—*and I can!*

The trouble with the ordinary listener, such as R. J., is that he goes and buys a very natty converter and tacks it on to the end of the set, preparing to do a lot of long-distance work.

Twiddling ensues from one end of the dial to the other, often without the slightest knowledge of the wavelengths covered.

On my set, during daylight, that is, I tune between 20 and 14 metres, and should there be nothing doing there I don't waste any further time in searching over other wavebands, because I know that there will be nothing else to hear except the locals, such as Rome, Zeesen, and Moscow.

Talking about Zeesen and Moscow, if R. J. cannot hear one or both of these stations on any sort of short-wave apparatus, he must, I suggest, be rather "ham-handed," or quite unfamiliar with the workings of an adapter such as he states he has in use.

I admit that at the moment conditions generally are not good, but it is not at all difficult to pick up one or two Americans, no matter what time of the day you listen—after lunch-time, anyway.

* * * * *

I have had quite a number of requests from both listeners and transmitters for information about 5-metre work. There is a great deal of interest on the ultra-shorts just now. Listeners who are very snappy on the normal short waves seem worried about finding their way on the 5-metre band. Calibrations seem to be the bogey.

I have a list of about fifteen transmitters working on 5 metres all within a reasonable distance of London. I want to increase this list. Will those working on such wavelengths write to me? This will help both listeners and transmitters in their calibrations and in the compilation of range reports.

* * * * *

I was very interested in the progress made in short-wave components when I went round Olympia. Last year there was a real dearth of good short-wave gear, whereas I noticed quite a number of short-wave converters, double-gang condensers for short waves, and 5-metre sets, which seemed to be very efficient.

One or two of the bigger commercial broadcast sets I noticed were fitted with short wave tuning—from about 12 to 80 metres.

* * * * *

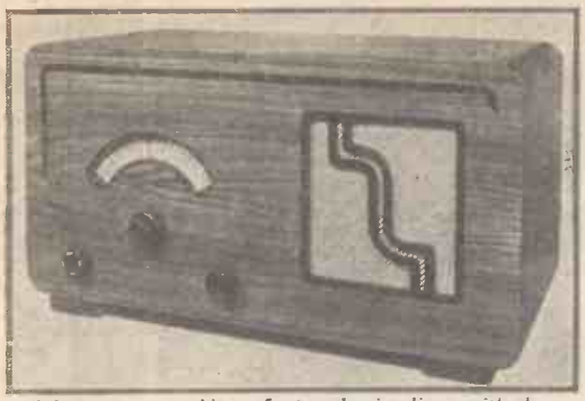
I have always been rather prejudiced against short-wave super-hets for general experimental use. Admittedly, the most efficient type of set for single-station reception, such as at the Post Office; but for the average man I have thought such sets rather complicated and unnecessarily expensive.

What with background noise, second-channel interference and very selective tuning I have not myself used super-hets unless I wanted to pick up a particular station at very good strength.

I have now rather modified my views after trying out a high-frequency pentode as oscillator-detector in a short-wave super-het of home design. Admittedly, the super was not quite conventional. I was using an intermediate frequency of 1,500 kilocycles. But I did find that the selectivity was just right for coping with congested wavebands, such as 30 metres.

Sets of the Season

Atlas A4 Receiver



A long, narrow cabinet of very pleasing lines, with the set on the left and the loud-speaker on the right, houses this new Atlas set

HERE is a new season set that will interest a great many of our set-buying readers. It is inexpensive, good to look upon, brings in the foreigners very easily, gives good tone, and has one of the nicest tuning scales we have yet examined.

A4 is a powerful three-stager, with variable-mu screen-grid high-frequency amplifier valve, a screen-grid detector, and a pentode power output valve, all three stages getting their high-tension and grid-bias from the output of a DW3 valve rectifier fed from the A.C. mains.

This powerful sequence of valves drives a mains-energised moving-coil loud-speaker. The set chassis is fitted into the left-hand side of the long, low cabinet, with the moving-coil loud-speaker on right.

Due to the provision of three alternative aerial tapping points the set can be worked equally well from an indoor or an outdoor aerial. Then there is a mains aerial tapping for those living near a broadcasting station.

Control is a particularly good feature of this A4. The tuning will appeal to all who like to be sure the circuits are always in gang. There is a two-gang condenser with a main tuning knob and a super-imposed control knob for final trimming.

This trimmer has to be altered at the extremities of each wave-band, but not for every station received.

The scale is remarkably clear. It is well lighted by a bulb at the back. There is a pointer travelling over the scale marked in medium waves from 200 to 560 metres, and from under 900 to over 2,000 metres. In addition to the wavelength markings there are clearly-engraved station names, 31 on the medium and 14 on the long.

Apart from the tuning knob and associated scale the control is done with the volume-cum-reaction control on the right and the combination switch knob on the left.

Neat metal chassis of the Atlas set is clearly shown by this back view. Note the energised moving-coil loud-speaker at the side of the chassis

We found, on testing the set, that the chassis connections are most accessible. Provision is made for a pick-up, an external loud-speaker, and the aerial and earth. Mains voltage adjustment is very simple.

On testing the set with a 60-foot outdoor aerial and a good earth we were immediately impressed with the clean-cut quality of the London stations. There is plenty of volume, and no sign of box resonance even when the volume is at its maximum.

Speech is undeniably clearer than the average. It is a good moving-coil, and very sensitive into the bargain.

Good Selectivity

Selectivity pleased us very much. We hardly hoped, with only two tuned circuits, to clear the foreigners near the London wavelengths so easily. For example, the Scottish Regional was received at full loud-speaker strength without a trace of interference of the London Regional. This we consider is a good test of a set near London.

Similarly, the London National station, which at the particular point of the test is received more loudly than the Regional, was well silenced by the time we had come upon Bratislava.

In referring to selectivity in this type of set we must, of course, make it clear that the trimmer knob plays a decisive part in station separation, though for the reception of nearby stations there is not much need to touch the trimmer.

Bringing in Stations

The makers are fully justified in marking so many stations on the tuning scale. Most of the thirtyone stations marked for medium waves were brought in quite easily, without unduly forcing the reaction.

Mains hum is negligible, and is not increased when the mains aerial is used. With this attachment, by the way, it was found easy to bring in nearly a dozen of the foreigners. The set is certainly very sensitive.

Quality of reproduction is so good that we can heartily recommend the set for use with a gramophone pick-up. If this device is utilised an external potentiometer volume control will be wanted.

BRIEF SPECIFICATION

Makers : H. Clarke & Co. (Manchester), Ltd.

Price : £12 12s.

Valve Combination : Variable-mu screen-grid (Mullard VP4), detector (Mullard SP4), pentode output (Mullard PM24M), and mains rectifier valve (Mullard DW3).

Power Supply : A.C. mains from 200 to 250 volts.

Type : Table-cabinet set with energised moving-coil.

Remarks : Recommended straight three; good quality and easy control.

A Mercury-vapour Rectifier

MERCURY-VAPOUR rectifying valves have not been very much in demand except for use in small transmitters and public-address outfits. Output valves used in the larger radio gramophones are slowly requiring a higher high-tension voltage and current, consequently there has been a steady increase in the demand for gaseous rectifiers as used so generally in America.

The Tungsram people have always been foremost in reproducing valves having characteristics similar to those popular in America, and they have now brought out a valve which we consider to be one of the most useful of its kind. This is similar to the R.C.A. type 82, a bi-phase mercury-vapour rectifying valve.

It requires a filament voltage of 2.5, and at this voltage consumes 3 amperes. When the maximum voltage of 500 volts is applied to each anode, the maximum *continual* D.C. output is 125 milliamperes.

Valves of this kind are very suitable for use in apparatus which is in continual use, as they will stand up to very hard work without losing any of their emission. They should be invaluable in public-address amplifiers or cinema equipment where they would be subjected to continual load.

Tungsram have always been noted for their A.C./D.C. valves. In fact they were the first people to introduce low-voltage valves of this type into the country. They have now augmented their range by introducing a valve designated the Ditetrode. This is a screen-grid valve and diode mounted on the same foot in the same bulb and having a filament voltage of 20 and a current of .18 ampere. It has been designed to rectify, amplify, and to provide automatic volume control. It is supplied with a seven-pin base.

An improved feature of this valve is that the diode section is completely isolated from the tetrode section, having its own special cathode. This enables the two systems to be operated independently without any possibility of interaction. The type number is DS 2018.

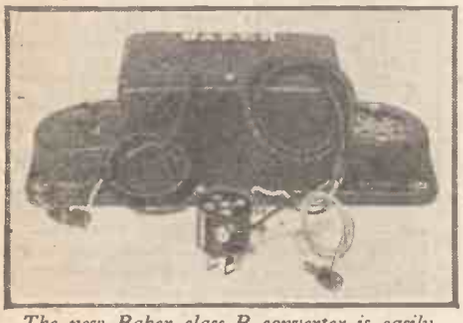
We Test for You

A Weekly Review of New Components and Tests of Apparatus Conducted by J. H. REYNER, B.Sc., A.M.I.E.E.

BAKER CLASS-B CONVERTER

A WELL-MADE class-B converter is that recently placed on the market by Bakers Selhurst Radio. As readers will know, these converters are intended for attachment to existing battery receivers and enable large power outputs to be obtained with small high-tension consumption.

The Baker model is housed in a neat crackle-finished metal case at one end of which is a seven-pin valve holder, and at the other a tone-control switch. All the necessary components are mounted in the case and no accessories except the class-B valve are required. The converter is easily added to a battery set.



The new Baker class-B converter is easily added to existing battery sets

The output valve of the set is removed and inserted in the plug adaptor of the converter, the adaptor then being placed in the original output valve socket. The two leads provided should also be connected to the existing loud-speaker, and if this has a variable ratio transformer the best tap can very simply be found by trial.

On test the converter was very satisfactory, and it can be thoroughly recommended. The retail price is £1 17s. 6d.

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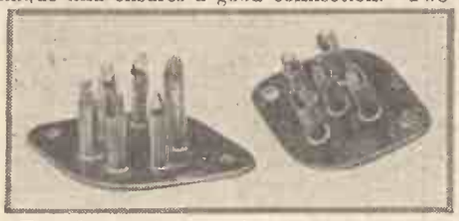
BRITISH RADIOPHONE VALVE HOLDERS

THREE well-made chassis-mounting type valve holders are those made by the British Radiophone Co., Ltd. These valve holders are respectively the four-pin, the five-pin, and the seven-pin type, and are built up on paxolin sheets approximately one sixteenth inch thick. The sockets themselves are of phosphor bronze, and are rigidly fixed in the paxolin.

The method of gripping the valve pin is unique and ensures a good connection. Two soldering tags are provided on each socket, the ends of which are tinned to facilitate soldering.



The five- and seven-pin chassis-mounting valve holders by British Radiophone

We found these valve holders to be entirely satisfactory, a good sound grip being obtained with all types of valve. The retail prices are 6d. for the four-pin and the five-pin, and 9d. for the seven-pin type.

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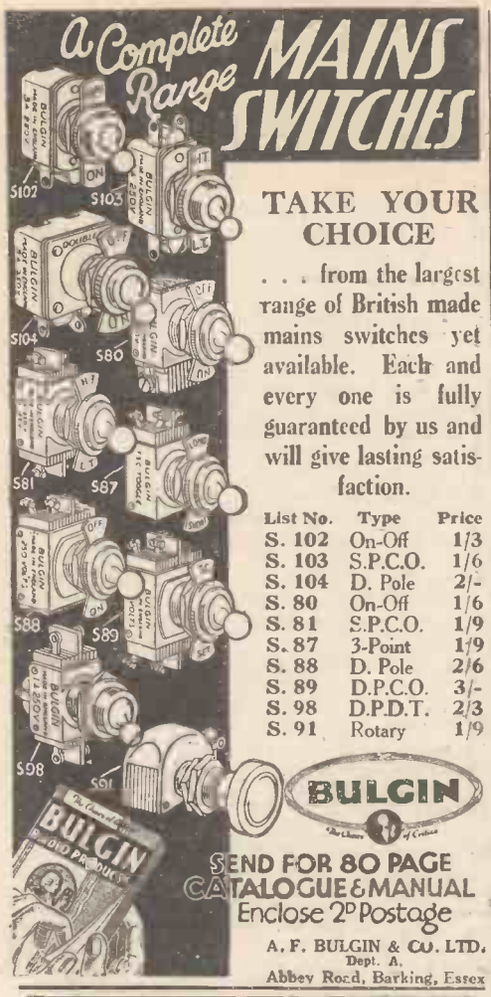
TELSEN ELECTROLYTIC CONDENSER

A NEW dry electrolytic condenser which we have just tested is that made by Telsen Electric Co., Ltd. This condenser is of the conventional tubular shape, but the container is made from moulded bakelite instead of metal. Mounting and wiring is facilitated by the provision of a metal bracket at the base, on which is mounted a terminal for the negative connection. The condenser on test, designed for 500-volt peak working, was rated to have a capacity of 6 microfarads.

The new Telsen 6 - microfarad dry electrolytic condenser provided with special mounting bracket

On test the condenser was found to be well up to its rated capacity; the actual measured capacity being approximately 7 microfarads. The steady leak current when the peak voltage was applied to the condenser was approximately 3 milliamperes, but this rapidly dropped to .5 milliampere after a short while.

This electrolytic condenser, which should prove very useful in practice, costs 5s.



Discard your present aerial and connect up to the AIRCLIPSE. You will be delighted with the immediate improvement in selectivity and clarity. The AIRCLIPSE is *not* another gadget—not a condenser—but an auto-inductive aerial that filters incoming signals. It eliminates lightning danger. Can be placed inside or outside the set. Enables the set to be moved from room to room. The Secretary of an important radio society writes: "The efficiency of this is so amazing that I shall have no hesitation in recommending it on all occasions."

AIRCLIPSE

Auto-Inductive **AERIAL** PROV. PAT. 9177/33

5/-

For A.C. Mains and Battery Sets.

Of all dealers, or in case of difficulty order from—

Aircilpse, Ltd., 182 Vauxhall Bridge Rd., London, S.W.1

Telephone : Victoria 5022.

What Readers Are Asking About the—

A.C. Triodyne *and* Signpost Four

WHY, many constructors have asked us, has not the A.C. Triodyne automatic volume control—surely in a new-season set that is an omission? But, no! A very good reason for not using this admittedly desirable feature is that there is not enough high-frequency amplification available to provide a worth-while control.

We are not suggesting that the A.C. Triodyne has any lack of power in its high-frequency stage. On the contrary, there is more than you will find in many other three-valvers. The point is that three-valvers are inherently unsuitable for really good A.V.C.

Nor is the double-diode-triode wasted in the Triodyne, as one reader has suggested. While this special valve certainly is very useful for A.V.C. circuits, that is by no means the end of its value. We have used this valve because it enables the functions of detection and amplification to be separated, thus providing us with really fine quality devoid of the usual detector distortion.

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The Triodyne has a good measure of tone control, provided by the output arrangement of a 5,000-ohm resistance, and a .01-microfarad fixed condenser. This combination will suit most loud-speakers of to-day, but sometimes you may find that your particular reproducer is too high or too low pitched with the values specified.

There is a very easy way out of this difficulty. Simply change the fixed resistance for a variable one of, say, 15,000 ohms. That, in conjunction with the existing fixed condenser, will enable all types of loud-speaker to be tone-corrected to suit the output valve.

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The selectivity of the Triodyne has been questioned. It has a variable degree of selectivity in both its tuning circuits, in the aerial-tuning circuit and in the intervalve tuning. For this reason we can say that the selectivity of the Triodyne is above the average.

You can work wonders with the aerial pre-set, and with the corresponding pre-set in the intervalve coupling. With a short aerial it is likely that you will need a fairly appreciable amount of the aerial pre-set capacity to give good signal strength, but with a longish aerial wire probably you will be able to unscrew the pre-set until the plates are almost all out.

The intervalve coupling condenser is similarly worthy of your attention. Signal strength must be compromised with selectivity, and possibly you may find it advisable to make a re-adjustment during reception.

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When connecting up the batteries of the Signpost Four, it is a good idea to wire up the lead No. 18 to the anode of the screen-grid valve before inserting the high-tension plugs in the battery. This will prevent the short that might be caused if the wire touched the metal coating of the valve, assuming this coating happened to be wired to the wrong valve-pin.

Remember, by the way, that the high-frequency choke in the anode circuit of the detector valve has three terminals, two of which are joined to the choke winding and the other to the metal screen of the choke. Take care these connections do not get mixed up.

If you want to use an external loud-speaker you certainly can, but for effective results a class-B output choke is needed between the loud-speaker terminals and the loud-speaker.

Notes and Jottings

ROBERT TREDINNICK, the popular "record" broadcaster of Midland Regional is now collaborating with Columbia in the production of a "sampler" record each month. For nearly two years Columbia have been supplying this novelty record to dealers, who in turn pass it on to their customers, on loan, so that they can hear the chief new records.

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The Westinghouse Brake & Saxby Signal Co., Ltd., have produced another edition of their famous book, "The All-metal Way." The 1934 edition is larger than previous editions and besides containing full information on the use of the metal rectifier in mains units, it deals comprehensively with the use of the new Westectors. The use of the Westector as the second detector in super-het circuits, in battery-economiser circuits, and for automatic volume control is carefully explained with the aid of many circuit diagrams. Copies of the 1934 All-metal way can be obtained from the manufacturers at 82 York Road, King's Cross, N.1. No charge is made for the publication, but readers *must* send 3d. in stamps to cover the cost of postage.

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The French pilots Rossi and Cordes, who recently broke the long-distance non-stop flying record by flying from New York to Rajak, a distance of approximately 5,700 miles, used Philips valves in their wireless gear.

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Bishop Auckland and District Amateur Radio Society has organised a radio exhibition, which will be held in the Bishop Auckland Town Hall during the first three days in November.

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Two new batteries for use with class-B sets have been announced by the Ever Ready Co. (G.B.), Ltd., 9f Hercules Place, Holloway, N.7. One is a 126-volt type tapped at every 10.5 volts, and prices at 17s. 6d., and the other is a 135-volt type plus an 18-volt grid-bias section costing 18s. 6d.

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An interesting publication is the Multitone Guide to Class B, which we have just received from Multitone Electric, Ltd. There are twenty pages in the booklet, which is divided into two sections. The first part contains useful articles on the theory of class B, notes on class-B economy methods, and the essential requirements of class-B components. The second part is devoted to the practical side, much useful information being given on the methods of ensuring good quality and stability. Copies can be obtained free from Multitone Electric, Ltd., of 95-98 White Lion Street, N.1.

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The new B.B.C. organ has been severely criticised. Some have said that it sounds just like an ordinary organ, others have said that it sounds like a harmonium, and many have even expressed disgust that it is nothing like a cinema organ. The air will be cleared of all misunderstanding on September 10, when J. I. Taylor, a member of the Compton staff, gives a recital of improvisations with a commentary by Filson Young.

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Twelve talks under the general title, "National Character," will be given in the autumn. The series will be introduced with a twenty-minute talk by Mr. Stanley Baldwin. A feature of the series will be the introduction of a foreigner at the microphone to tell listeners about various aspects of our national character as they appear to him.

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Visitors to Olympia who congratulated us on the attractiveness of the "A.W." stand will be interested to know that the decorations were undertaken by the Textophot Display and Advertising Studios, Ltd., of 79a Copenhagen Street, N.1.

What A.V.C. Means to You

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

Everybody is asking just what A.V.C. (an abbreviation of "automatic volume control") means. In this simple article J. H. Reyner explains what the effect is and how it is obtained. Very soon AMATEUR WIRELESS *will be introducing automatic volume control to its readers in practical form. Remember, though, that A.V.C. is only really useful in multi-valve sets*

THERE will be a good deal of talk about automatic volume control (A.V.C.) this season. You will find this set and that claiming to have A.V.C. fitted and salesmen will, no doubt, convey the impression that unless your set has A.V.C. it is out of date.

Let us say at the outset that automatic volume control will not interest you at all if you are merely a local-station listener. In such cases the user adjusts the strength of his set to suit his requirements and leaves it at that.

Most listeners nowadays, however, are not content with the local programme. They like to tune in to Fécamp or Radio Toulouse, or one of the other foreign stations and in such circumstances fading is often experienced.

By fading, we mean that the strength of the signal does not "stay put," but wanders up and down so that the programme is barely audible one minute, while the next it is blowing your head off. Nearly every listener will have observed this at one time or another and will agree that it is irritating in the extreme. It often happens on some of the more distant British stations, particularly on the shorter wavelengths.

Keeping Signals Level

Automatic volume control puts a stop to this. It holds the receiver in check when the signal is good and puts its shoulder to the wheel when the strength is weak. All one has to do is to set the control at a convenient level and it will stay there so that you can listen to the programme in comfort without continually bobbing up and down to re-adjust the controls.

How does it do this? The mechanism is simple and, therefore, effective. We can vary the strength of the signal from the loud-speaker in various ways, and one of the most popular methods to-day is to control the amplification of the high-frequency valves. This is recognized as the method which gives smoothest control free from distortion.

With an A.V.C. system we take a look at the strength of the signal at the detector, usually by connecting an extra rectifier in the circuit. If the signal is a strong one this extra rectifier will take a large current. If it is weak, the current will only be small, and we can use this fact to control our set.

For instance, we can pass the current through a resistance, when it will produce a voltage. If the current is large this voltage will be large, and vice versa. Suppose we use this voltage to bias the grids of the high-frequency valves. When the bias is large the high-frequency amplification is reduced to a small fraction of its normal value. But this is just what we want, because we only develop a large voltage on a strong signal and here we want to limit the amplification.

On a weak signal the voltage developed by the A.V.C. detector is very small and has practically no effect, so that the receiver produces the full amplification. In fact, the set adjusts itself to the conditions *automatically*, there being no need to alter any of the controls at all. So much for the mechanism: let us see now how it works out.

First of all it can only be applied satisfactorily to really powerful receivers for this reason. The set must be capable of giving good loud-speaker strength on a foreign station *with the volume control in the mid-way position.* Then when the signal fades, there is a reserve of amplification on which to draw, to make up for the weak signal. If the set is already working "flat out" there is no reserve available. Consequently, when the signal fades, we cannot increase the strength, although the A.V.C. is trying to do so.

The A.V.C. will, of course, limit the strength on a strong signal and this action is often useful. In fact, it leads up to the second effect which you will notice on any set with A.V.C., which is that all stations appear to come in at the same strength. If you are expecting the local station to blow the roof off, therefore, you will be disappointed.

It will be no stronger than a foreign station, and the actual strength of both will be determined by the setting of the manual volume control.

"Manual volume control," I hear you ask. "What is that?" Simply an auxiliary control to adjust the strength. It is independent of the A.V.C. and serves to set the level of the reproduction at loud, medium or soft, as you wish. Once you have done this the A.V.C. will hold all stations at the same level. So you see that you lose nothing in flexibility with A.V.C. You merely make it easier to tune.

It is sometimes stated that A.V.C. sets are unselective. This appears to be true, because the local stations will occupy several degrees on the dial and over this region the tuning has no noticeable effect. This is because the A.V.C. is limiting the strength all the time so that there is no sharply defined tuning point. The effect is illustrated in Fig. 1 which shows the difference between an A.V.C. set and a normal tuning system.

Selectivity Not Impaired

Actually the selectivity is not impaired at all, but it is desirable to tune approximately in the middle of the spread in order to make sure that the quality is good. Otherwise the reproduction may sound a little scratchy. The limiting action of the A.V.C. prevents any detector overload which is nearly always present on a strong signal with a normal set.

Another point on which misunderstanding sometimes arises is the effect of A.V.C. on an orchestra and on musical reproduction generally. Some people imagine that all the light and shade will be taken out of the music and it will sound dull and monotonous. This is quite a misapprehension, because the A.V.C. operates on the strength of the carrier.

Without going into technicalities, most readers are aware that the waves picked up on the aerial come in a continuous stream from the transmitting station and that the speech or music is obtained by varying the strength of these waves in accordance with the sound vibrations.

These sound vibrations, however, occur many hundred times every second, so that the average value of the "carrier" wave remains constant — or should do. Our A.V.C. is operated only by the carrier wave and therefore does not affect the speech or music in any way. If the strength of the carrier wave alters, however, due to fading or some other cause, the A.V.C. operates at once and so keeps the general level of the music or speech the same as it was before.

Finally, we come to the question of fitting A.V.C. Can it be adapted to an existing receiver or must the receiver be rebuilt? The answer to this depends on the type of set, remembering what was said earlier on regarding the need for high sensitivity. Generally speaking, it is possible to add A.V.C. to a set without much trouble, particularly by using some of the special valves which are now coming on the market.

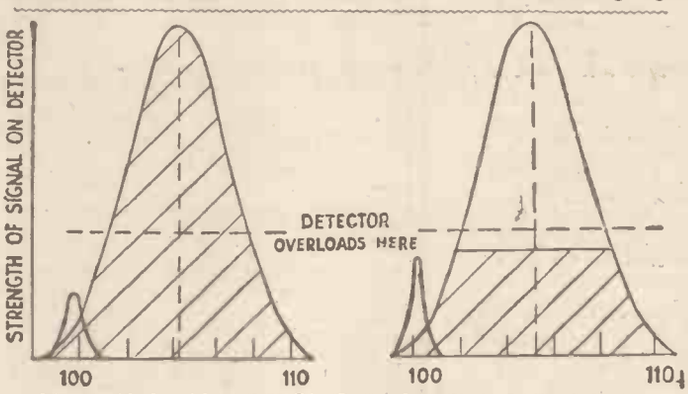

Fig. 1—(Left, with no A.V.C.) Strength not limited. Tuning seems fairly sharp, but detector overloads. Foreign station shown dotted. (Right, with A.V.C.) Strength limited to a safe value, but tuning appears broad. Foreign station actually stronger than before

Listeners' Forum

Letters from Our Readers

AMATEUR ADVANTAGES IN SET CONSTRUCTION

To the Editor, AMATEUR WIRELESS.

SIR,—I was very pleased to see Mr. James championing the cause of the home constructor on page 318 of the August 26 issue. *Of course* the amateur beats the set manufacturer—he always will, while developments occur at the present rate. No manufacturer can foresee developments six months ahead, but the amateur, at trifling cost very often, can incorporate new ideas as and when they come along. P. B. (Stratford).

TELEVISION UP-TO-DATE

SIR,—Surely Thermion's remarks on television in last week's issue of "A.W." are somewhat contradictory? In one paragraph he says he finds the flicker very trying and in another, when writing about cathode-ray reception, he states that he was very favourably impressed. Has it occurred to him that any television demonstration at the present time, whether by cathode-ray or mechanical methods, must be dependent on the system used for transmission? As a mechanical system is employed with thirty-line scanning, results must obviously be limited by this.

Excellent pictures are now obtainable by either system and there is real entertainment in receiving the all-too-short broadcasts.

R. D. (Guildford).

SIR,—I have read with great surprise your remarks in the current issue of AMATEUR WIRELESS on the possibilities of the scanning-disc system of television. On page 290 you say that television "will not be accomplished by means of the scanning disc." I do not see how you can be so sure of that.

We are by no means at the end of the resources of scanning-disc systems of television, as is proved by the wonderful results that are now being obtained by the latest mirror-drum receivers marketed by various firms this year.

You seemingly fall into the trap of comparing the present popularity of wireless sound broadcasting with the *potential* popularity of vision broadcasting. Sound has had over ten years start on television broadcasting. I think we should remember this when we try to assess the value of any television system.

R. K. (Canterbury).

SHORT WAVES ARE SOME GOOD!

SIR,—Surely your correspondent R.J. (Liverpool) was writing with his tongue in his cheek about short waves—or else with the deliberate intention of "drawing" the thousands of fans who thrive on short-wave reception?

I imagine Kenneth Jowers, your short-wave expert, could tell R.J. a few things about short-wave reception at this time of the year. (He does—on page 361!—Ed.) I should say that R.J. does not know how to tune a short-waver.

The whole secret is to turn the tuning knob *very slowly over a small part of the scale*; it is useless to try to find stations by flicking over the whole scale at one go.

True, the Americans are not strong at the moment, but there is no difficulty in bringing them in at 'phone strength on a super-het adaptor. N. G. (Staines).

Postcard Radio Literature

Here "Observer" reviews the latest booklets and folders issued by well-known manufacturers. If you want copies of any or all of them FREE OF CHARGE, just send a postcard giving the index numbers of the catalogues required (shown at the end of each paragraph) to "Postcard Radio Literature," AMATEUR WIRELESS, 58/61 Fetter Lane, E.C.4. "Observer" will see that you get all the literature you desire. Please write your name and address in block letters.

New Dubilier Guide

DUBILIER, who tell me that they have been making condensers for over twenty-one years, have just issued their 1933-1934 catalogue. In the booklet is listed a complete range of paper and mica dielectric condensers including the new Dubilier tubular paper types. You will find some useful information about the use of dry electrolytic condensers here; a large range of dry electrolytics of the high and low-voltage types are listed. Many pages devoted to technical facts about Dubilier metallised resistances are well worth reading. **32**

The 1934 Melody Maker

From A. C. Cossor, Ltd., I have received a folder full of useful information about the new battery Melody Makers, models No. 341 and 342. Both these Melody Makers are identical except that one is fitted with a permanent-magnet moving-coil, and the other has a moving-iron loud-speaker. The circuit consists of a variable-mu high-frequency stage, detector and pentode output. Of course, the sets are supplied in kit form with very attractive horizontal-type cabinets. **33**

Telsen's New Components

Besides a range of battery and A.C. sets, Telsen are manufacturing an extensive assortment of components this season. In a leaflet which they have just sent me they give some interesting and useful information about their new electrolytic condensers, screened high-frequency chokes, combined volume controls and switches, totally enclosed tuning condensers and mains transformers and units. Almost every type of component needed by the home constructor will be found fully described in the pages of the new Telsen catalogue. **34**

Blue Spot Loud-speakers

The choice of a loud-speaker merits considerable thought and for that reason alone I would recommend you to glance through the new Blue Spot 1934 catalogue before you buy your next reproducer. It is chock full of loud-speaker information, and tells you all about the famous Blue Spot balanced-armature units, the new ranges of moving coils and the improved pick-up, which is claimed to have a remarkable frequency response. Of particular interest in this catalogue is the information given about extension loud-speakers. Blue Spot make models for use with many well-known commercial sets. **35**

Bulgin's 1934 Catalogue

Bulgin's have sent me a copy of their new 1934 catalogue. It is quite a bulky affair with 269 illustrations and a special 28-page section full of useful technical information with many circuits and simple explanatory diagrams of interest to the home constructor. Sixty six lines have been reduced in price for the next season. Copies of the catalogue are free through this service, but readers must enclose a 2d. stamp with the coupon to cover the cost of postage. **36**

PREPAID ADVERTISEMENTS

Advertisements under this head are charged THREEPENCE PER WORD, minimum charge THREE SHILLINGS. DEPOSIT SYSTEM.

As the publishers cannot accept responsibility for the bona fides of advertisers in this publication, they have introduced a system of deposit which it is recommended should be adopted by readers when dealing with persons with whom they are unacquainted.

The amount of the Deposit and Fee must be remitted by Postal Order or Registered Letter (Cheques cannot be accepted), addressed to "Amateur Wireless," Advertisement Department, 53/61 Fetter Lane, London, E.C.4.

INVENTORS' POCKET-BOOK.—How to patent. Invaluable aid to selling your ideas. Expert advice. Copies free. —Edwin O. Axe, A.I.M.E., 27 Chancery Lane, London.

REPAIRS to Loud-speakers, transformers and headphones, 4/- each; Blue Spots or Wufa's, 5/-; mains eliminators, etc., quoted for; prompt service; satisfaction guaranteed; terms to trade.—Loud-Speaker Repair Co., 5 Balham Grove, London. Battersea 1321.

THE IMPROVED "TONIC" self-generating trickle-charger kit keeps 2-volt accumulators fully charged. Electric mains and charging stations unnecessary. Ideal for remote places, 7/- each, postage 9d. Particulars, testimonials, with pleasure.—Williams, Netherend, Cradley, Birmingham.

USED AND NEW RADIO COMPONENTS AND SETS ON EASY TERMS.—Dual-wave Coil, 5/6. L.F. Transformers, 4/9.—Arlin, 44 Ranelagh Road, Westminster, S.W.1.

POWERITE Mains Transformers. A real engineers job with three-year guarantee. Competitive prices. Lists free. Trade inquiries invited.—Nasco Wireless Products, Pittville Works, Tower Road, Aston, Birmingham.

MULLARD BALANCED ARMATURE 4-POLE SPEAKER UNITS.—Brand new; 3/6 post free.—Electric and General Distributors, 154 King's Cross Road, W.C.1.

MULTITONE CLASS-B CONVERTOR, with Cossor class-B valve; new and unused; cost £2/11/6, accept £2/2/-. Post paid.—Trott, Baltonsborough, Glastonbury.

FEED YOUR WIRELESS with Fuller High-tension Accumulators; capacity, 6,500 milliamps, 120 volts. Delivered free on first payment of 7/6. Lists free.—Leslies Radio, Catford, S.E.6.

CHARGERS, ELIMINATORS, INSTRUMENTS, from 30/-. Send for list of all types.—Bunbaken, 280 Deansgate, Manchester.

BANKRUPT BARGAINS.—List free with 3-valve diagram. Part exchange. Second-hand sets and components taken in part exchange for any new components or receiver. Kits: 3-valve, 17/6; ST300, 35/-; ST400, 45/-. Triotron Valves, trade supplied. Lumophon Sets, trade supplied. Transformers, from 1/6. Dual Coils, from 2/6. Panels, from 2/-. Valveholders, 4d. .0005 mica, 10d.; airspaced, 2/-. SM0005, 3/6. Disc Drives, 1/9. 1-mfd., 1/3; 2-mfd., 1/6. P.M. M.C., from 13/-. Diffs, 1/8. ST Coils, 5/6. Good BA Units, 4/-. A.C. Trickle Chargers, 17/6. 20-m/A A.C. Eliminators, 35/-. Both Westinghouse Rectifiers. D.C. eliminators, from 13/-. Ganged Screened Coils: Two, 7/6; three, 10/6. Class-B Triotron Units, complete, 16/6. Valves, 9/-. Class-B Transformers, 6/-. Valveholders, 1/-. Anything radio supplied.—Butlin, 143b Preston Road, Brighton. Preston 4030.

"UNIVERSAL" RADIO BARGAINS.—K.B. Pups, complete with batteries and valves, in sealed cartons, 42/6. K.B. Mains Pups, A.C. or D.C., 62/6. Burgoyne Transportable 3, Cossor valves, Drydex batteries, 57/6. Ready Radio Meteor S.G. Kits, with walnut cabinet and Soundex moving-coil speaker, 62/6. "Universal" Super Three Kits, 24/6. "Universal" Class B 3 Kits, 35/6. Permanent-magnet moving-coil Speakers, Lamplugh Silver Ghost Senior, 25/6; Junior, 15/11. Celestion Soundex, 13/3. Blue Spot 100U, 14/11. Farrand N. & K., 29/6. Dario Super Transformers, 3/6. "Universal," 2/9, Milligate Pick-ups, 4/11. Daptacon, with arm, 6/3. Utility 2-gang, 7/6. Lissenola Speaker Units, 1/11. Eliminators, A.C., 35/6; D.C., 15/6. Valves from 3/3; S.G., 7/3. All above brand new, guaranteed in original cartons. Full range Lissen Kits and Sets, cash or terms. £10,000 worth of other radio bargains. Send stamp for our huge bargain list and print of our Super Three Kits.—"Universal," 20 Victoria Road, Peckham, S.E.15. New Cross 4933. Peckham agents for Milnes H.T. Units.

TELEVISION APPARATUS. We specialise in all components. Illustrated list free.—Sanders, 4 Grays Inn Road, London, W.C.1.

REAL SERVICE.—Keen quotations or price list; all makes components, speakers, eliminators, etc.—Childs', Radio Factors, 29 Moray Road, London, N.4.

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When ordering, please send Postal Order, NOT STAMPS. Quote the Blueprint number shown below; not the number of this issue.

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Full-volume 2 (SG Det, Pen)	AW392
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"A.W." Iron-core Two with Q.P.P.	AW396
Screen-grid Two (SG Det, Trans)	WM289
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"Up-to-the-minute Three" with Class B, 1/6	AW384B
New Britain's Favourite Three (D, LF, Class B)	AW394
A.C. Triodyne (SG, D, Pen)	AW399
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Prosperity Three for Batteries (SG, D, Pen)	WM296
1933 Economy S.G. Three (SG, D, Trans)	WM306
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Narrow-pass Three (SG, SG Det, Pen)	WM314
£6 6s. Radiogram (D, RC, Trans)	WM318
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