REFLEX CIRCUITS FOR EXPERIMENTERS

Practical Wireless

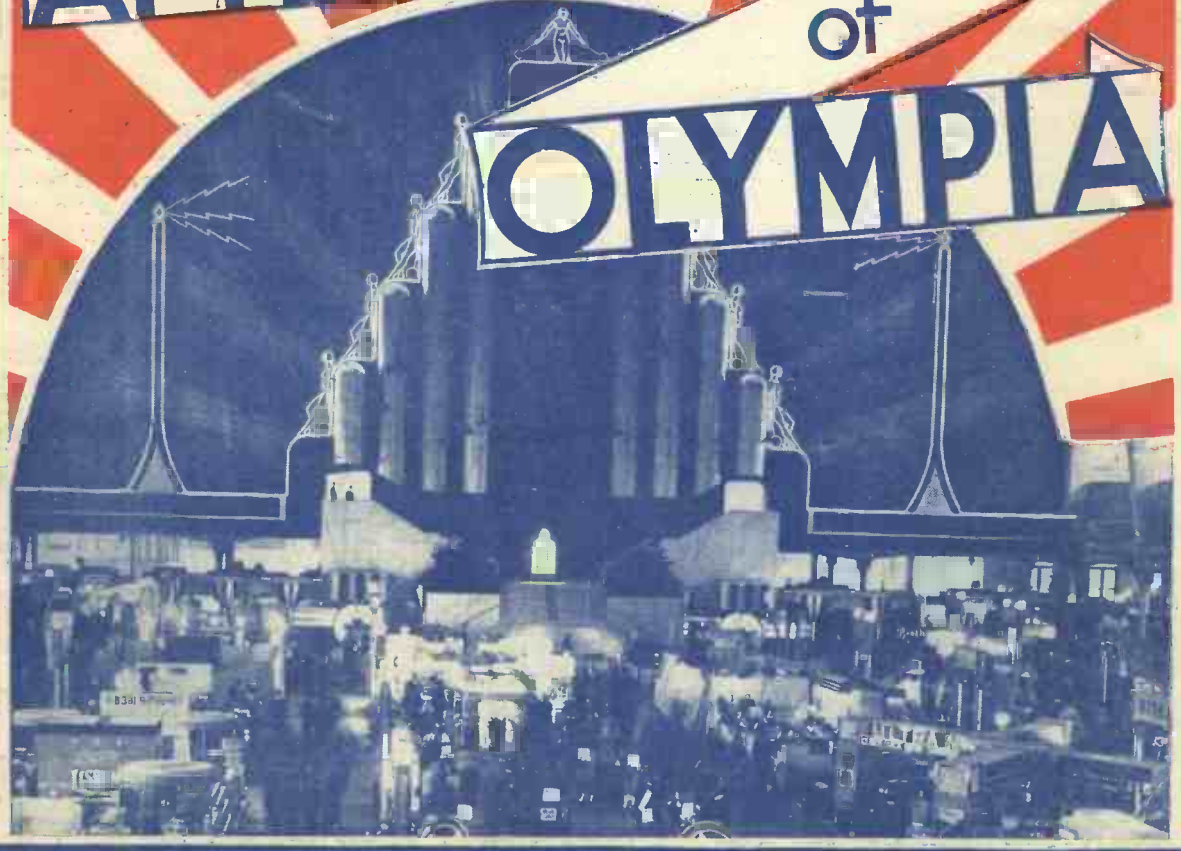
3D

AND AMATEUR TELEVISION

EDITED BY F. J. CAMM.

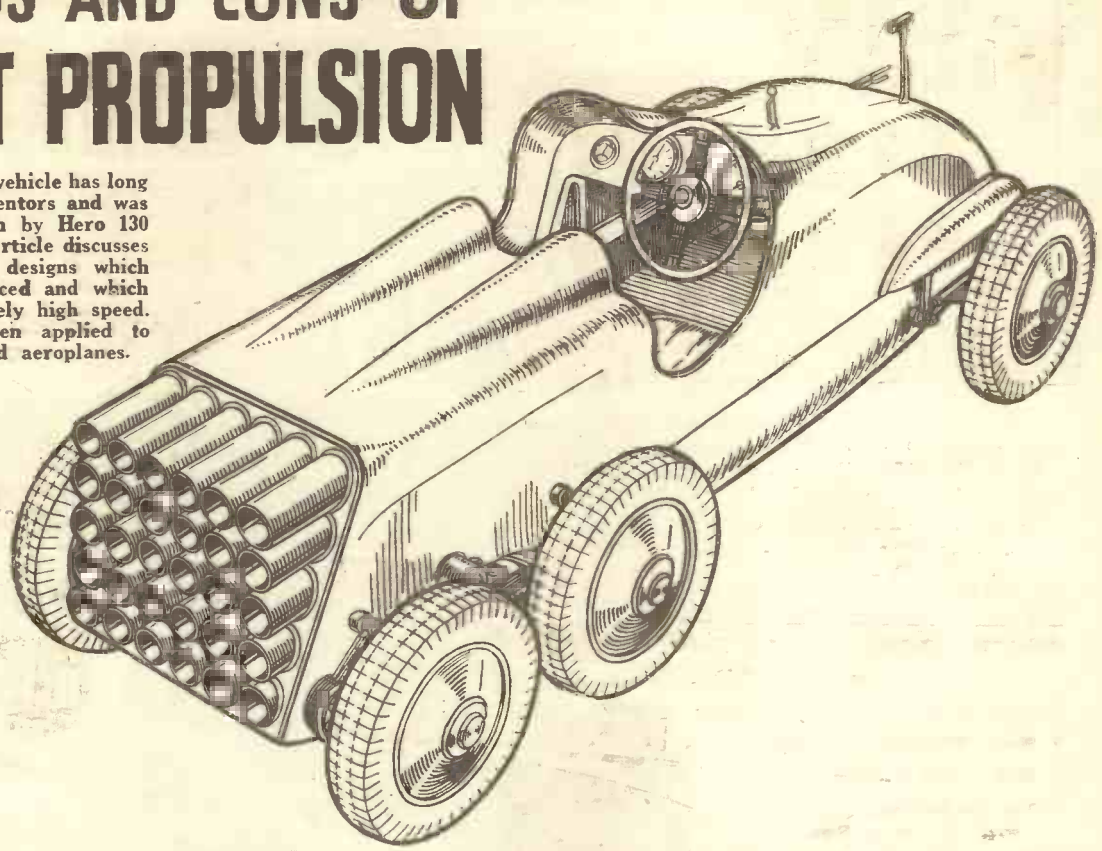
Published every Wednesday by
GEORGE NEWNES LTD.
Vol. 4. No. 102.
September 1st, 1934.
Registered at the G.P.O. as a Newspaper.

AFTERTHOUGHTS of OLYMPIA



THE PROS AND CONS OF ROCKET PROPULSION

The rocket-propelled vehicle has long been the dream of inventors and was first experimented with by Hero 130 B.C. This interesting article discusses the several successful designs which have since been produced and which are capable of extremely high speed. The principle has been applied to motor cars, trains, and aeroplanes.



THE September issue of this interesting monthly contains a further attractive blending of fascinating scientific subjects treated in everyday language, and illustrated with dozens of interesting drawings and photographs. Feature articles include How Bridges are Built, The Pros and Cons of Rocket Propulsion, How Water is Raised from Deep Wells, How Pictures are Sent by Telephone, the Fourth Dimension, the New Television, Revolution Counters and Their Uses, and Colour Light Signalling, whilst the country dweller will be particularly interested in an article on House Lighting Plants.

Those of a scientific turn of mind will like the articles on Photo Cells, Liquefying Gases, and the Healing of Wounds in Metal, and those whose interests are in a practical direction will turn to the Special Articles, Fitting Electric Clock Chimes, Files and Filing, the *Practical Mechanics* Tablegram, and Model Aeroplane Stability. Interesting articles on Historic Locomotives and old Waterloo Bridge and the reason for its collapse, round off an excellent issue.

6D.

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99 P.M. This speaker very rapidly made a name for itself—a name that stands as high today as ever it did. Chassis, **59/6.** Cabinet in walnut, **87/6.**

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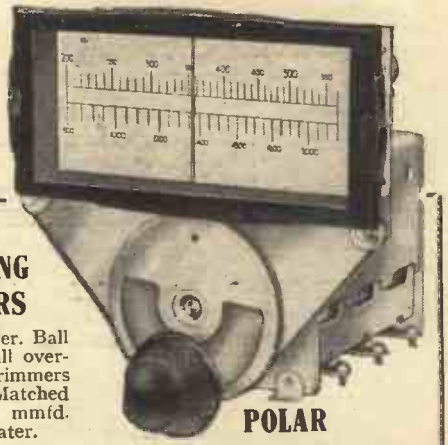

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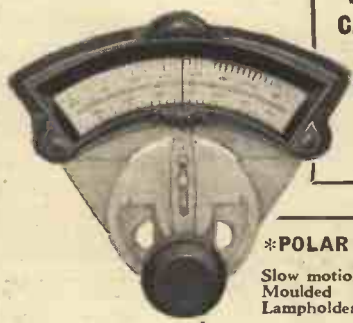

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CA 5509

Music's Golden Tongue

No. 1

Testing an "His Master's Voice" Loudspeaker for accuracy of reproduction

Before a loudspeaker is fitted into an "His Master's Voice" instrument it is subjected to most rigorous tests—not only for defects but for its absolute truth of tone and accuracy of reproduction. These tests are made through the whole range of sound, musical and otherwise, from the highest to the lowest. "His Master's Voice" have the advantage, here, in that they have been concerned with the science of sound reproduction since it first became a commercial possibility towards the end of the nineteenth century. The knowledge and experience accumulated during this time lie behind every instrument "His Master's Voice" make.

TESTING AN "HIS MASTER'S VOICE" LOUDSPEAKER

Every "His Master's Voice" Loudspeaker is tested acoustically against a "Master" speaker for the accuracy of its response to every musical sound. A succession of test passages are transmitted through both—a piano passage, a drum passage, a tenor passage, a soprano passage, the test for sibilants in speech, the orchestral test, the violin passage for harmonics, the heterodyne note for response to high and low frequencies, and so on. New speakers are tested for freedom from electrical or mechanical defects, and, finally, have to pass a "public performance" test in a sound-proof room. If, in any of these tests, the slightest inadequacy is evident, it is promptly rejected.

"HIS MASTER'S VOICE"

THE GRAMOPHONE COMPANY, LTD., 98-108 CLERKENWELL ROAD, LONDON, E.C.1

HOW THE BLATTNERPHONE WORKS—See Page 720

Practical Wireless

EDITOR:
Vol. IV. No. 102. || F. J. CAMM || Sept. 1st, 1934.
Technical Staff:
W. J. Delaney,
H. J. Barton Chapple, Wh.Sch., B.Sc. (Hons.), A.M.I.E.E.
Frank Preston, F.R.A.

Variety from Blackpool

BLACKPOOL provides another forty-five minutes' programme for North Regional listeners on September 7th. It will consist of shows by the Arcadian Follies and Tom Vernon's Royal Follies, broadcast from the South and Central piers respectively.

The Radioptimists

A NEW Midland radio concert party will be heard in the National programme on September 12th. This is The Radioptimists, formed by Martyn C. Webster, Midland Regional producer, who for five years ran a similar combination, also called the Radioptimists, in Scotland. As the name implies, it will be on Co-optimist lines, giving scenas and sketches with music. The personnel is: Alma Vane and Hugh Morton, who have played the lead in Martyn Webster revues this year; Dorothy Summers (comedienne); Marjorie Westbury (soprano and one of the Midland Wireless Singers); Denis Folwell and Harry Saxton (comedians), and the Three Knaves (Jack Wilson, Jack Hill, and Basil Hempseed) for three pianos. The music for the first appearance on September 12th will include some specially-written numbers by Michael North.

"Outwards from Bristol Bridge"

A PROGRAMME bearing the above title will be given from the West Regional on September 6th. It is described as an evening tour in search of diversion, and listeners are promised some interesting entertainment with plenty of music and fun.

"Telford and Scotland"

THE centenary of the death of Thomas Telford falls on September 2nd, and will be commemorated on that day by a talk to be given in the Scottish Regional programme by J. Inglis Ker. Later in the week (on September 7th) a more elaborate tribute will be paid to Telford's memory in the shape of a feature programme, entitled "Telford and Scotland." This has been compiled by Marris Murray, an Aberdeen journalist, and music has been specially composed for it by Ian Whyte, who will conduct the New Light Orchestra. The programme will be produced by Gordon Gildard. Telford's achievements in road-making, bridge-building, and harbour and canal construction will be summarized in this programme, and the whole will serve to remind listeners of the great work in developing the communications of Scotland carried out by one who was, perhaps, the greatest civil engineer Scotland has ever produced.

Variety from Scottish Radio Exhibition

ON September 3rd, at 7.15 p.m., September 4th, at 8.0 p.m.; and September 7th, at 6.30 p.m., the B.B.C. are giving three more relays in the Scottish Regional programme of variety from the Theatre at the Radio Manufacturers' Exhibition at the Kelvin Hall, Glasgow.

"The Comic Side of Band Contests"

THIS is the title of a talk which Charles Procter will give from the North Regional on September 3rd. The talk will be topical, for on the same day the eighty-second annual September Championship Brass Band Contest will be taking place at Belle Vue, Manchester, and on the following day—September 4th—the winning band in this contest will broadcast from the Manchester studios. Which of the twenty-seven bands competing will be the one to broadcast? As they have held the Belle Vue 2,000 guinea trophy for the last two years, the Brighouse and Rastrick Band may, perhaps, be regarded as "favourite"; but the Black Dyke Mills and the Besses-o'-th'-Barn Bands, veterans of the contest, are well in the running; and the Tintwistle, Mann and Felton's (Kettering), Pendelton Public, Hanwell and Baxendale's Works Band stand a good chance.

Morning Talks to Schools

DURING the early part of the year the experiment of morning talks to schools was tried and found successful, so that in the autumn this is being extended, and every morning, at 11.30, there will be a talk on various subjects. One which should interest a wide circle of listeners is that on Tuesdays on "Peoples of the World" by various speakers. The first talk, on September 25th, is on the Wandering Pygmy Folk of the Equatorial Forest. An equally-attractive series, too, has been that on Life and Work in Different Parts of the World. This was planned on a four-year basis, and the British Isles, Europe and the British Empire have now been completed. The fourth series—that of the World—will deal with places which have not been dealt with before and on September 28th the subject will be "The Wheat Farmer in the Argentine."

"Guess Who It Is"

A GUESSING competition (without prizes) will be provided for National programme listeners, on September 8th, by an anonymous variety show, entitled "Guess Who It Is." Those taking part will consist of well-known and less well-known radio artists whose names—contrary to the usual practice—will be announced after they have broadcast. The programme will be compèred by John Watt.

Foreign Language Talks

IN the Foreign Language series, listeners will welcome Monsieur E. M. Stéphan back to the evening programme, when he will begin a new two-year course. This new series will be on Tuesdays from 6.50 to 7.20, and a pamphlet covering the course for the first year will be ready in September. Herr Max Kroemer will begin the second year of his very popular course on Thursdays at the same hour, and a pamphlet covering this will also be published in September.

ROUND the WORLD of WIRELESS (Continued)

"In Town To-night"

THE B.B.C. have had so many requests from listeners to re-introduce the Saturday broadcasts entitled "In Town To-night," during the coming winter, that they have now arranged for a second series. Under the same title as before, namely "In Town To-night," these broadcasts will start on October 6th and will be continued on succeeding Saturdays. All that is brightest and best in London's week-end life will parade before the microphone. Listeners will again have the opportunity of hearing the most distinguished of London's residents and visitors who have something interesting to tell. "In Town To-night" will cover all social grades and this season will introduce many novelties.

THE LATEST SIX-VALVE PORTABLE

American radio operators on a visit to Cannes interested in the technicalities of an H.M.V. Superhet Portable Six.

Well-known Songs and Tunes

A PROGRAMME entitled "1880—An evening of select music in the drawing-room of Mr. and Mrs. Carruthers," which has been prepared by David Kean will be given for West Regional listeners on September 3rd. This programme deals in a gentle way with the old-fashioned musical evening, and contains many well-known songs and tunes beloved by our parents; listeners will get a fleeting memory of horsehair chairs, antimacassars, aspidistra, and the faintest fragrance of lavender with a suspicion of sentiment. All the dialogue is historically accurate.

Profitable Evenings

THE Chief Education Officer for Birmingham, Dr. P. D. Innes, is to give a short talk for the Midland Region on September 8th, on "Profitable Evenings"; the occasion being the forthcoming opening of the session for evening classes in Midland towns.

Light Music from Midland Regional

AN excellent programme of light music for Midland Regional listeners during the week will be given by Harry Engleman's Quintet, with Mary Pollock, on September 3rd; and Jack Wilson and his Versatile Five, with Edith James, on September 6th; while the late Saturday night entertainment is another cabaret show by Orlando and his Band, with Pat Hyde and guest artists, relayed from the Welcombe Hotel, Stratford-upon-Avon.

INTERESTING and TOPICAL PARAGRAPHS

Greta Keller's Return

THIS popular artiste's return to the microphone, which has been postponed since June, is now given definitely in the programmes. On August 30th she will broadcast a fifteen minutes' feature, on September 4th she will appear in Entertainment Hour, and on September 15th her third broadcast of this series will take place in the variety programme. Miss Keller, a Viennese singer, has built up a reputation in English-speaking countries on her performances for the B.B.C.

"Clean Cities"

DR. VEITCH CLARK, Medical Officer of Health for Manchester, will contribute to the "Schemes" series a North Regional talk about "Clean Cities" on September 7th. A keen advocate of smoke abatement, Dr. Clark will no doubt urge that by a greater use of smokeless fuels the national health could be improved and a check applied to much extravagance. It is argued that smoke, necessitating so much cleaning and replenishing of household furniture, costs this country approximately £80,000,000 a year—working out at an average of ten guineas a year for every householder.

Light Music by "Heavy" Composers

THE "20-20" programme, to be broadcast to the North Region on September 5th, will consist of two twenty-minute gramophone recitals, the first of which is called "Giants at Play: the Masters go gay." This will be a programme of light music by "heavy" composers, and will include, for example, a Bach gavotte played on the guitar, Haydn's "Toy Symphony," and "Giants and Fairies" by Elgar. The second half, entitled "Three Pianos," is to consist of piano recitals by three famous jazz pianists, Charlie Kunz, Ivor Mor Moreton, and Dave Kaye.

Flute Recitals from North Regional

JOSEPH LINGARD, for many years principal flautist of the Hallé Orchestra, will give two flute recitals in the North Regional programme on September 6th. The first of these is during the Children's Hour, when he is to broadcast some Near-Eastern music in connection with a Rumanian programme (of talks and stories) arranged by Roma Lobel, a native of Rumania. In the evening he will broadcast Handel's Sonata No. 5 in F and the Sonata "La Flute de Pan" by Jules Mouquet.

"At the Shore"

THE second programme in the series "At the Shore" is to be heard by Northern Ireland listeners on August 29th. The first programme dealt with the Coast Road, but this one goes in the opposite direction from the city of Belfast and is concerned principally with the Mourne Mountains and Mourne coast. This beautiful country abounds in picturesque legend and history.

Talks on Walking

LAURENCE MILLS, a Kidderminster manufacturer, is to give the next of the summer series of talks for Midland Regional listeners on Walking. On September 6th he will tell of the delights of footpaths. The subject is one to which he has given many years of pleasurable study. As secretary of the Footpaths Committee of the Midlands Federation of Ramblers, he has had to deal with several cases of attempted interference with rights of way.

Across North Africa

AN adventurous motor journey across North Africa is the subject of a Midland Regional talk to be given on September 11th, by Geoffrey Bunn, a student of Birmingham University. With two friends, he decided, when in Cairo, to motor overland to Tangiers, crossing the Libyan desert, and then through Spain and France after crossing to Gibraltar. Their car had to be equipped with special reserve tanks for water and petrol for this journey.

(Continued on page 727)

SOLVE THIS!

PROBLEM No. 102.

Allen had carried out a certain amount of experimenting with a one-valve set and had discovered several interesting points. Being interested in rectification properties he tried the effect of cutting out the usual grid condenser. He reasoned that the grid leak was normally joined to L.T. positive, thus making the grid positive, and therefore it should be possible to eliminate the leak and condenser as the lower end of the tuning coil was joined to L.T. positive and thus impressed the positive potential on the grid. When he tried this he found it very unsatisfactory. He considered that the circuit was in order as it was exactly similar to an anode-bend circuit, except that positive instead of negative bias was applied to the grid. Where was his reasoning wrong? Three books will be awarded for the first three correct solutions opened. Address your attempts to The Editor, PRACTICAL WIRELESS, Geo, Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 102 and must be posted to reach here not later than first post September 3rd.

Solution to Problem No. 101.

When Jackson screened his entire aerial he not only prevented the wire from picking up the interference but it was effectively screened from all radio signals at the same time. It is, of course, necessary to have some unscreened wire in order to pick up a signal, and Jackson had also screened his earth wire so that there was no means of entry to his receiver for the wireless signals.

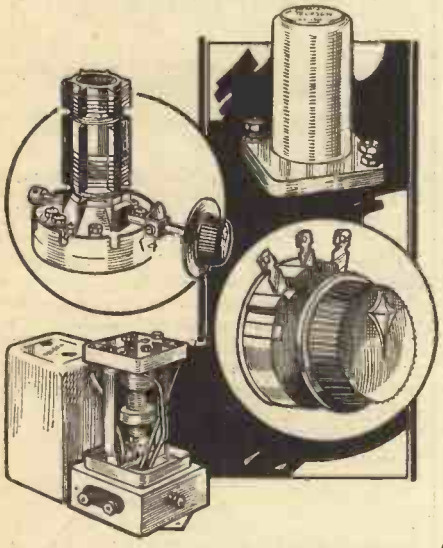
The following three readers successfully solved Problem No. 100, and books have accordingly been forwarded to them:—A. Goodall, 0. Longfield Avenue, Pudsey, Leeds; H. F. Leslie, 34, Victoria Road, Aldershot, Hants; J. Hudson, "White Lodge," Newby Mills, Burniston Road, Scarborough.

RADIOLYMPIA REFLECTIONS

A Review of the Principal Exhibits and Some Afterthoughts of Olympia

Illustrations Drawn at Olympia by Our Artists

THOSE sceptics who are continually claiming that radio has reached "saturation point" must have had a shock, on visiting the 1934 Radiolympia to find that the display was not only the best yet, but that interest in every branch of wireless was keener than in any previous year. It must be admitted that a considerable amount of space was devoted to complete ready-made receivers, but it is equally true to say that the variety and

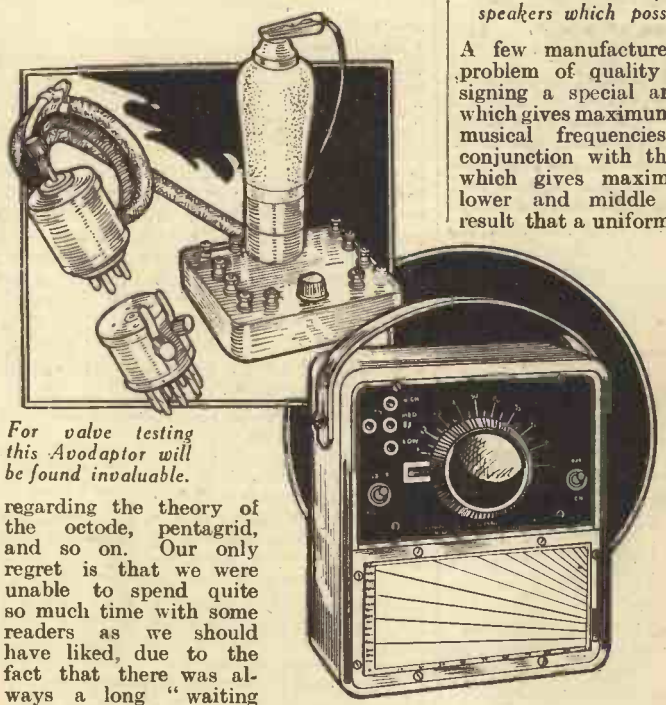


A group of new Telsen components, including a short-wave coil, H.F. choke, an I.F. transformer, and a volume control.

quality of components and accessories offered to the home constructor were very much in evidence, despite the enormous price reductions which manufacturers have been able to effect. So great was the interest in home construction that it is agreed that the coming season is going to be a "bumper" one for the amateur and experimenter, who can pursue his hobby more inexpensively than at any time since radio became Britain's National hobby.

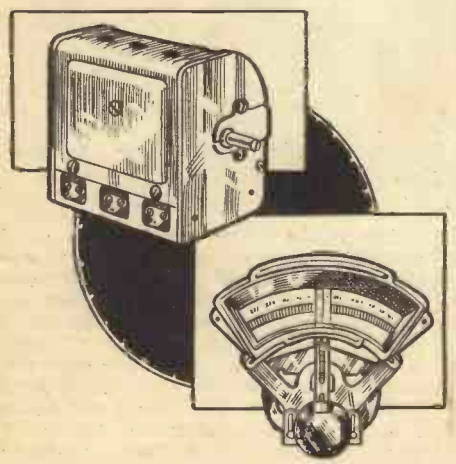
Home-constructor Interest

Ample evidence of home-constructor interest was afforded PRACTICAL WIRELESS Technical Staff, who were in attendance to answer any readers' queries free of charge. We were inundated by inquiries of every kind, from those concerning the reason for a particular fault in a receiver to those regarding the theory of the octode, pentagrid, and so on. Our only regret is that we were unable to spend quite so much time with some readers as we should have liked, due to the fact that there was always a long "waiting list." We were, however, very pleased to make the acquaintance of hundreds of new readers and to meet again a large number of those who called upon us last year. All spoke in high praise of our low-price-with-efficiency campaign, and expressed their appreciation of the "Leader" series of receivers.



For valve testing this Avodaptor will be found invaluable.

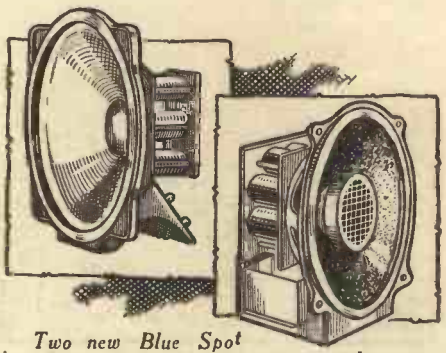
The test engineer and the keen experimenter will find this Avo-Oscillator a valuable piece of apparatus.



Two J.B. components, a gang condenser and an arcuate drive.

New Designs of Loud-speakers

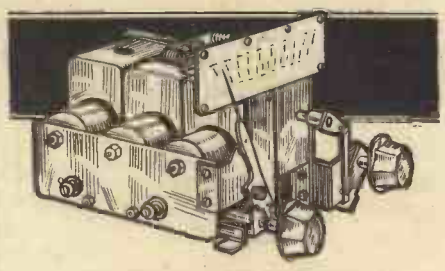
In going the rounds of the exhibition one could not fail to be impressed by the variety of novel and interesting loud-speakers which were to be seen on a number of stands. It was very apparent that makers have been carrying out a large amount of experimental work, with a view to improving the quality of reproduction—and that success has attended their efforts.



Two new Blue Spot speakers which possess some novel points.

A few manufacturers have tackled the problem of quality reproduction by designing a special and additional speaker which gives maximum response to the higher musical frequencies. This is used in conjunction with the normal instrument, which gives maximum response to the lower and middle frequencies, with a result that a uniform response is obtained at all frequencies between about 50 and 10,000 cycles.

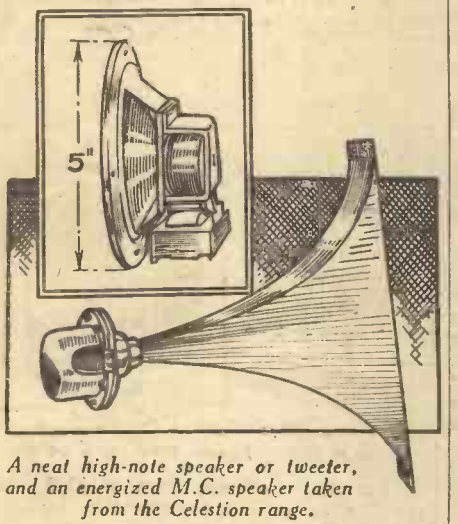
One new unit for handling the upper frequencies is the Celestion High-Note Speaker, type T.3, which consists of a special moving-coil movement attached to an unusually shaped metal horn. This instrument is of the energized pattern, and is intended for use in conjunction with a cone-diaphragm moving-coil, such as the Celestion E.10. It is priced at £3 3s., and a special input transformer for separating the high and



A tuner which will probably become the tuner of the future. The Varley Permeability Tuner.

low frequencies can be obtained at 12s. 6d.

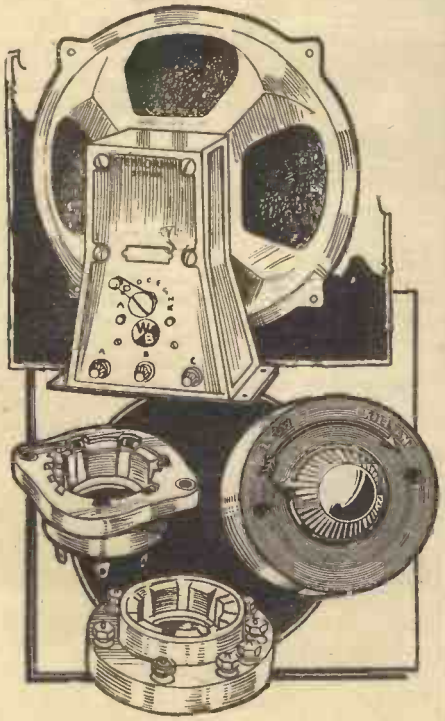
Another new speaker for providing equal response to the complete mystical spectrum is the Blue Spot "Super Dual," which combines two separate cone-diaphragm moving-coil units, these being mounted concentrically. The large cone is of normal type and deals with all except the very high frequencies, whilst the small one



A neat high-note speaker or tweeter, and an energized M.C. speaker taken from the Celestion range.

comes into operation on frequencies above about 1,500 cycles. To lighten the smaller movement, thereby ensuring the minimum of inertia, the speech coil is wound with aluminium wire, whilst the cone is of special material. An input transformer and the necessary filters are fitted to the instrument so that no extra fittings are required.

Another loud-speaker development of importance which was revealed at Olympia



In addition to the popular Stentorian speaker, Messrs. W.B. also manufacture the volume control and valve-holders shown in this group.

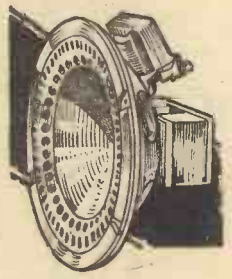
was the introduction by Messrs. W.B. of the new "Stentorian" range of units. These are of especial interest to the owner of a small receiver, who has hitherto been obliged to stick to the old moving-iron speaker because of the comparative insensitiveness of the average moving coil; the "Stentorians" certainly give a greater output for a given input than do any other moving coils we have tested. A new feature of interest on the W.B. stand was the neat tone control which can be fitted to almost any speaker in order to vary the pitch of reproduction as required.

Still dealing with speakers, mention should be made of the bowl-type instruments made by Kingsway Radio, Ltd. These are very attractively made and are finished in a modern style, as can be seen by examining one of the accompanying illustrations. Another novel speaker is the "Mastersinger," which is combined with an electric light shade. Due to the position of the speaker, near to the ceiling, and to the fact that the electric shade gives a "diffusion" effect, it is claimed particularly good reproduction can be secured.

High-grade Measuring Instruments

It was very interesting to find that a number of manufacturers were now catering more than ever for the real experimenter who wishes to take accurate measurements. The Automatic Coil Winder Co., who are so well known as manufacturers of the "Avometer," "Avominor" and "Avodaptor," have added to their range of instruments the "Avo-Oscillator," which is extremely useful for making a variety of tests on receivers and components. It provides a modulated H.F. signal, the frequency of which is variable over the complete long- and medium-wave bands; the frequencies to which it is adjusted can readily be determined by use of the graphs which are shown on the front of the unit. The price of this high-grade accessory, complete with valves, dry cell, and 20-volt H.T. battery, is £5 10s.

A variety of other useful test instruments were to be seen on the Bulgin stand. There were here meters of almost every type required by the experi menter, and at remarkably attractive prices. Other meters shown were for use as visual tuning indicators, and these also were in various types and shapes, so that they are suitable for use in conjunction with any type of tuning dial or component arrangement.

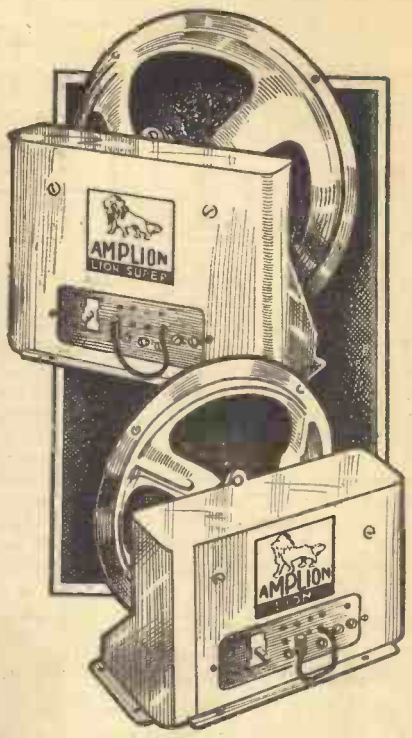


A new Goodman speaker.

Among the low-priced, though accurate, testing instruments and meters came the "Pifco" units made by Provincial and Incandescent Fittings Co., Ltd. The A.C./D.C. "Radiometer" and the "Rotameter" are items in question, and both of them attracted much well-merited attention.

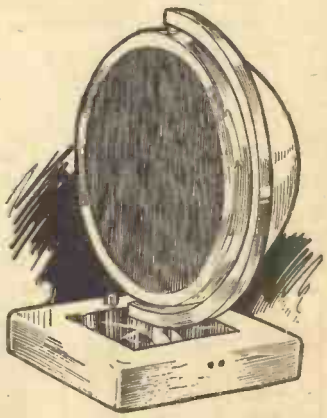
Tuning Units

Tuning coils and condensers were to be seen in a variety of very interesting types, and one could not fail to be impressed by the many important changes which have been brought into effect since last year. There were several midget gang condensers, which must have warmed the hearts of those constructors who are in favour of



The latest Lion speakers; two forms introduced at Olympia by Messrs. Amplion, Ltd.

buying components of high mechanical efficiency and who are also interested in the development of the compact receiver. The midget screened gang condensers on the stands of Wingrove and Rogers ("Polar") and of Jackson Bros. Ltd., proved to be very popular indeed; these were shown in both "plain" and superhet. types.



A speaker of novel design. This is the Bowl speaker, manufactured by Kingsway Radio.

Among the many types of coil which were to be seen, the new Colvern "Ferrocart" units, employing a new form of construction, were to the fore. Other coils of novel type were to be seen on the Bulgin, Wright and Weaire ("Wearite") and Telsen stands, whilst something quite new was shown on the Varley stand. This was a new ganged permeability tuner which, it is claimed, gives constant selectivity and amplification over the whole of both wavebands. In order to demonstrate the efficiency of the new tuner two cathode-ray outfits were set up on the stand.

A SIMPLE CAPACITY TESTER

A Useful Bridge which will Enable You to Measure the Values of Condensers and Other Capacities.

By Test Engineer

THE necessity for some simple form of apparatus for capacity measurement, such as that described here, must have been felt at one time or another by every wireless enthusiast. The time and labour of fault location in service work on commercial receivers may be reduced with such gear. To the experimenter, of course, there are innumerable ways in which the ability to measure capacities will prove of interest and value.

The bridge described here is extremely effective, employing as far as possible parts which constructors are likely to have on hand, or which, at any rate, may be purchased with very little outlay.

How It Works

The action of the instrument is very easy to understand. If an alternating or intermittent potential such as that obtained from a buzzer is applied across the points A and B of the bridge circuit, shown in Fig. 1, the current may be considered to take two paths—one through the point C and the two condensers in this arm, and the other through D and the two condensers in this arm. Now it is possible by so arranging the values of the four condensers to obtain a condition when the potential at C is the same as that at D.

In this case no current will flow through the telephones which are connected across these points, and no note will be heard. This is actually secured when the capacity AC bears the same ratio to the capacity CB as the capacity AD does to DB. Thus, if AC is .0003 mfd. and CB three times as much, AD could be practically any value, and so long as DB was three times the value of AD no note would be heard. By making the capacity in AC variable it is possible to calculate any unknown capacity connected in AD, providing AC has a suitably calibrated scale and the unknown condenser is within the working range. The range of measurement available by tuning AC from zero to maximum will depend upon the choice of the value of DB.

The values used here have been chosen by calculation and experiment to give two ranges of capacity measurement most useful for receiver test work while using condensers which are most likely to be on hand. So long as the circuit arrangement and capacity values are adhered to, it matters very little as to the actual layout or form of the unit. The variable capacity must have a maximum of .001 mfd. to give a sufficiently wide range, and in the case of the original model two .0005 mfd. mica dielectric ganged condensers were used, but one of the old straight-line capacity type of .001 mfd. would be equally suitable. These are very often to be had from wireless stores.

Use a "mosquito" or high-note buzzer for preference, and one which is not too noisy mechanically, otherwise the note in the earphones will be drowned by the vibration of the armature.

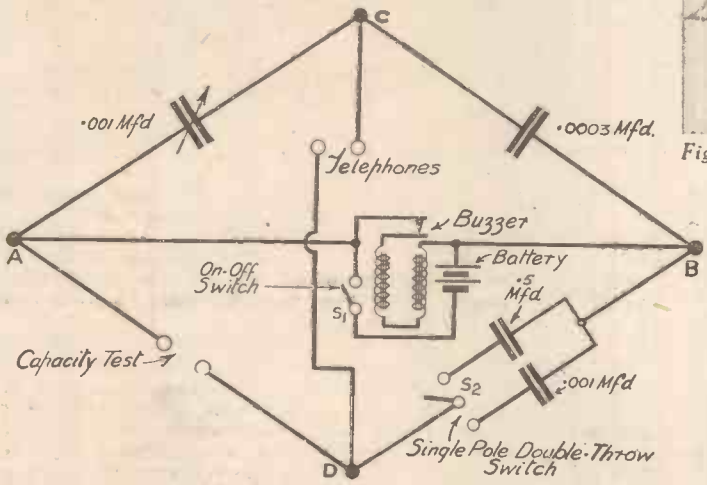


Fig. 1.—Theoretical circuit diagram.

Fig. 3.—The finished tester with a group of components to be tested.

Construction

Wiring and construction should present no difficulties, since there is surprisingly little complication about the unit. It should be possible to assemble and complete the whole job in an hour or two. When the bridge is ready for work the scale must, of course, be calibrated on both ranges, and while this presents no difficulties, suitable fixed condensers of marked capacity must be available. For the first range two or three or more condensers between .0001 mfd. and .004 mfd. are required. These should be connected in turn to the "capacity test" terminals, starting with the smallest capacity and increasing in steps. Switch on the buzzer and set the single-pole double-throw switch for the right range (the .001 mfd. in circuit for the lower range, and the .5 mfd. for the higher), then tune the .001 mfd. variable for minimum signals.

Each zero position obtained should be marked accordingly. For the second range values between .1 mfd. and 2 mfd. are required. It should be noted that with three or four condensers practically the whole of the range may be covered by series and parallel connections. For example, a .0002 mfd. and a .0003 mfd. will give readings for the individual values, and also for .0005 mfd. when joined in parallel. Two .5 mfd. condensers will give .25, .5, and 1 mfd. readings, and so on.

The scale may be calibrated directly, that is, the actual capacity values written on the scale, or, alternatively, a scale divided into degrees can be used and the readings plotted in the form of a graph. The first method is somewhat simpler and quicker to read, while the second method enables intermediate values to be estimated from the curves plotted with three or four points. Where the first method is used it is a good idea to make the pointer double ended, in which case one half of the circle may be used for the lower range, and the opposite half for the higher range, thus avoiding confusion between the two sets of figures.

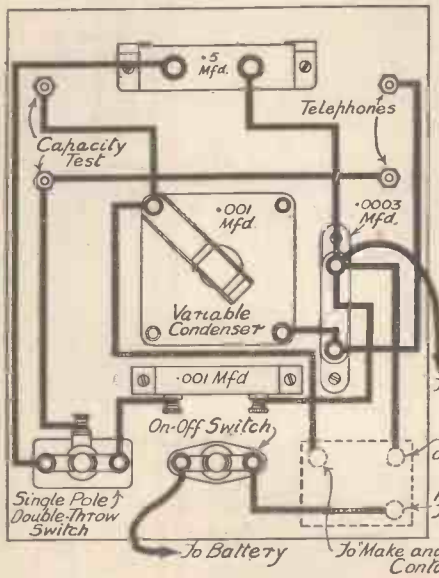


Fig. 2.—Wiring diagram of the simple capacity tester.

FALLING PRICES

Very Largely as a Result of the PRACTICAL WIRELESS Low-Price Campaign there have been a Number of Important Reductions in the Prices of Components During the Past Few Months

NOT the least important of the changes which have occurred in wireless during the last year is the reduction in the price of components, and even of complete receivers. There has, of course, been a gradual reduction in the price of wireless apparatus over the last ten years or more, but 1934 has probably witnessed more important reductions than has any preceding year. This fact is all the more significant because it was considered (and the opinion was freely expressed) that prices had reached bed-rock levels. How, then, has it been possible for manufacturers still further to reduce their prices? One reason is that radio has become more stabilized, and, therefore, it has been possible to make components in larger numbers with less fear that they would soon become obsolete, but there is another and probably more significant reason. This is, that PRACTICAL WIRELESS, in championing the cause of the home constructor, has insisted upon using and specifying only those parts which could be purchased at a moderate figure.

Better Value Than Ever Before

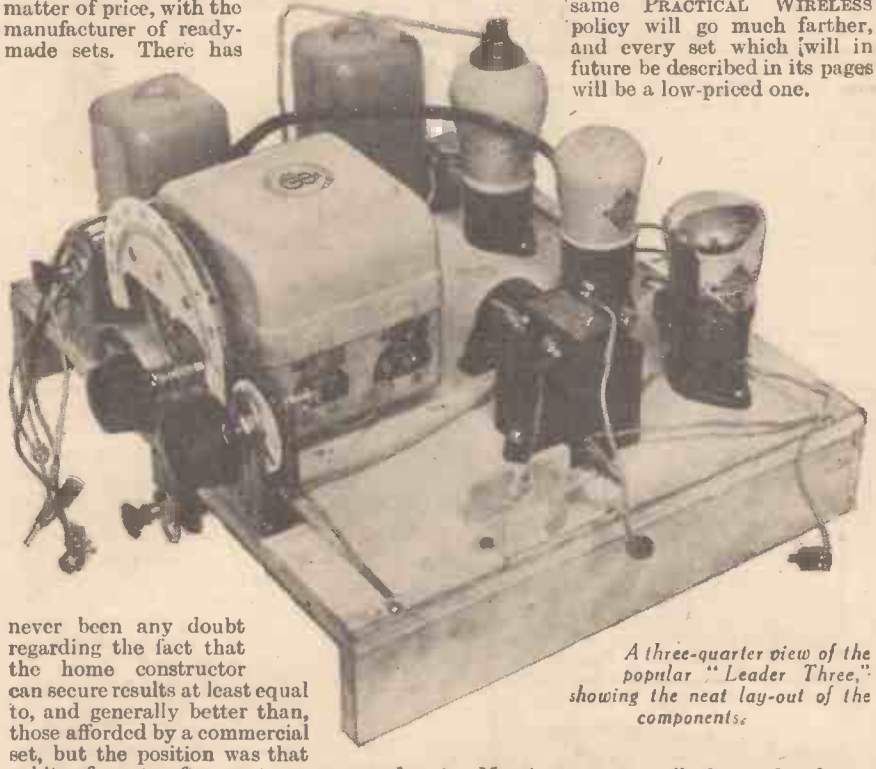
This has not been a "cut-throat" campaign, but a genuine attempt to ensure that the home constructor should have value for money, and that he could compete, in the matter of price, with the manufacturer of ready-made sets. There has never been any doubt regarding the fact that the home constructor can secure results at least equal to, and generally better than, those afforded by a commercial set, but the position was that a kit of parts often cost even more than a ready-made set of similar type. This did not affect genuine constructors and "old hands" who knew that a commercial receiver could never afford the same amount of enjoyment as the home-made, but it did begin to make the newcomer hesitate.

PRACTICAL WIRELESS, therefore, inaugurated the bold policy mentioned above and requested component manufacturers to produce parts at much lower prices. There was no attempt to sacrifice efficiency, but merely to save expense by employing less fanciful containing cases, and by replacing comparatively expensive terminals by more convenient soldering tags.

The "Leader" Series

It was very soon discovered that manufacturers were perfectly willing to co-operate, as they did in the production of our first "Low-price-with-efficiency" receiver — the "Leader Three." So popular did this set become that hundreds of readers very soon "asked for more." That lead to the introduction of the A.C. version of the "Leader," then to the "Ubique" universal three-valver, and to the "Summit" and the "Armada," our latest receivers which are described in this issue. This same PRACTICAL WIRELESS policy will go much farther, and every set which will in future be described in its pages will be a low-priced one.

Neatness, compactness, and simplicity of control are outstanding features of the "Leader."



A three-quarter view of the popular "Leader Three," showing the neat lay-out of the components.

Mention cannot easily be made of every component manufacturer who has given us his backing, but the names of Heayberd, T.M.C., Wearite, Graham Farish, and Ferranti will all be remembered in connection with the "Leader" series, whilst Bulgin, Formo, W/B and Telsen components come within our "low-price-with-efficiency" classification. A number of other components also represent better value than before, although their actual prices have not been changed. For example, several of the condensers—particularly electrolytics—made by Messrs. T.C.C. and Messrs. Dubilier have now an appreciably higher peak voltage rating than they had before.

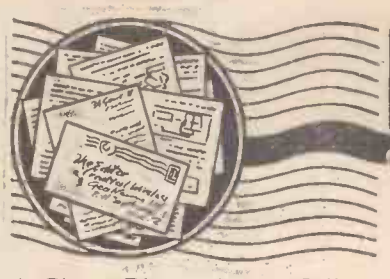
Soldered Connections

There may be a few readers who imagine that it is a retrograde step to request—perhaps one should say "demand"—that the prices of components should be reduced, because in order to effect the saving manufacturers may dispense with some of the beautifully-finished bakelite containers and nicely-plated terminals, but this view will certainly not be held by the majority. We may go further by saying that the replacement of terminals by soldering tags is a definite move in the right direction, because there is no doubt that a properly soldered joint is considerably more efficient than one made by tightening a terminal nut on to a loop of wire. Besides, PRACTICAL WIRELESS readers recently voted in strong favour of soldered connections, which they knew to be more reliable and real savers of time.

Valve Prices Down

A particularly striking example of a price reduction that has been desired for some time concerns valves. Readers are aware that the prices of all the most-used types of valves were substantially reduced only a few weeks ago. It is significant to remark that some little time prior to the reductions being announced the Editor of PRACTICAL WIRELESS had sent a letter to every valve manufacturer in which were set out the objects of the PRACTICAL WIRELESS policy!

There is little doubt that in the very near future all component manufacturers will come into line with those who have already given us their backing.

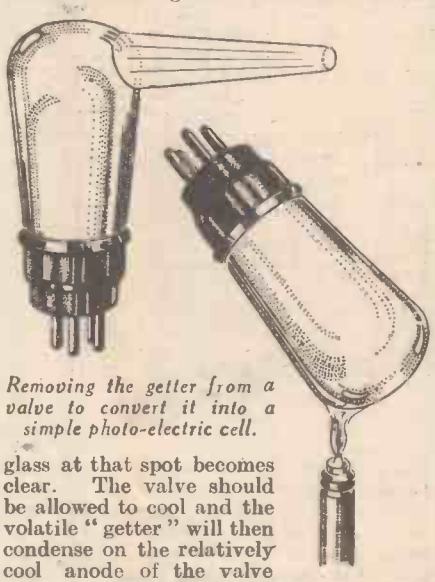


READERS' WRINKLES

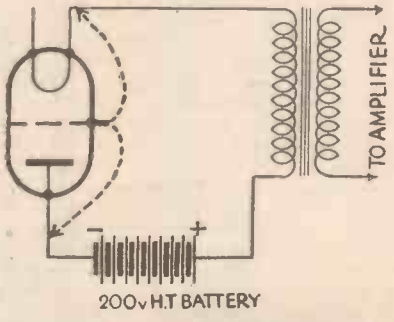
THE HALF-GUINEA PAGE

A Cheap Photo-electric Cell

A PHOTO-ELECTRIC cell can be made from any old valve that has been gettered with magnesium or barium. The valve should be heated in one spot over a gas flame until the "getter" volatilizes and the glass at that spot becomes clear. The valve should be allowed to cool and the volatile "getter" will then condense on the relatively cool anode of the valve and act as a light sensitive surface. Good results have been obtained by treating P.M.14, P.M.6, and P625A valves in this way.



Removing the getter from a valve to convert it into a simple photo-electric cell.



How to connect up the photo-electric cell described above.

The anode of the valve, or screen, in the case of a P.M.14 valve is connected as cathode and the filament as the anode, to a 200v. source of supply. Connecting the grid to anode or filament is sometimes an advantage. When connected to an amplifier, all sorts of useful experiments can be carried out.—G. MILLER (Sunderland).

[*We are publishing this Wrinkle on account of its novelty. We presume that Mr. Miller has actually made up the device, but as we have not carried out any tests on these lines we are unable to guarantee its efficacy.*—ED.]

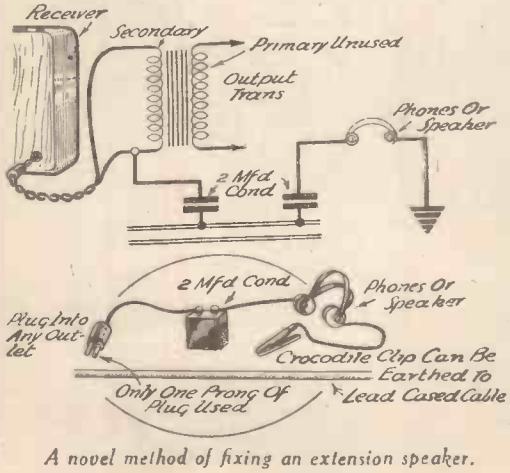
THAT DODGE OF YOURS!

Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay £1-10-0 for the best wrinkle submitted, and for every other item published on this page we will pay half-a-guinea. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be *original*. Mark envelopes "Radio Wrinkles." Do NOT enclose Queries with your Wrinkle.

Fixing an Extension Speaker

BY means of the arrangement shown in the accompanying sketch a radio programme can be listened to anywhere in the house without having to connect wires to the 'phones or speaker. Instead of using a speaker or earphones close to the set, the plug is connected to the secondary of an old output transformer as shown. The connections from the plates of the receiver output valve connect to P on the transformer and from there to one side of a 2 mfd. fixed condenser. The B plus receiver connection hooks to the other side of the secondary winding. Connect the other side of the condenser to one prong of the plug (not shown in drawing). At the receiver end, connect a wire to one prong of a second plug, and connect the other end to one side of a 2 mfd. fixed condenser. The other side connects to earphones and speaker. Insert the two plugs into any convenient receptacle, making sure the wired prongs make contact with the same wire on the line, then, by using a crocodile clip, clip it to the water pipe.

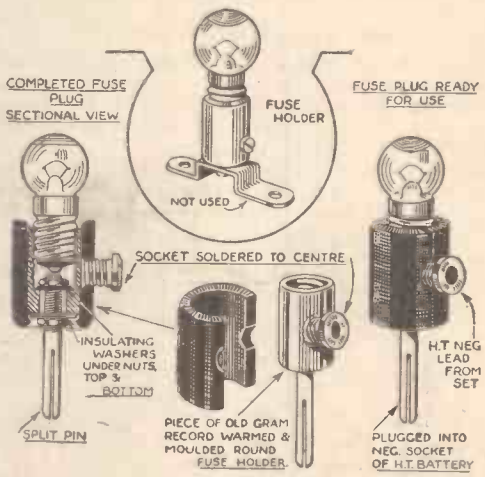
Switch on the receiver, and plug into the speaker or 'phone jack as shown. Thus by the aid of two coupling condensers, and the electric light wire and earth, you can hear the programme at any point in the house where the wires and earth can be reached. —T. C. BIDDLECOMBE (Twickenham).



A novel method of fixing an extension speaker.

A Two-way Plug Fuse

FROM a few very simple materials, an excellent plug fuse (as illustrated) can be constructed in a few minutes. The materials required are as follows: An old type fuse-holder, a split pin with nuts, a parallel socket, and a discarded gramophone record. Dismantle the fuse-holder by unscrewing the bottom set screw, also the side connecting screw, if one is fitted. Of the various parts, those used are the main brass holder and the two insulating washers. The rest can be discarded. Next, take the parallel socket, fix in a vice, and cut off a portion of the threaded end with a hacksaw, leaving the socket about ⅜in. long. Then solder it to the centre of the brass holder, as shown in sketch. If preferred the socket can, of course, be soldered on without shortening, though the shorter length looks neater. Now fit the split pin, using the original washers to insulate same from the brass holder, and allowing the head of the pin to protrude slightly above the inside nut, and tighten up the bottom nut. Next take the gramophone record, warm until pliable, and cut off a piece about 1⅛in. long by ¾in., also cutting out the two nicks as shown to clear the socket, and mould round the brass holder. Screw in one of the standard types of fuse bulb, and the plug is then ready for use.



A handy two-way plug fuse.

A great advantage of this type of two-way fuse is that the lead from the set can be plugged in or withdrawn in the ordinary manner without disturbing the fuse bulb, which would, of course, be liable to fracture if left dangling at the end of a lead, and the insulation ensures that the device is perfectly safe in use. —R. L. GRAPER (St. Albans).

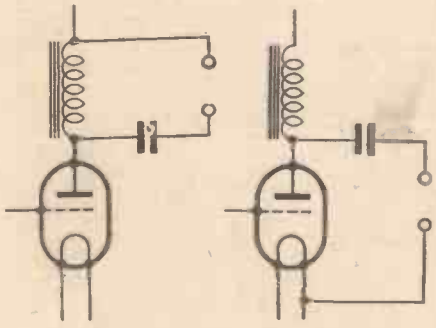
ALTERNATIVE CIRCUIT CONNECTIONS

Some Interesting Points Regarding Accuracy and Efficiency.

By G. H. WRAY, F.C.S.

THERE are many amateur constructed receivers in which certain circuits, while not actually wrongly connected, are only partially correct. These receivers often apparently function quite well, therefore indicating that the circuit connections are fundamentally correct, but improved reception results would be obtained by employing an alternative and sometimes more correct method of connection.

For instance, in the case of the speaker in a choke filter circuit, the correct method is shown in Fig. 1, and the incorrect method in Fig. 2. Although the latter method of connection safeguards the speaker by preventing any direct current from passing through the speaker winding, it allows the alternating current present in the anode circuit of the valve to pass back through the high-tension supply. In Fig. 1, the alternating current passes through the speaker winding to the filament negative of the valve.



Figs. 1 and 2.—Showing the correct and incorrect methods of connecting a speaker in a choke filter circuit.

The Reaction Circuit

There are two positions in the reaction circuit in which to connect the reaction condenser. If the coil has a split winding, the condenser should be connected on the negative low-tension side of the coil, as in Fig. 3. An advantage gained by this method is that the moving vanes of the condenser are at earth potential. This method of connection only applies in the case of split wound coils, otherwise the condenser must be connected on the anode side of the reaction coil.

In cases of low-frequency instability, it is often the practice to stabilize the set by connecting a grid leak in parallel with the secondary winding of the low-frequency transformer. An alternative and sometimes more effective method is to connect the grid leak between the transformer grid terminal and the grid socket of the low-frequency valve. This also prevents H.F. currents from passing into the L.F. circuit.

Some uncertainty is often met with as to the correct position to insert the milliammeter in the anode circuit of the output valve, in order to indicate overloading and consequent distortion. The correct position is at the low potential end of the choke. If it is required to measure the total current consumption of the receiver, then the milliammeter should be inserted between the H.T. negative and the L.T. negative terminals. If there is any tendency to low-frequency instability, due to the introduction of the resistance of the milliammeter, a 2 mfd. condenser should be shunted across the meter terminals.

The Output Stage

In connection with the subject of high-tension measurements one frequently finds constructors taking a good deal of trouble, in the case of mains-operated sets, to adjust the resistance of anode circuits in order not to exceed the maximum high-tension voltage recommended by the valve makers. In the case of pentode and screen-grid valves this trouble is unnecessary. It may be pointed out that the anode current in valves of this class is regulated by the grid voltage, and therefore any anode voltage reasonably in excess of the rated voltage will have no deleterious effect on the functioning or the life of the valve.

Another point, in the case of moving-coil speakers with low-resistance speech coils necessitating the use of a step-down transformer, arises when the receiver is situated at some distance from the speaker, or the set is in one room and the speaker in another. Under these conditions it is generally necessary to employ long leads to the speaker, the leads usually consisting of twin flex. This arrangement is a satisfactory one, provided that the step-down

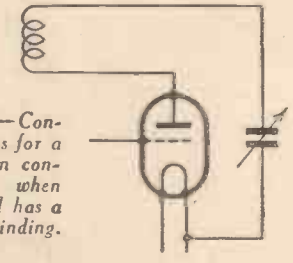
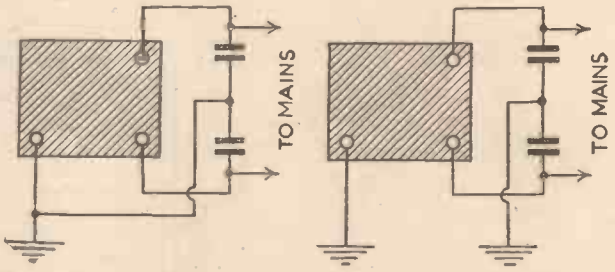


Fig. 3.—Connections for a reaction condenser when the coil has a split winding.

transformer is mounted in the set itself and not attached to the speaker chassis. In the latter case, the use of long speaker leads will probably cause a cutting of the higher musical notes, due to the capacity of the twin flex. This loss of high notes is caused by the capacity providing a second path of more or less low impedance, and is equivalent to placing a condenser in parallel with the primary winding of the transformer. The effect of this unwanted capacity is negligible provided that it is in parallel with the secondary circuit of the transformer, and it is therefore advisable to detach the transformer from the speaker chassis and mount it inside or close to the set.

Dial Lights

Dial illuminating lamps and pilot lights in mains-operated sets should be connected to the transformer heater winding which supplies the valves of the receiver. It is inadvisable, where valve rectification is employed, to operate these lights from the rectifier filament heater winding, as under certain conditions it is possible to accidentally earth the high-tension supply, with consequent damage to the rectifying equipment.



Figs. 4 and 5.—Circuit diagrams showing the connections for an anti-interference filter.

It is generally accepted that high-frequency screens should be earthed if they are to effectively serve a useful purpose. This does not apply in all cases, however, and effective screening is often obtained without earth connection to the screens. The advantage obtained lies in the fact that the damping effect of the screen is reduced if it is not connected to earth.

In fitting an anti-interference filter, consisting of two condensers with the centre-point earthed, to a mains-operated receiver, the filter is sometimes found to be ineffective when the centre point between the two series condensers is connected to the earth terminal of the set, as shown in Fig. 4. Improved results and a more silent background are often obtained by providing a separate earth connection for the filter, as shown in Fig. 5.

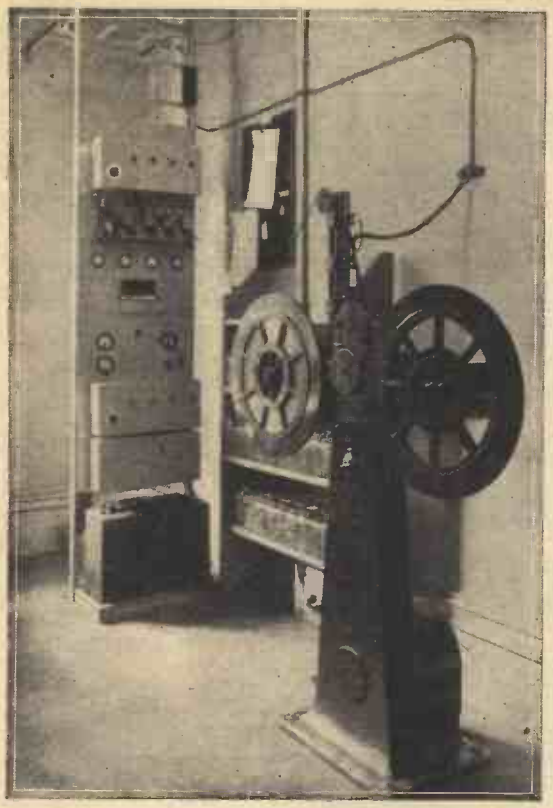


Fig. 1.—This photograph shows the Blattnerphone installed in the B.B.C's premises at Savoy Hill in 1931. The amplifier and control panel can be seen in the background.

HOW THE BLATTNERPHONE WORKS

A Description of a Method of Making Sound Recordings on Steel Tape

MANY readers have no doubt often wondered how the B.B.C. manage to reproduce a talk or other item during the evening programme which was actually given earlier in the day; or how it is possible to give a selection of important items in the past year's broadcasts made on New Year's Eve. Similarly, it has probably often puzzled listeners to know how "trailers" of forthcoming plays are given without having the caste in the studio. All these questions can be answered very simply and by means of one word—Blattnerphone. This is a marvellously efficient recording apparatus, which is in many ways far superior to ordinary wax recording such as is employed for gramophone reproduction, and it is so good that the British Broadcasting Corporation have found it worth while to install at least three expensive Blattnerphone outfits at Broadcasting House.

Advantages of the Blattnerphone System

The Blattnerphones are used extensively for making records of programme rehearsals so that the artists can hear their own performances within a few minutes of completion. This would be impossible if ordinary wax recording were used, since a considerably greater time is required in order to "bake" the original matrix, prepare the record from it, and so on. From this it might be imagined that, since the Blattnerphone is so good, it should replace the gramophone. But when it is explained that the simplest type of apparatus costs hundreds of pounds, whilst the "record" itself is valued at several pounds for a "playing time" of a few minutes, it will be realized that the Blattnerphone is by no means a rival to the gramophone. Those readers who have compared the reproduction given by the Blattner-Stille system (the name is after the inventors) with the original must have been struck by the amazing fidelity, and yet it can be stated definitely that the B.B.C. are still experimenting with a view to obtaining even better results. It is because of this that the photograph shown in Fig. 1 was taken in the old Savoy Hill Studio, before the B.B.C. moved into their Portland Place premises. I was recently advised by B.B.C. officials that they will not allow photographs to be made of the present apparatus owing to its experimental nature.

Lack of High-Frequency Response

As a matter of fact, however, the only real fault with the existing apparatus is that it will not give perfect response to the higher musical frequencies, although it is wellnigh perfect on speech. The Blattnerphone at present in use is so good that it can be used perfectly well, not only for "re-broadcasting," but also for the making of wax records from the sounds recorded by it.

Variable Magnetization

The principles underlying the functioning of the Blattnerphone are quite simple and easily understood, even though the practical details present no little difficulty. The operation of the apparatus depends upon the variable magnetization of a specially-prepared steel strip or tape as it passes between two magnets which carry windings into which sound frequencies are fed. This will be more easily understood by referring to Fig. 2 which is a diagrammatic representation of the "input" or "recording" section of the Blattnerphone. It can be seen that the ordinary broadcasting microphone is connected to an amplifier which feeds into the coils surrounding the recording magnets. It will be understood that the fluctuating signal currents constituting the output from the amplifier will vary the strength of magnetization of the magnets. Thus, as the steel tape passes between the poles of the magnets, its degree of magnetization is varied along the complete length of the tape. The effect can be compared with a similar system in which pencil lines on a strip of paper vary the light intensity of a beam directed on to a photo-electric cell. In the latter cases, however, it was shown that sounds were produced by varying the area of blackness on the "sound track" of a film or strip of paper, whilst in the present case, the sound is recorded by varying the intensity of magnetization. The effect is shown graphically in Fig. 3, where the magnetic strength of the tape is represented by a graph which corresponds to sound waves such as are produced when a person speaks.

The steel tape is run between the magnets at a definite speed in one direction, and then, after the required "record" has been made the tape is wound back (much more quickly this time) in readiness for reproduction. At this juncture it might be mentioned that in order to compensate for the deficiencies of the Blattnerphone at high audio frequencies the amplifier which feeds it is specially designed to give high-note emphasis. This largely compensates for the failings of the recording system, but it is impossible for it to do so completely at the present stage of

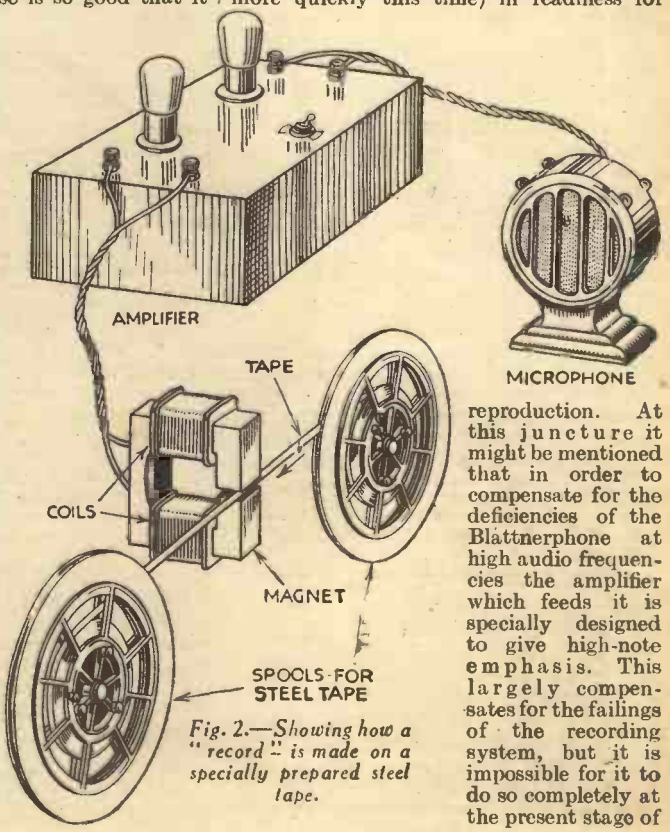


Fig. 2.—Showing how a "record" is made on a specially prepared steel tape.

developments, since if too much emphasis is given, a form of "hiss," which is similar in effect to the needle scratch experienced with wax records, becomes evident due to the "grain" in the steel. It should also be explained that the normal microphone, besides supplying the Blattnerphone, may also be connected to the standard amplifiers and broadcast transmitter in the usual way, so that any or every broadcast transmission can be "Blattnerphoned" for further use.

Reproducing The Steel "Record"

The method of "reproducing" the Blattnerphone record is just the opposite of the recording system, and consists of passing the tape, at the same speed as was used in recording, between the poles of a second magnet, which might be likened to the "works" of an ordinary gramophone pick-up. The magnet has a double coil which is connected, just like a pick-up, to the input terminals of a standard amplifier feeding into a loud-speaker (see Fig. 4). Variations in magnetization of the tape thus cause corresponding varying or fluctuating currents to flow through the windings. These currents are (almost) exactly the same as those passing through the first or recording magnet coils, and therefore the speaker reproduces the sounds as they were picked up by the microphone in the first place, so completing the cycle of operations.

Wiping-Out the Recording

It was mentioned above that the special Blattnerphone steel tape is very expensive. This is actually true in regard to its first cost only, since a single tape can be used time after time by "erasing" or wiping out one set of "magnetic impressions" and applying another recording. The method of "erasure" is simple enough in theory and consists of passing the tape between the poles of yet another magnet system. This time the magnets are very powerful and are energized by means of a uniform direct current, with a result that the tape becomes magnetically saturated so that all traces of the variable magnetism are entirely removed. Because of this it will be appreciated that the recording process consists of a partial de-magnetization of the tape, in addition to the variable magnetization produced by the audio-frequency currents fed to the magnets from the amplifier.

The complete Blattnerphone instrument consists of three distinct parts whose functions have been briefly described above; these are referred to as the "recording head," the "reproducing head," and the "wipe-out head," for reasons which will now be apparent.

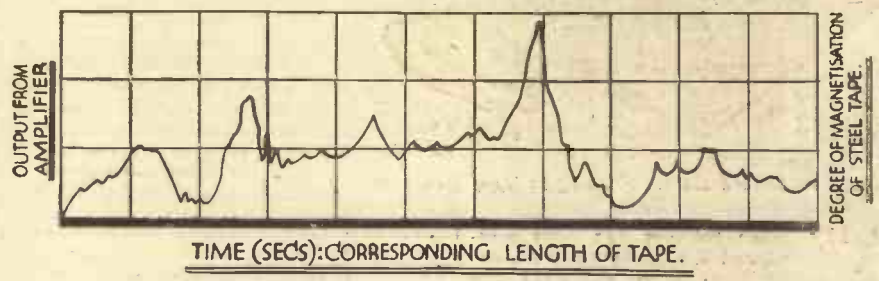


Fig. 3.—A graphical representation of the degree of magnetization of a length of the Blattnerphone tape by comparison with the output from the recording amplifier. The wavy line represents a sound wave.

Ensuring Good "Quality"

In using the Blattnerphone there are several important points to watch. One of these is that the output from the amplifier is not sufficiently great to "overload" the tape by allowing it to become magnetically saturated at certain points, and another is that high-note tone compensation should be provided in the amplifier. The first item is looked after by controlling the amplification produced by the amplifier, for which reason an H.F. voltmeter is included in the output circuit so that the control engineer can ascertain that the audio frequencies supplied to the recording head do not exceed a certain pre-determined figure.

In practice it is generally found better to design the reproducing amplifier so that it tends to emphasize the higher frequencies. Thus, double tone compensation is provided, first in the recorder and then in the reproducer. By this means there is less risk of distortion and of obtaining the undesirable "hiss" which was mentioned above.

The Blattnerphone is already one of the most important pieces of apparatus employed by the B.B.C., and it is safe to predict that, in view of the improvements which are still being made in this method of reproducing, it will eventually attain to perfection.

That the efficiency of the Blattnerphone as at present in use is extremely high can be judged by listening during the day to any important speeches which are made, and again listening when they are re-broadcast in the evening programme or at the end of the News Bulletin. In numerous instances it will be found that the steel tape recording bears so close a resemblance to the original that absolutely no difference can be detected, and only in very rare instances will the least trace of distortion be noticed.

Recording Long-Distance Broadcast

In addition to its use as a means of quickly making excellent records of "original" sounds, the Blattnerphone has proved to be extremely useful for recording items actually broadcast from a distant station or transmitted over a land line. A recent example of such a use being made of the Blattnerphone was the broadcasting on the evening of Easter Monday by the B.B.C. of a portion of the ceremony of the closing of the Holy Door by the Pope in Rome at noon on the same day. Other examples may be quoted by the score, whilst mention might also be made of the re-broadcasting on numerous occasions of "eye-witness" accounts of important events during the evening programmes.

Tone Correction

It will be appreciated that in many instances it is necessary to employ special tone-correcting devices in conjunction with the Blattnerphone amplifier equipment to compensate for deficiencies of the microphone, land-line, wireless transmission, etc., as the case may be. This presents very little difficulty at the present time, however, when it is common practice to include correction or tone-control devices in the circuits of most types of "quality" amplifiers.

The steel-tape recording instrument is probably of greater value to the B.B.C. than any other device installed at Broadcasting House, and it is being used more and more extensively as its efficiency is being increased. One of its great features is that records can be kept of any or every programme at a modest cost, after which those items which are not required again can be erased. Those which are wanted again can be retained as long as necessary, or they can be "transferred" from the tape to an ordinary wax record in a minimum of time. All that is necessary is to connect the reproducing head directly, or through a suitable amplifier, to the recording stylus which makes the grooves on the original record or matrix.

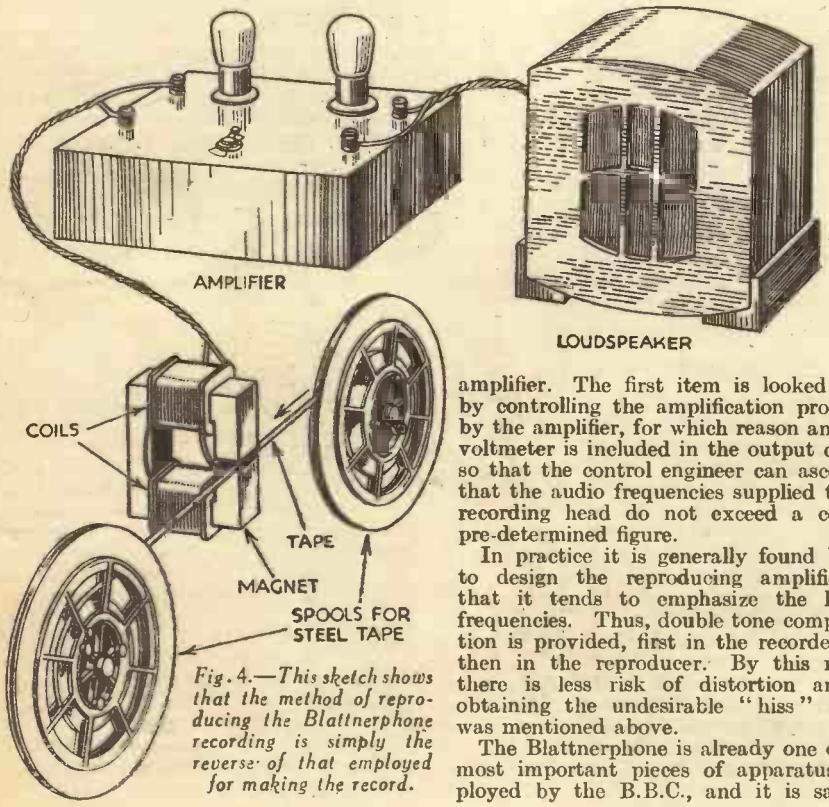
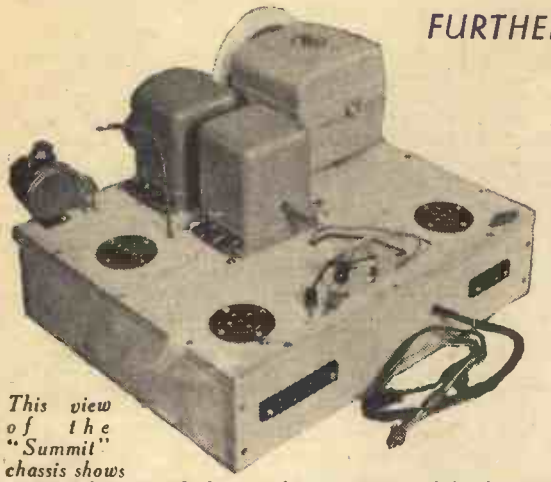


Fig. 4.—This sketch shows that the method of reproducing the Blattnerphone recording is simply the reverse of that employed for making the record.



This view of the "Summit" chassis shows the neat layout and absence of wiring on top of the chassis.

FURTHER NOTES ON, AND OPERATING INSTRUCTIONS FOR,

THE "SUMMIT"

This Week Instructions are Given for Using the "Summit" with a Gramophone Pick-up, and for Operating It from a Mains Unit

AFTER the receiver has been completed and the preliminary adjustments have been made in the manner described last week, the chassis can be fitted into the cabinet. This will present no difficulty if the dimensioned front view given in the first constructional article is followed. The positions of the various holes should, of course, be marked on the inside of the cabinet, after which small pilot holes can be made by means of a small bradawl or 1/16in. drill. It will then only be necessary to bore the holes through from the front. Six holes are required in all, of which those for the reaction condenser, on-off switch, potentiometer and wave-change switch should be ⅜in. diameter, that for the spindle of the tuning condenser being ¼in. diameter, and that for the condenser escutcheon being 1½in. diameter.

The next step is to mount the speaker unit, screwing it both to the front and the base of the cabinet with ½-in. screws; in fitting the screws to the front, however, care must be taken to ensure that they do not go right through the wood. If there is any doubt concerning the latter point it will be advisable to slip a washer under the head of each screw.

Matching the Speaker

Before finally covering in the cabinet by fitting the back, the speaker should be adjusted to match the output valve. The adjustment is made by rotating the small arm fitted to the rear of the instrument. It is not necessary to calculate the correct ratio of transformer, since it is an easy matter to alter the setting until the tone of reproduction is most pleasing to the ear. It should be mentioned in passing that the small knob in the centre of the rotating arm is for the purpose of switching the speaker out of circuit, and is only required when it is desired to bring an external loud-speaker into use.

Pick-up Connections

It will have been noticed, by studying the circuit diagram and wiring plans, that no provision has been made for the connection of a gramophone pick-up. This is because it has been found that most constructors do not wish to use a pick-up, but there is no difficulty whatever in connecting one when it is desired. The simplest method of connecting a pick-up is to join one lead to the grid terminal of the detector valve-holder and the other to a wander plug which is inserted into the 1½-volt socket on the grid-bias battery. If it is proposed to use a pick-up fairly frequently it will be found most convenient to fit two terminals, or a third terminal socket strip to the chassis. One of the terminals can then be connected directly to the valve-holder, the other being provided with a short length of flex passing through a hole in the top of the chassis and going to the grid-bias battery.

List of Components

Two dual-range coils, types A.D. and T.G. (Wearite).
One two-ganged condenser (J.B. "Unitune").
One .0003 mfd. differential reaction condenser (Graham Farish).
One 50,000-ohm potentiometer (Ferranti).
Five resistances: 10,000 ohms, 30,000 ohms, 40,000 ohms, 50,000 ohms, 1 megohm (Dubilier, 1 watt).
Three .1 mfd. fixed tubular condensers (Graham Farish).
Two .0002 mfd. tubular condensers) T.M.C.).
One 1 mfd. fixed condenser (T.M.C.).
One 3pt. on-off switch (Snap Switches).
One 5-1 Niclet L.F. transformer (Varley).
Three valve-holders: Two 4-pin and one 5-pin (Clix).
One "L.M.S." screened H.F. choke (Graham Farish).
One "Snap" H.F. choke (Graham Farish).
One 100 m.a. fuse and holder (Bulgin type F.5.).
Three wander plugs, GB-1, GB-2, GB+ (Belling Lee).
Two component brackets (B.R.G.).
One "Summit" cabinet (Peto-Scott).
One Metaplex chassis, 12in. x 10in. x 3in. (Peto-Scott).
One four-way battery cord (Belling Lee).
Two terminal socket strips: One A and E and one L.S. (Belling Lee).
One G.B. battery clip (Bulgin No. 1).
One coil connecting wire; screws, etc. (B.R.G.).
One "Stentorian" Standard M.C. speaker unit (W.B.).
One 120-volt H.T. battery.
One 9-volt G.B. battery.
Three valves: One V.P.210; one H.L.210, and one H.P.T.220 (Cossor).

Fitting a Radiogram Switch

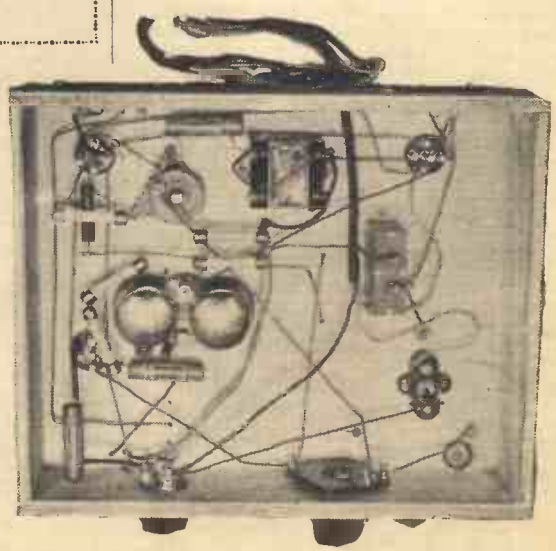
A still better method is to fit a single-pole change-over switch, for then it will not be necessary to disconnect the pick-up from the set when radio reception is required. The switch may be of any convenient type and it will have three terminals. Of these, the centre one should be joined to the grid terminal on the detector valve-holder, the other two being connected to one pick-up terminal and to the detector grid condenser respectively. When that is done the lead from the grid condenser to the grid must be removed.

Using an Eliminator

Those readers who wish to operate the "Summit" from the mains can do so without making any alteration whatever, since the set is perfectly suitable for direct connection to almost any type of eliminator, either A.C. or D.C. If a new mains unit is to be made or bought it should have an output of approximately 120 volts at 20 milliamps, for although so much current is not required it is always better to have a little "reserve" than to work at the extreme limit. There being only two high-tension leads, there cannot be any confusion regarding their method of connection, and if the unit is fitted with a third (screening grid) terminal, this can simply be ignored so far as this receiver is concerned. On the other hand, there is no objection whatever to slightly modifying the receiver to make use of the screening-grid H.T. feed. The modification involves only the removal of the two fixed resistances, which together form a fixed screening-grid potentiometer, and the connection of the screening-grid terminals on the first valve-holder to the eliminator terminal provided.

Results to Expect

No particular mention has yet been made of the capabilities of the "Summit," but it can be said without hesitation that it will give excellent reception from a number of British and Continental stations. After dark it is by no means difficult to bring in twenty odd stations at real programme strength, whilst very many others can be received at lower volume levels. In daylight one can be certain of tuning in four or five stations at good strength in any part of the British Isles, provided that the aerial is reasonably good.



A below-chassis view of the receiver, showing the simple and well-spaced wiring.

REFLEX CIRCUITS FOR THE EXPERIMENTER

It is Some Years Since Reflex Circuits were Widely Used, but the Writer Shows that they are Still of Interest to the Experimenter and, After Explaining the Principles, Describes a Reflex Circuit of Modern Design. By FRANK PRESTON.

REFLEX circuits are rarely used at the present time, although they were extremely popular between 1922 and 1924. Despite this, however, there are doubtless many readers whose interest in wireless does not date back for so long a period as ten years, and who would like to experiment with some of the arrangements which were in favour in the earlier days of wireless. It is no exaggeration to say that reflex circuits, if carefully designed, can even now be used with commendable success, and that they are worthy of consideration quite apart from their rather historic associations.

One Valve As Two

Before going on to describe one or two reflex arrangements, it might be as well, for the benefit of newer experimenters and constructors, to explain exactly what a so-called reflex circuit is. The name is fairly explanatory, for it is defined in the dictionary as "bent or turned back; directed backwards." Thus, a reflex circuit is one in which the signal voltages are "turned back." In other words, after the signals have been rectified by their passage through the detector, they are passed back to the high-frequency amplifying valve, in which they are then amplified at low frequency. It will be understood from this somewhat bald statement that one valve is made to function as both a high-frequency low-frequency amplifier. Theoretically, then, it is possible to obtain the same output from two valves wired in a reflex arrangement as from three valves connected in a more conventional circuit. In practice such a wonderful result is not quite achieved, although an appreciable amount of extra amplification can be secured, particularly in a receiver of the simpler type.

The Detector

At this point it is worthy of note that the first reflex circuits to be used actually employed a crystal detector, with the result that "three-valve" reception was to be obtained by using only one valve. This was an advantage not to be overlooked in the days when valves, and all other components, were very expensive and when the average valve filament (there were only battery-operated valves then, of course) consumed something like 4 watts, as compared with the .2 watt required by modern 210-type valves. To-day the particular advantages mentioned do not weigh so heavily, although the saving of one valve is worth considering. For purposes of comparison an early type of reflex circuit of the kind just referred to is given in Fig. 1, where the simplicity of the arrangement is clearly to be seen. If the course of the signal voltages is followed it will be seen to go from the aerial-tuning circuit to the grid of the valve, from there to the (tuned-) anode circuit, to the crystal detector, back to the grid-filament circuit of the valve by way of an L.F. transformer and, finally, to the phones or speaker joined between the tuned-anode circuit and H.T. positive.

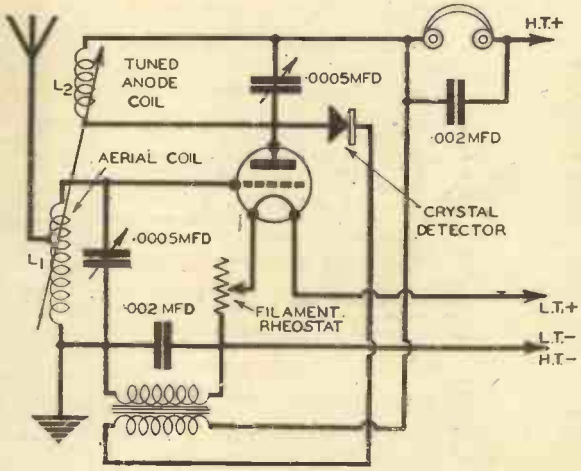


Fig. 1.—An early type of reflex circuit in which a crystal detector was employed.

The arrangement is simple enough and the principle perfectly obvious. As to the practical details, it should be observed that the secondary winding of the L.F. transformer is at the earth end of the aerial circuit, and also that it is by-passed by means of a .002-mfd. fixed condenser. Due to the method of connecting the low-tension battery and filament rheostat (this component was always used with the earlier types of bright-emitter valve) a small value of grid bias is applied to the valve.

Quality of Reproduction

The principal fault with the reflex circuit was that reproduction was not so good as with the "straight" arrangement, because the same valve could not function efficiently at both high- and low-frequencies. In spite of this difficulty, however, really good results were frequently obtained, and the actual arrangement shown can be tried out with modern components. One point to observe is that reaction is provided by coupling together the tuned-anode and aerial coils; this means that one coil must be movable in respect of the other. For this reason the circuit is most easily tried out by making use of plug-in coils fitted in a two-coil holder. Appropriate sizes for medium and long waves are 35 and 150 for L.1, and 75 and 250 for L.2, respectively.

A More Modern Circuit

It is not anticipated that there will be very many readers who will wish to go to the trouble of rigging up the circuit shown in Fig. 1, since better results can be obtained with a more up-to-date arrangement using modern components and a valve (instead of the crystal) as rectifier, with reaction. A suitable circuit for such an arrangement is shown in Fig. 2, where the first valve is a variable-mu H.F. pentode, and the second a normal type of three-electrode

(*Continued on page 741*)

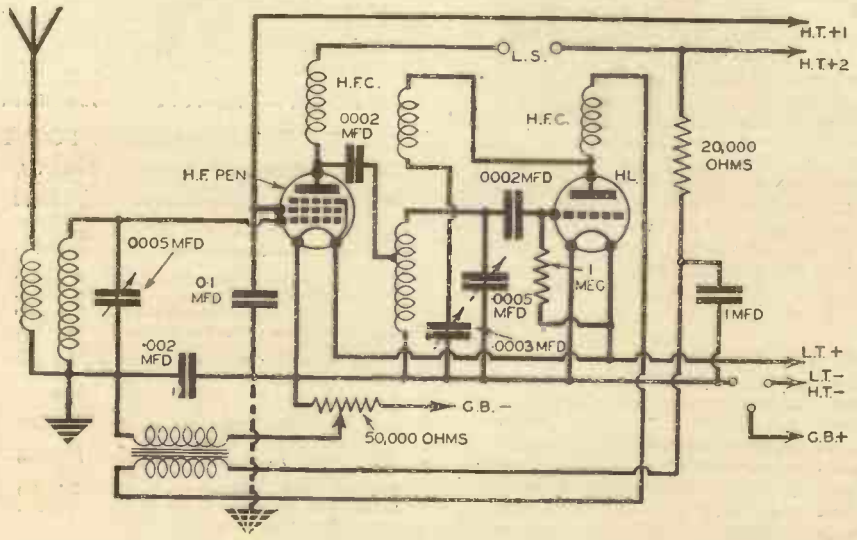
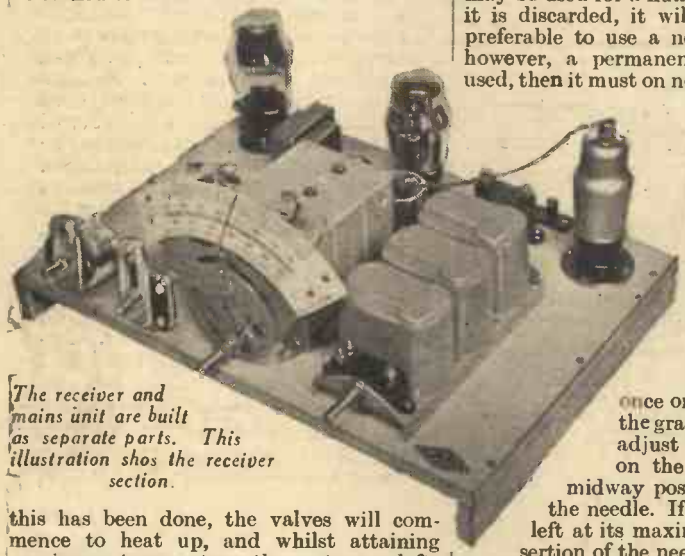


Fig. 2.—The above circuit is a suggestion for a reflex circuit employing modern components. Broken lines show an alternative earth connection, which may be tried.

THE "ARMADA" MAINS THREE

How to Obtain the Best on Radio and Gramophone Records with this Novel Radiogram

IF the receiver has been constructed exactly in accordance with the details which have already been given, it should not be found difficult to tune in any desired station or to play a record. However, for the benefit of those who are making their acquaintance with home-constructed apparatus for the first time, it would perhaps be as well to give the various points careful explanation so that no trouble can arise, and in order that the best may be obtained from the apparatus. Firstly, when tuning in to a broadcast station, the right-hand control knob should be turned to the desired waveband. When this has been done, the valves will commence to heat up, and whilst attaining maximum temperature the extreme left-hand knob should be set to a position about half-way between maximum and minimum, the knob next to it should be turned as far as it will go in an anti-clockwise direction, and the tuning control should be adjusted so that the pointer is set to the required wavelength. After a few seconds the valves will commence to function and the signal should be heard. The extreme left-hand control—the volume control—should then be used in order to obtain the required degree of volume. If, even when this is at its maximum setting, volume is not sufficient, then the knob next to it—the reaction control—should be employed to build up the signal, but when this is adjusted it will be found advisable to employ both hands, one hand being used for the reaction control and one for the tuning control, and as the reaction knob is turned slowly the tuning control should at the same time be given a slight adjustment. The reason for this is to be found in the fact that the application of reaction will slightly affect the detector grid coil, and to maintain the circuits in tune a slight readjustment of the tuning condenser becomes necessary. Although only a slight movement is called for, it will be found necessary, if the maximum volume is required, to employ this "two-handed" control. It should, of course, be remembered that the use of reaction results in the cutting of the higher frequencies, and therefore quality must suffer. Where a station is so weak that it becomes necessary to employ so much reaction that distortion becomes evident, it is obvious that it is undesirable to listen to that station, and therefore the range of reception should be limited to that which may be comfortably covered by the receiver.



The receiver and mains unit are built as separate parts. This illustration shos the receiver section.

Gramophone Records

For best results on gramophone records the choice of the needle is a vital point. There are many different types of needle on the market, and although many may prefer to employ what is known as a "permanent" needle—that is, one which may be used for a number of records before it is discarded, it will generally be found preferable to use a needle once only. If, however, a permanent type of needle is used, then it must on no account be removed from the pick-up until it is ready to be discarded, or the records will be damaged. The Talkie needle will be found as good as any, both from the point of view of volume and tone, and this type of needle has a fine point which will not damage the record provided it is used once only. Set the switch to the gramophone position and adjust the volume control on the pick-up carrier to a midway position before inserting the needle. If the volume control is left at its maximum position, the insertion of the needle will produce very distressing noises from the loud-speaker, and the placing of the needle on the record will also prove objectionable. When the needle is in position the pick-up arm should be swung outwards, when the turntable will commence to rotate. Place the needle carefully on the edge of the record and gently push it inwards until it commences to run in the spiral groove. Then turn up the volume control until the surface noise becomes apparent from the speaker. As soon as the music commences a final adjustment of volume may be made and the lid closed down to remove the extraneous noise of pick-up scratch, etc. When the needle comes to the end of the record the turntable will automatically be stopped and the record cannot be damaged.

The finished radiogram.

Adjusting the Speaker

At the bottom of the loud-speaker chassis will be found a knob with a circular scale, and each constructor should adjust this knob to produce the balance of tone which appeals to his individual ear. There is obviously an optimum position dependent upon the impedance of the output valve, but with many listeners it may be found that a deeper or a more brilliant tone is desirable, and the matching control may thus be utilized in order to produce this degree of control, although for maximum volume and best results the correct setting should be used.

LIST OF COMPONENTS FOR THE "ARMADA" MAINS THREE.

One set Ferrocart coils, types G1, G2 and G3, with mains on/off switch (Colvern).
One three-gang Midget condenser (C1, C2 and C3) Polar.
One Arcuate slow-motion drive (Polar).
One .00015 mfd. differential condenser (C7) (Polar).
One 30,000-ohm 1 watt resistance (R9) (Ferranti)
One 20,000-ohm 1 watt resistance (R2) (Ferranti)
One 15,000-ohm 1 watt resistance (R1) (Ferranti)
Two 5,000-ohm 1 watt resistances (R10 and R5) (Ferranti).
Three 500-ohm 1 watt resistances (R7, R8 and R11) (Ferranti).
One 300-ohm 1 watt resistance (R4) (Ferranti).
One 1 megohm grid leak (R6) (Ferranti).
One .0005 mfd. tubular condenser (C17) (T.M.C.).
One .0002 mfd. tubular condenser (C10) (T.M.C.).
One .0001 mfd. tubular condenser (C8)(T.M.C.)
One .1 mfd. type 250 condenser (C4) (T.C.C.).
One .5 mfd. type 80 do. (C11) (T.C.C.).
Two 1 mfd. type 80 do. (C5 and C6) (T.C.C.).
One 2 mfd. type 80 do. (C12) (T.C.C.).
One 50 mfd. electrolytic type 501 (C9) (T.C.C.).
One 50 mfd. electrolytic type 521 (C13) (T.C.C.).
Three 4 mfd. type 80 (C14, C15 and C16) (T.C.C.).
Two 5-pin valveholders (Clix).
One 7-pin valveholder (Clix).
One screened H.F. choke (binocular) (Telsen).
One screened H.F. choke (standard) (Telsen).
One mains choke (Telsen).
One 5/1 pip transformer (Graham Farish).
One type W.31 mains transformer (Heayberd).
One type H.T.8 metal rectifier (Westinghouse).
One "Multimu" speaker (R. and A.).
One tablegram cabinet (Peto-Scott).
One Blue Spot pick-up and volume control (Blue Spot).
One 5,000-ohm volume control (C.P.157) (Varley).
One "Truspeed" electric gramophone motor (B.T.H.).
One A.C./V.P., one A.C./H.L., andone A.C./Y valve (Hivac).
Aerial and earth terminal strip (Belling Lee).
Two component brackets (B.R.G.).
One Bulgin fuse plug (with fuses).
One Metaplex chassis to fit tablegram cabinet.
Wire, flex, screws, etc.

HOUSING A NEW CHASSIS

How a New Radio Receiver can be Adapted to an Old Cabinet

A PROBLEM which may confront the reader, at one time or another, is that of adapting a radio chassis to a cabinet for which it was not intended. Sometimes the opportunity comes to buy a new and handsome cabinet with the object of installing in it an existing chassis. On the other hand, it may be desired to replace an old-fashioned receiver with a more up-to-date chassis, at the same time retaining the original cabinet. All sorts of troubles may be found in this proposed change over.

Using an Overlay

One of the greatest difficulties is to conceal the present holes in the cabinet through which the various control spindles of the original chassis passed. An attempt may be made to cover existing holes with a thin wood overlay, and in many cases this will form a practical solution to the difficulty if the overlay matches the cabinet work in appearance and polish. As a rule the smaller the overlay the less noticeable it will be. The illustration, Fig. 1, gives an example of a successful overlay where it actually improves the appearance of the cabinet, the original cabinet holes being shown in dotted lines. The edges of the overlay should be beaded or chamfered, and painted black. One of the more serious problems is the fitting of a different form of wavelength scale from that originally used,

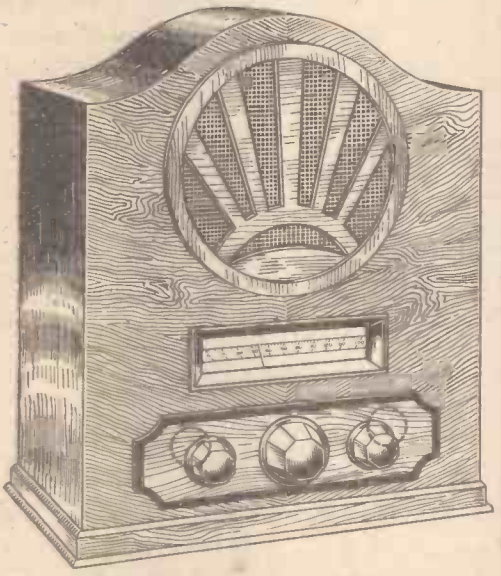


Fig. 1.—The oblong overlay is useful in concealing spindle holes not suited to the chassis.

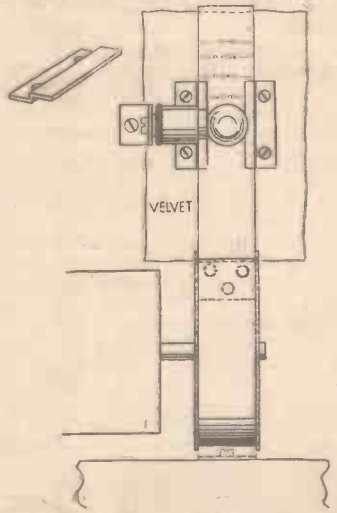


Fig. 3.—Rear view of the simple wavelength, or tuning scale.

and in this direction there is ample scope for ingenuity. If the original escutcheon hole in the cabinet comes higher than is required, one way is to enlarge the hole in a downwards direction, and to get one of the modern clock-faced dials. A drive of this type can be operated very well by means of pulleys and string, which enables the control spindle to be placed in any convenient position through one of the old cabinet holes.

Another good scheme is to fit a full vision disc drive, of which there are many patterns on the market. As this cuts away a large part of the cabinet, it will probably be the means of getting rid of one or more undesired holes.

A ruse which the writer has employed with good effect is shown in Fig. 2. and 3. The new chassis had an ivorine wavelength scale fixed by screws to a circular drum, and as the escutcheon hole of the new cabinet came much higher, a piece of plain celluloid was attached to the drum at one end only. The free end was joined to the bottom end of the wavelength scale, the latter being held against the back of the cabinet with light aluminium runners. As the drum is rotated it takes the new celluloid strip with it, and thus pushes the wavelength scale up or down in the plane parallel to the front of the cabinet. The pilot lamp can be fixed to a bracket screwed inside the cabinet. The velvet is used to prevent the scale from becoming scratched.

If the old cabinet has a hole in either side for a control, this position can often be used for an on/off switch or for a tone or volume control. This will mean removing the control from its present position and joining longer leads. In certain cases it will be necessary to shield these leads with metallic braiding earthed to some point on the chassis.

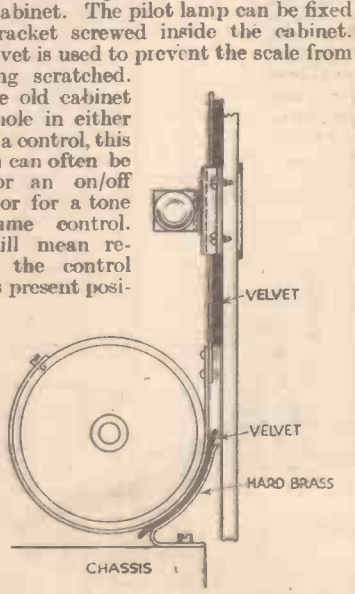


Fig. 2.—A side view of the wavelength scale.

Curing Microphonic Troubles

A more powerful chassis or a different type of cabinet may give rise to a microphonic howl. The trouble is caused by the vibrations from the loud-speaker being transmitted to the chassis, thus causing the tuning condenser, a valve, or some other part to vibrate until the howl is continuous. One remedy is to set the loud-speaker a little way back from the front of the cabinet. If this is done, care must be taken to see that the quality of reception does not suffer. The tendency is to lose bass notes. Another plan is to mount the entire chassis on a sheet of sorbo rubber.

A word of warning is necessary if the chassis is one of the new A.C./D.C. type. Manufacturers are now connecting one side of the mains direct to the chassis. If the positive side of the mains is earthed, which frequently happens, the entire metal chassis will be alive, at mains voltage, to any local earth. Under these conditions it is wise to protect the chassis and all control spindles so that they may not be touched by hand.

Round the World of Wireless.

(Continued from page 712.)

Organ Recital from West Regional

ARTHUR J. BAKER will give an organ recital for West Regional listeners from the Central Hall, Bristol, on September 7th. The most important item in the programme is the fugue by Liszt, which has been arranged for the organ by H. A. Fricker.

Droitwich Spa Orchestra

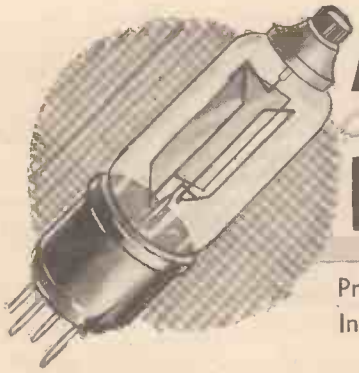
VICTOR HELY-HUTCHINSON has chosen an interesting programme for Midland Regional listeners for the seventh and last of the Sunday evening concerts to be given by the Droitwich Spa Orchestra, and relayed from the Winter Gardens on September 2nd. The overture to "The Magic Flute," the tone-poem "In the Steppes of Central Asia" (Borodin), Grieg's Holberg suite and Chabrier's Spanish Rhapsody are the principal orchestral works. Muriel Sotham (contralto) sings two Wagner songs with the orchestra.

Choral Concert from Caernarvon

THE Nantlle Vale Orpheus Male Voice Choir, conducted by C. H. Leonard, will give a concert for West Regional listeners from the Plaza Cinema, Penygroes, Caernarvon, on September 2nd. The members of this choir are mainly quarrymen engaged in the slate quarries of the Nantlle Valley, to which Snowdon serves as a majestic background.

"America Calling"

THIS popular item of entertainment runs into a third edition on the National wavelength on September 13th and on the Regional wavelength on September 14th. Eddie Pola will again present the programme. Jack Hylton, who took part in the two previous editions and thoroughly enjoyed the experience, has accepted the B.B.C.'s invitation to him to assist, with his band, in the third edition.



Interesting Experiments with PHOTO-ELECTRIC CELLS

Practical Information Regarding the Use of Photo-electric Cells for a Variety of Interesting Purposes is Given in This Article, along with Details for Making a Suitable Amplifier and Relay.

PHOTO-ELECTRIC cells, although they have not been made for any great length of time, have found innumerable applications in commerce, and they lend themselves very well to experimental use by the amateur. It need scarcely be explained that photo-electric cells are devices by means of which electrical apparatus can be switched on merely by varying the intensity of light falling on them. Not only are the cells sensitive to ordinary "white" light, however, but they are made in types which may be actuated by lights of different colours, and even by ultra-violet and infra-red rays, which are not visible to the human eye. Because of this they can be employed to produce many amazing and seemingly wonderful results. For example, by fitting a photo-cell to the door of a safe connections could be made whereby a bell would ring, a door close, or the shutter of a camera open immediately a light were shone on the safe door. By making different connections a photo-cell could be used to count the number of articles passing along an endless belt in a factory where mass production methods were employed. Then again, arrangements could easily be made whereby electric lights were switched on as soon as the daylight fell below a predetermined intensity. There are many other interesting applications of which every reader is doubtless aware, and attention need only be called to those shop window demonstrations where passers-by pass a hand over a certain lighted portion of the window to set a model locomotive into motion or cause portions of the window display to be illuminated. The methods of accomplishing all these amazing results will be fully discussed later, but for the time being it will be more interesting to consider the function of photo-electric cells in general and the system of connecting them to their associated apparatus.

How the Photo-cell Functions

Essentially, a photo-cell consists of an anode and a cathode, which are placed inside a glass envelope generally fitted with a four-pin cap like that of a wireless valve. (This is shown in Fig. 1.) The cathode consists of an extremely thin film (thought to be of only atomic thickness) of caesium, potassium, or other element deposited on a suitably prepared silver conductor, whilst the anode takes the form of an open metal network. When light falls on the cathode it emits electrons in the same way as does the filament or cathode of a wireless valve, even though there is no polarizing voltage applied to it. The electron emission is of very low intensity and reaches only a few micro-amperes, so that in order to make use of it some form of amplifying device is called for. It is now accepted that the most efficient amplifier of electric currents is the wireless valve, and therefore this is generally used for the purpose, although there are available certain forms of gas-filled relays

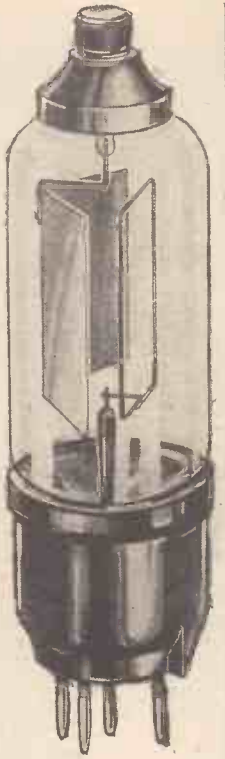


Fig. 1.— The above sketch shows the electrodes in a typical photo-electric cell.

An Amplifier Circuit

A simple photo-cell amplifier circuit is given in Fig. 2, where an ordinary 2-volt power valve is used in conjunction with its associated batteries and a relay. The voltage of the grid-bias battery is at least twice as high as that normally required by the valve when used in a wireless set, and is such that if it were applied to the grid of the valve there would be no flow of anode current. But, it will be seen, the photo-cell is inserted between the negative side of the G.B. battery and the grid. Because of this the G.B. potential will not be applied to the grid unless the cell is conductive; in other words, unless light is focused on to it. When the cell is in darkness the grid will be slightly positive, due to the fact that it is connected to the positive side of the L.T. battery through a 10 megohm grid leak, and consequently there will be a flow of current through the anode circuit. On the other hand, when the cell (or, more correctly, the cathode of the cell) is illuminated, the full G.B. potential will be applied and this will prevent the flow of anode current.

A relay is connected in the anode circuit of the valve, so that any current flowing must pass through it. Now when current flows through the windings of the relay an iron core is magnetized, and this attracts an armature (C in Fig. 2) which then makes contact with the point marked S2. It will now be clearly understood that if points C and S2 were inserted in an electric circuit, current would flow through that circuit when the cell was in darkness, but the current would cease immediately any illumination were applied to the cell. Alternatively, if the points marked C and S1 were used instead, current would only flow when the cell was illuminated. The brief explanation just given will suffice for the reader who wishes to investigate the interesting possibilities of photo-electric cells, and we can now turn our attention to more practical considerations. The connections given in Fig. 2 require little explanation, and the few com-

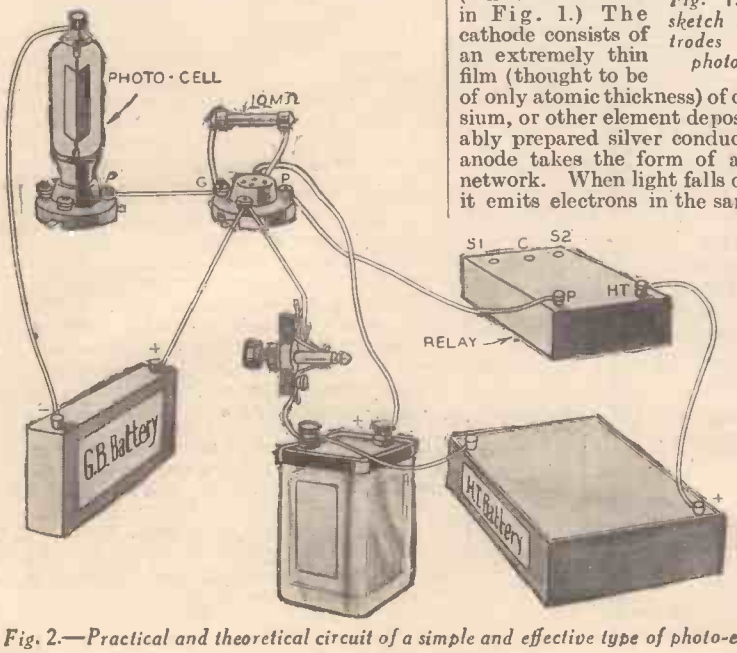


Fig. 2.—Practical and theoretical circuit of a simple and effective type of photo-electric cell amplifier for battery operation.

ponents shown can soon be mounted up on a suitable baseboard. Perhaps it should be explained that the anode of the photo-cell is joined to the "plate" pin on the valve base, but the cathode is connected to the terminal situated on top of the glass envelope; that explains why only one connection is made to the photo-cell valve-holder. The valve may be of any small power type, such as the Hivac type P220, Cossor 220P, Mullard P.M.2A, or any similar type in other makes.

Making the Relay

The relay is the next item calling for an explanation, and this is shown in the pictorial wiring diagram simply as a rectangular box, although its essential parts are shown in the theoretical circuit. A suitable component can be bought readily enough from one or two manufacturers, and some of those sold by ex-W.D. firms can be used with fair success. The truly practical man will prefer to make his own, and full constructional details are given in Figs. 3 and 4. It will be seen from these drawings that an electro-magnet is made up by fitting a cardboard or paxolin bobbin on to a bundle of soft iron wires which form a core. The bobbin is wound by putting on 10,000 turns of 38-gauge enamelled wire, and can then be attached to a base-board by means of a strap made from a strip of brass, fibre, or other non-magnetic material. A contact arm—which is combined with the armature—is next required, and this is made from a strip of sheet brass. The brass must be springy, and if it is not it should be heated to redness and then hammered on a hard surface whilst cooling. The armature consists of a small piece of soft iron, and it is riveted on to the contact arm. Two contact points are shown and their main features are illustrated, but very few readers will care to go to the trouble of making them when it is explained that they can be obtained from old electric bells or shocking coils. It is preferable that the points of the contact screws and also corresponding spots on the contact arm should be made of platinum or silver, to prevent burning due to the small sparks which will inevitably be produced, but this is not by any means essential provided that the relay is not to be kept in constant use.

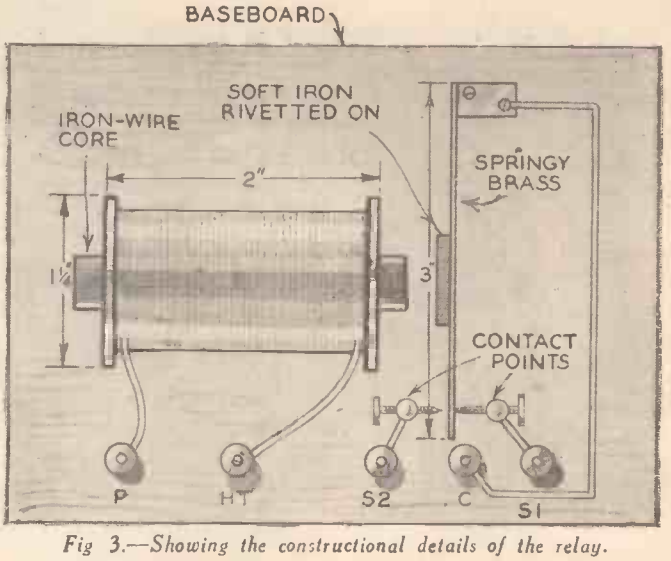


Fig 3.—Showing the constructional details of the relay.

In mounting the contact arm and screw points, the former should be so placed that the armature is as near as possible to the core of the magnet without actually touching. S1 should be adjusted so that it makes good contact with the arm, and S2 should be set to the position at which the arm touches it just before the armature touches the end of the magnet. It will be understood from the foregoing instructions that a fair amount of care must be expended in assembling and adjusting the relay if efficient working is to be obtained.

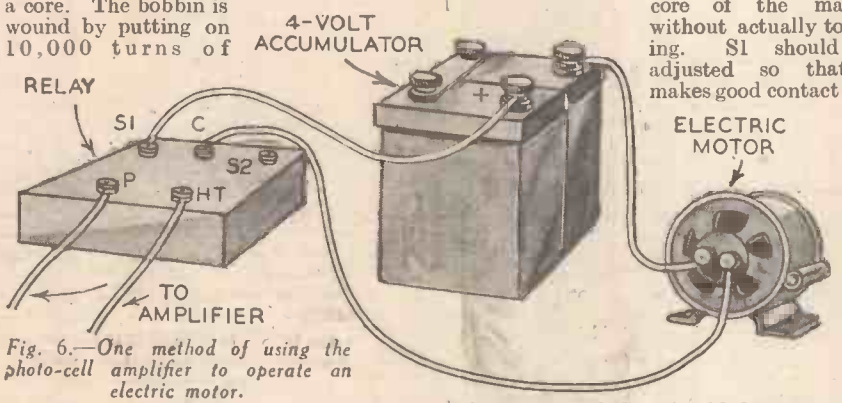


Fig. 6.—One method of using the photo-cell amplifier to operate an electric motor.

Shielding the Cell from Indirect Light

The photo-electric cell must next be considered, since it is practically essential that it should be shielded from all light except the narrow beam which will be directed on to its cathode through the "window" provided in its glass bulb. This can best be provided for by making a tube about 2in. diameter to fit round it, as shown in Fig. 5. The rectangular "window" should be at the same height as that in the cell, and it is also a good plan to arrange for the tube to be rotated so that the amount of light passing to the cathode can easily be varied to suit all conditions of illumination.

Figs. 6, 7, and 8 show alternative schemes which may easily be tried out with the aid of a 4-volt electric bell, flash-lamp bulb, electric motor and a 4-volt accumulator. These are only offered as suggestions, and it will readily be understood that they may be modified and re-arranged in a multitude of combinations. It might be mentioned at this point that when using up to 6 volts or so in the relay circuit it is not quite so essential that platinum contacts should be used, but if the mains are being used for supply purposes it would be unwise to attempt to use a relay not fitted with contacts of that kind.

Mains Working.

When the experimenter is limited to batteries as a source of power supply for both the amplifier and the external circuits, there are not quite so many spectacular experiments that can be tackled, but where the mains are available the scope is truly unlimited. The circuit arrangement for a mains-driven amplifier is given in Fig. 9; this is of the very simplest, though by no means least effective, and can be

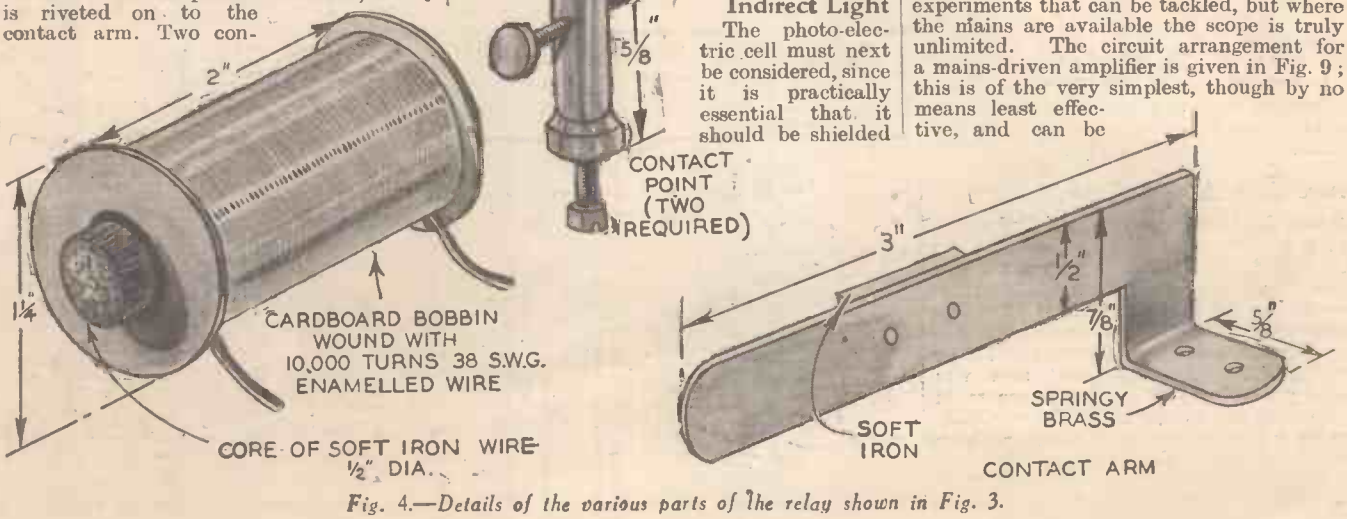


Fig. 4.—Details of the various parts of the relay shown in Fig. 3.

used for nearly every purpose to which a photo-cell lends itself. The valve is an ordinary 2-volt battery one like that specified for the battery amplifier, and the mains voltage is broken down to the correct figure for feeding its filament by means of two series resistances; that marked A provides the necessary "automatic" grid-bias, and that marked B provides the voltage drop which is applied to the anode. A 20-ohm variable resistance is also included in circuit to compensate for slight mains-voltage fluctuations, and this should be adjusted until the voltage across the valve filament is just 2. The resistances must be large ones because they have to handle a fair amount of power, consequently the figures given for the wattage rating should be adhered to. In principle there is no difference whatever between the mains and battery-operated amplifiers, and the connections to the relay are identical in both cases. In describing the second amplifier as mains-operated no mention was made of the kind of mains voltage (A.C. or D.C.), so it should be explained that it can be operated from either kind of supply equally well, due to the fact that the valve and photo-cell act as their own rectifiers on A.C.

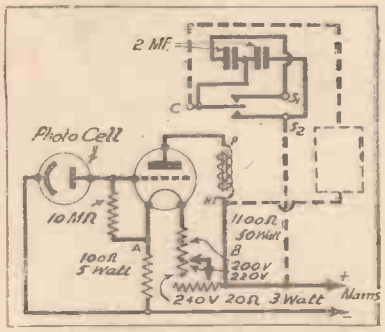
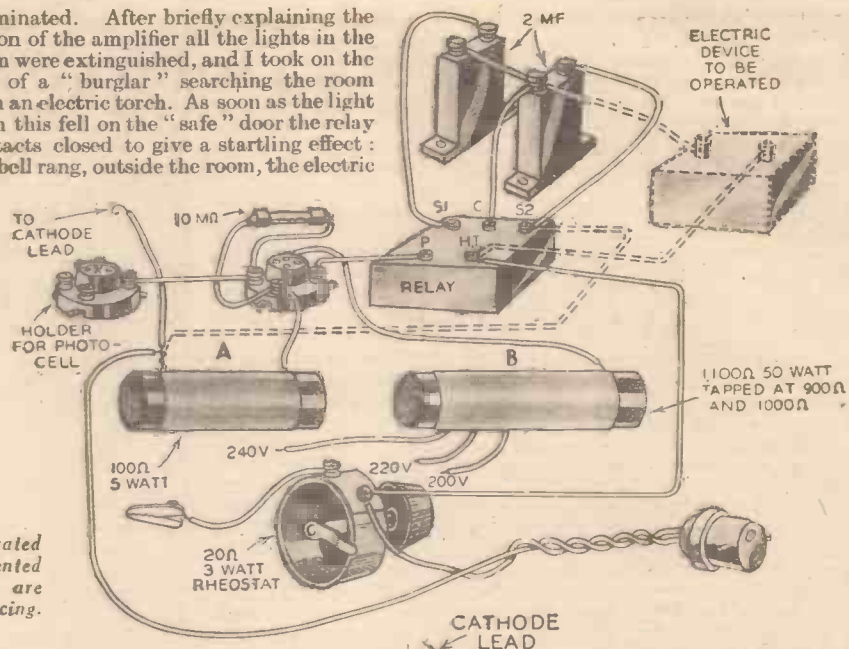


Fig. 9.—The simple connections for a mains-operated photo-cell amplifier. The external circuit is represented by broken lines. Notice that two condensers are connected across the relay contacts to prevent arcing.



lamp lit up, one motor wound a cord round its spindle, so pulling an external bolt on the door, the second motor operating a cam which opened the shutter of a loaded camera at the same instant as the fuse "blew" and ignited a charge of flash powder. The audience was fully convinced of the efficacy of photo-cell burglar alarms, especially when the plate was rapidly removed from the camera by an assistant, developed, a lantern slide made from it and shown on the screen within about ten minutes of the "attempted robbery."

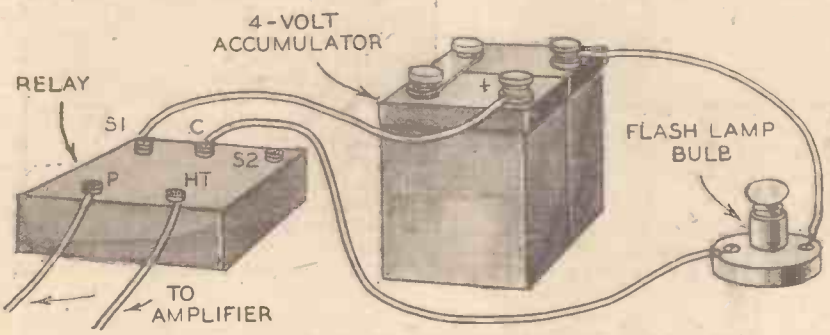


Fig. 7.—Operating an electric light by means of a photo-cell amplifier.

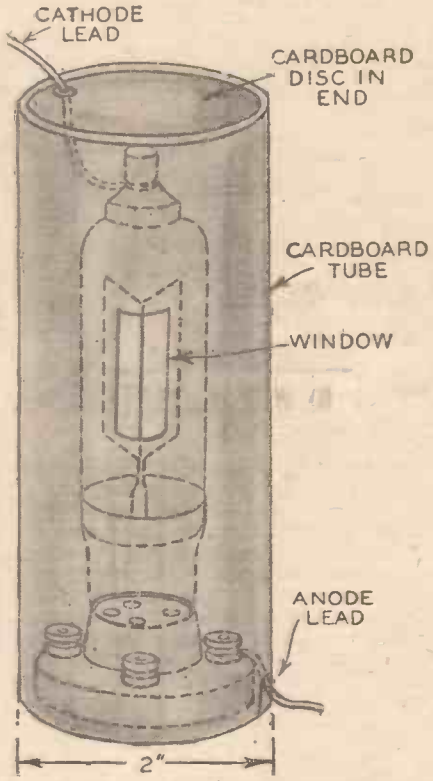


Fig. 5.—A cover for the photo-electric cell.

Interesting Applications

Space does not permit of a full description of all the fascinating uses to which the photo-cell amplifiers can be put, but it will be of interest to mention a rather complicated scheme that was worked out a few years ago when the writer was giving a lecture-demonstration on photo-cells and their applications. A "dummy" safe was rigged up and a photo-cell was concealed in the door and connected to the amplifier. The relay was connected in circuit with an electric bell, two electric motors, an electric lamp, and a short length of fuse wire, and was arranged to operate when the cell was illuminated. After briefly explaining the action of the amplifier all the lights in the room were extinguished, and I took on the rôle of a "burglar" searching the room with an electric torch. As soon as the light from this fell on the "safe" door the relay contacts closed to give a startling effect: the bell rang, outside the room, the electric

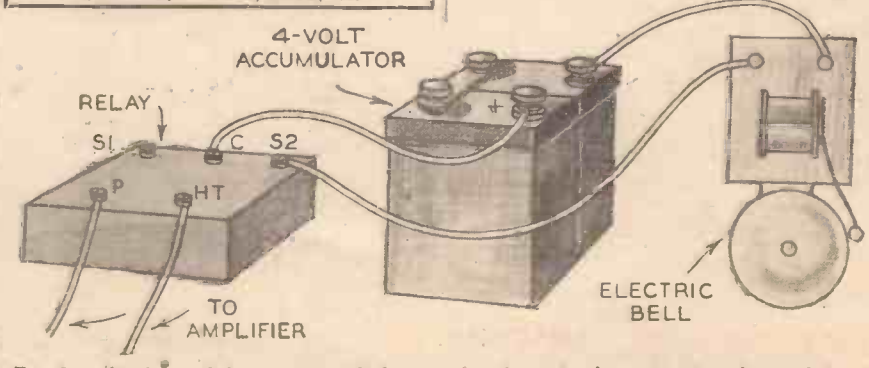


Fig. 8.—An electric bell can be switched into circuit by using the connections shown above.

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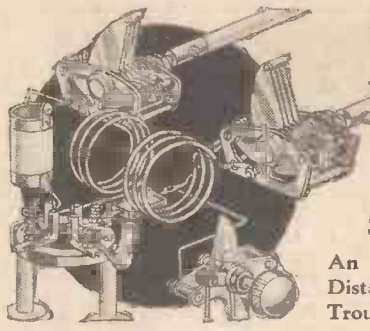

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"WHY is it that it is possible for Australian amateurs to hear our own amateur transmitters at work, and yet the latter cannot be heard in our own country?" This is a question which has been raised many times by amateurs, and especially by those new to wireless, and it is a subject which is full of hypothesis and guesswork. Fortunately, it is only on the short waves that its effects are fully felt. On the ordinary broadcast wavelengths we experience no trouble from this phenomenon.

The earth provides a rather peculiar effect with wireless waves, and is not always acting as a conductor. Probably the majority of our readers have seen in the daily press photographs of a short-wave transmitter which employed wavelengths as short as a pin, and which were directed along a beam in the same manner as light. This is one of the little peculiarities of wireless waves—they may be shot off in all directions from an aerial (hence the term "broadcast") or they may be radiated from a wire arranged in a metal screen, in which case the screen acts as a reflector. The arrangement is exactly the same as the reflector in a motor-car head-lamp. The wireless "rays" are concentrated in a direct beam which keeps to all intents and purposes parallel, and it is thus possible to send a wireless signal to one part of the globe without any risk of that signal being heard elsewhere than in the direct line of radiation.

Therefore, a very good conductor acts also as a very good reflector, provided it is arranged in a certain way with respect to the aerial or radiator. Conversely, a bad conductor acts as a bad reflector. This gives us the first point towards our analysis of the "dead" spot. When a station is transmitting, the surrounding earth, if in such a state that it is a good conductor (that is, if it is thoroughly wet due to excessive rainstorms, or situated in a marshy district, etc.), will act as a reflector, and will thereby reflect the radiated waves upwards. In this manner, therefore, the signals are prevented from radiating equally in all directions, and instead of travelling outwards towards the different parts of the world they are all (or nearly all) directed straight out towards the heavens. For some reason or other they come back. The reason which at present is given for this return is that there is a layer of ionized or electrified atmosphere which surrounds the earth, and this certainly can be accepted as an explanation.

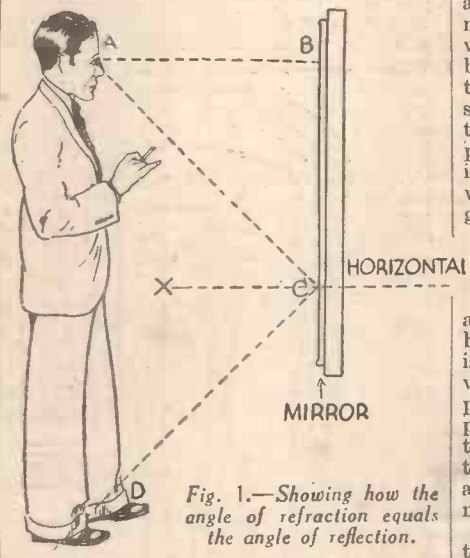


Fig. 1.—Showing how the angle of refraction equals the angle of reflection.

The Heaviside Layer

The name given to this belt of ionized atmosphere is the Heaviside Layer, and if we can imagine a conducting surface similar to our earth's surface, we can certainly understand the signals being reflected back. This layer does not, however, appear from experiments which have been carried out to be continuous. In other words, there would appear to be quite substantial gaps in this layer, and some unfortunate signals seem to have passed through these gaps and have never been heard of again. However, to return to our explanation of the "dead" spot. When the signal is reflected from the earth, it obviously, owing to the curvature of the earth, will not be directed in a perfectly vertical ray. When, therefore, it strikes the upper conductor (or Heaviside layer), it will be reflected back (or refracted) at a complimentary angle. It is well known that the angle of incidence and the angle of reflection are always equal, and this accounts for our being able to see distant objects in the reflection cast in a pond when we move sufficiently far away to enable our line of vision on the object to coincide with the angle from that object to its counterpart. Fig. 1 shows in a diagrammatic form how these angles are made up, and a few experiments before a looking-glass will make the idea quite plain. Stand before a large mirror so that you can see the whole of your body reflected (Fig. 1).

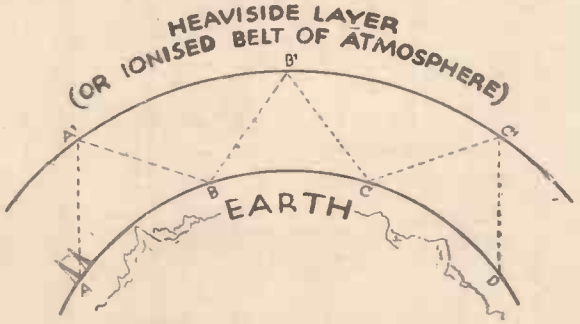


Fig. 2.—How a short-wave signal is deflected back to earth.

A Simple Analogy

When you look into the mirror at your own eyes, you look absolutely straight forward, and consequently, the reflection will also be a straight line, and this is shown by the dotted line AB. When, however, you look at the reflection of your feet, you look down the line AC, and the reflection of your feet in the mirror follows the line CD, which will obviously be the same as the line AC. The angle of incidence in the latter case is made by the lines CDX. The reflected wireless waves will therefore be directed back to earth at an angle corresponding to that with which it arrived at this Heaviside Layer, and it will consequently strike the earth at some point distant from the point of radiation (Fig. 2). If this point is also in a suitable condition, the signal will again be reflected, and so the sequence goes on. There are numerous variations which could be brought into this explanation, such as the fact that the reflection may not take place at the point where it strikes, but it may be conducted along for a short distance, and then thrown back, but these will only confuse the issue. It is obvious now from Fig. 2 that the signal will only be heard at B, C, and similar points, and it is this theory which at present holds good for the explanation of the non-reception of stations at points near to a broadcasting station while signals are clearly received at points situated much farther away.

One interesting fact might be added to these notes, and that is that the signals which are transmitted at lower frequencies (higher wavelengths) tend to follow the surface of the earth instead of being reflected, and this can be used to prove that the earth is actually a sphere (Fig. 3). If a signal follows the surface of the earth, and the earth is round, then the signal should come back to where it started from, with only the very shortest space of time separating it from the original signal.

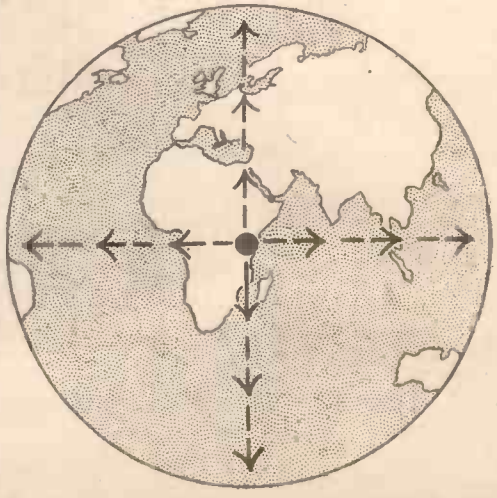


Fig. 3.—Illustrating how a signal radiates equally in all directions.

THE EASY ROAD TO RADIO.

THE BEGINNER'S SUPPLEMENT

OUR NEW COURSE FOR BEGINNERS.

In this Article the Importance of the Valve is Explained, and its Bearing on Transmission and Reception is Made Apparent.

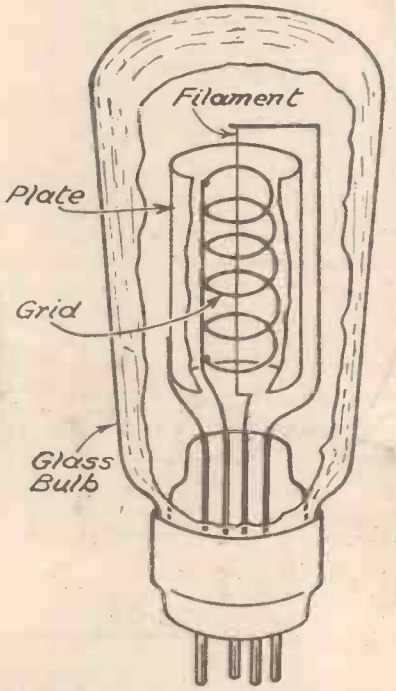
LAST week we saw how the sound waves in the studio were converted into electrical impulses, and how these were radiated from an aerial to be eventually received and re-converted into sound waves through the medium of the loud-speaker or headphones. Before we can fully realize how this conversion of sound takes place we must examine the wireless valve, as it is this versatile component which makes the whole world of wireless possible, and without it we should be unable to cover the vast distances which separate transmitters and receivers all over the world.

The Wireless Valve

In its simplest form the valve is simply a glass bulb containing some pieces of wire and metal. One thin wire is arranged in the form of a loop and is called the filament, or to use a more technical and accurate expression, the "cathode." Another piece of wire is wound round and round some supports and is held a short distance from this filament, and is known as the "grid," and the piece of metal is bent into the form of a box without ends and is held just outside the former two parts. It is commonly called the plate, but its correct technical name is "anode." Unlike an ordinary electric-lamp, the filament or cathode is made from a material, or coated with a material, which, when incandescent, gives forth an emission of electrons. These radiate outwards and are attracted to the outside plate by the simple method of making the anode positive, by joining it to the positive pole of a high-voltage supply. The negative pole of the supply is joined to the cathode. Therefore, when the cathode is glowing the space between cathode and anode is bridged by a stream of electrons which obviously have to pass through the mesh formed by the grid. By making the grid positive or negative it will obviously be possible to control the flow of electrons past it, and in this way we have a controllable valve in which a current will be found in the anode lead, this current being varied by any voltages applied to the grid. The position of the grid and the value of the current flowing across the valve renders it possible to obtain amplification, as it only requires a very small application of potential to the grid to modify the electron stream, and thus large variations in current in the anode lead will be obtained. This is, however, only one function of the valve, and it is not so important as the function known as rectification, and which will be dealt with later on.

Transmission

If the currents which are flowing in the anode circuit are introduced into the grid circuit, by the simple method



A sketch of a simple valve showing the general arrangement of the electrodes.

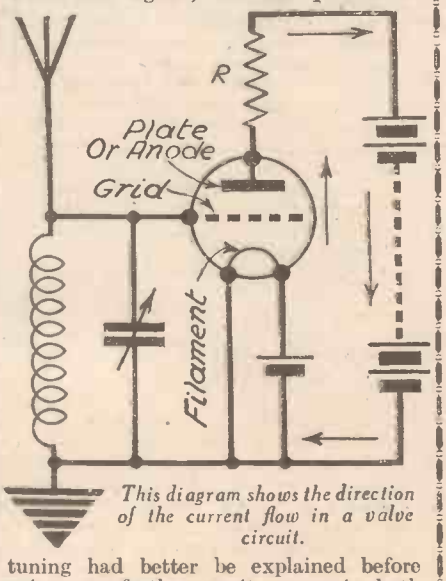
of placing a coil in each circuit and placing these close together, a state will arise which is known as oscillation. That is to say, the grid currents will be strengthened by the introduced anode currents, and the increased anode current will further increase the grid current, and so on.

If the coil is tuned by connecting a condenser across it, and the two circuits are brought into tune, then the valve will oscillate at the frequency of the tuned circuits. This may appear a little complicated at the moment but will be made clear at a later stage. If an aerial is joined to the anode circuit of a valve which is oscillating, the aerial will radiate these oscillations, and this is known as the carrier wave of the transmitting station. The electrical impulses from the microphone circuit are fed into the grid, and as we have already seen, this will vary, or to use its technical expression, will modulate the oscillations, and thus, when any signal is fed into the microphone, the carrier wave will become modulated or varied in strength in accordance with the microphone signals.

Situated between the microphone and the actual valves are numerous pieces of apparatus which are designed to enable the signal to be controlled in many various ways. For instance, in addition to a volume control, which enables the loud noises to be reduced in strength and weak noises to be over-emphasized, there are various mixing panels which enable two performances or more to take place at the same time in different studios, and the signals in one studio may be intermixed with those from another studio or one may be used whilst another is suppressed, and so on. It is this which enables the radio play to be produced, and the well-known Effects Department to introduce its various noises to give realism to a play. Furthermore, the various stations spread round the country, as well as the Post Office lines, are also brought to this point, so that outside transmissions may be broadcast from the one transmitting station. Obviously, it is necessary at the transmitting end to arrange certain refinements in the various circuits to prevent spurious oscillations or other defects, but these need not concern us.

Reception

Spreading out from the transmitting aerial we have, therefore, a radiation tuned to a certain frequency, upon which is superimposed variations corresponding to the sounds received by the microphone. In order to hear these sounds we must obviously tap or catch the radiated oscillations, and therefore we erect in the air a length of wire known as an aerial, and connect this through a coil to earth. By adjusting a condenser in parallel with the coil, so as to tune this circuit to the frequency of the transmission, we shall cause the aerial circuit to oscillate in sympathy with the transmitted oscillations and thus be in a position to utilize the signal; but the process of



This diagram shows the direction of the current flow in a valve circuit.

tuning had better be explained before going any farther, as it occurs in both the transmitter and the receiver. Next week, therefore, we shall describe the process of tuning, and how the terms frequency and wavelength are obtained.

BOX OR BRICKS?

Our Contributor Raises Some Provocative Points in this Article. It Would be Interesting to Know How Many "Unit" Radio Receivers Are in Use To-day

By "CONTROVERSIAL"

SOONER or later in the career of every serious radio experimenter there comes a time when he finds himself in a quandary concerning the outward form of his receiving apparatus. Although he has, from time to time, been unable to resist the temptation to overhaul or rebuild it, the family set has definitely come to stay. Any attempt to play tricks with it—or in other words to improve it or bring it up to date—is generally looked on with disfavour by everybody.

Keeping Up to Date

Thus, the enthusiast has to seek a fresh outlet for his activities—for much of the enjoyment of the technical amateur lies in building up new circuits, making improvements here, adopting each modern development as it is introduced, and generally keeping his technical knowledge up to date by practical experiment.

Now the number of experimenters who have a separate room at their entire disposal for this purpose is strictly limited. Many, if not most, have to content themselves with short leases of a corner of the kitchen table on privileged occasions, and are similarly poorly off for storage room. It is, therefore, rather important that even the experimental apparatus should be fairly good to look at, and should also be of convenient shape and size. And therein lies the snag.

An obvious solution to the problem would be to make up each experimental set on a proper baseboard or chassis, and enclose it in a cabinet of some kind. But this has certain disadvantages. In the first place, different circuit arrangements require vastly different sizes of base, they demand radical alterations to the grouping of components. Then, as speaker designs change, as improved forms of tuning dials and indicators are developed, and as other major modifications in radio practice come to pass, no one standard form of cabinet or chassis will suit for all requirements. Moreover, cabinets are expensive, and the outlay is scarcely justified in the case of a temporary and experimental receiver.

A still more powerful argument against the construction of experimental radio sets in a fully-finished form is that, if the circuit is properly designed and laid out, it is not a very easy matter to make alterations to it, yet it seems a waste of time and energy to rebuild the set for every experiment.

One Problem at a Time

Fairly long experience has taught me that, in nine cases out of ten, the experimenter occupies himself with one problem at a time. For example, he may wish to investigate for himself the advantages of Class "B" working, in which case it is only the low-frequency side of the set which requires any modification—but in all probability none of his existing receivers has sufficient space on the baseboard or chassis to accommodate the additional components required.

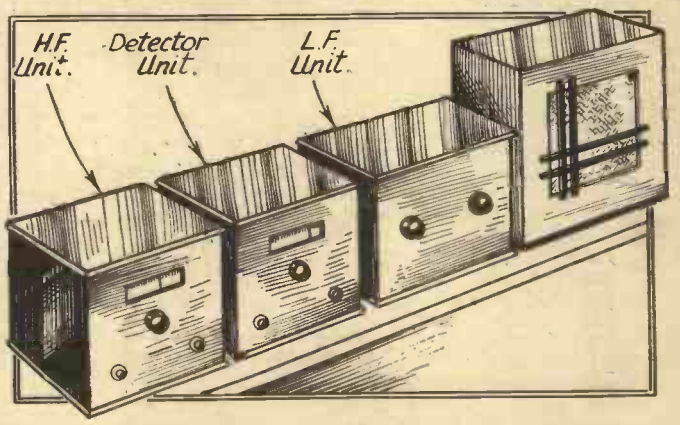
Again, he may wish to experiment with some new type of coil or with a band-pass device. A completely new set may seem essential, but actually it is only the radio-frequency portion which needs alterations—the audio-frequency amplifier arrangements can remain unchanged.

It seems to me, therefore, that anyone who undertakes experimental radio work for his own amusement, as thousands of readers of this journal undoubtedly do, might profitably consider building his experimental receivers on a multiple unit plan. In this way the equipment would be always complete although, perhaps, never finished.

Radio Bricks

In the very early days of radio something of this sort was actually done, one firm selling different units, such as high-frequency amplifiers, detector units, audio-frequency amplifiers, and so forth, under the name of "Radio Bricks." The scheme certainly permitted a fair degree of flexibility in the design of a receiving set, although as each unit was in a sealed box, experiments with different circuit arrangements were not possible.

As a good many users of mains radio still stick to the separate power unit, rather than incorporate the power pack in the set itself, why not continue the idea of sub-division a stage farther. Have the power unit in a neat, workmanlike case, or if you still have to work with batteries, build a battery box on a similar plan. Then build a low-frequency amplifier to whatever design appears suitable, and enclose it in a case of similar appearance to that of the power unit or battery box. Finally, construct some form of radio unit—a single valve detector or a high-frequency amplifier and detector combined, and fit this again in a case *en suite* with the other units, the complete equipment being assembled somewhat as shown in the accompanying illustration.



Showing the neat appearance of the units mounted side by side.

You will now have the essentials for a radio receiver suitable for general experimental work. If at any time it is desired to investigate, say, push-pull output, you can easily build a new low-frequency amplifier unit and substitute it for the original one.

The Cabinet Question

I would suggest that you spend a little thought on the design of cabinet, adopting only one, or at most two, standard sizes, and sizes at that which will build up into shapely combinations. Naturally, all cases should have the same depth from back to front. Probably the best sizes would be one with a square panel and the other with a panel twice as long as it is high, and equal in size to two of the square panels. Seven inches by seven inches, and seven inches by fourteen seem reasonable, and it might be a good plan to have one cabinet 14ins. square for a speaker section.

Here are one or two practical suggestions regarding the design of the units. First of all make up, or have made, a number of the standard boxes. Whether they are constructed of white wood or plywood (the latter being preferable), or even sheet metal, stain or colour them to tone with the general decoration of the room in which you usually work. You can stack up all your unit boxes, even if some of them are as yet empty.

Then the actual units, apart from the cases, should be assembled on separate baseboards of sizes which will slide easily into the unit boxes. Of course you will have to make holes in the front of each box for the control spindles to project. A terminal strip, preferably of the plug and socket type, should be fitted to the back of each unit, and these strips should be of the base-board mounting type. In general, each amplifying unit will require a pair of input and a pair of output terminals, as well as L.T. and H.T. terminals; the radio units will want aerial and earth terminals, high tension and low tension and, of course, output terminals.

Interconnection between units should be by flexible wires fitted with suitably-inscribed plugs. In this connection, let me make a plea for standardizing on one make of terminal or plug throughout—it greatly simplifies connecting up. Then have a good stock of flexes of different lengths and with plugs at each end. Some should be twin flexes and others single wires. Have, also, a supply of lettered tags or labels marked "H.T.Pos.," "Earth," and so forth, to avoid mistakes in wiring up.

If you feel particularly energetic one evening, you might make a general control unit to serve as a nerve centre for the whole system. On this would be concentrated the main battery switch or mains switch, volume control, and perhaps a link panel or system of plugs for making inter-connections between units. In any case, the scheme is one which should find favour in many quarters and will extend considerably the enjoyment derived from really "practical wireless."

WILL THE VALVE SURVIVE?

The Valve has Steadily Adjusted Itself to Meet New Broadcasting Conditions of Radio. Will it Survive All These Changes or is a New Device Necessary?

WHENEVER any startling change takes place, no matter in what sphere, somebody is certain to raise the query: "Will the so-and-so survive?" Even so young a science as radio has not been free from this particular topic. From time to time there have been such scares as "Will broadcasting survive?" "Will the superhet survive?" and so forth. Now some people are asking "Will the valve survive?"

It must be admitted that the conditions of radio reception have suffered most startling and rapid changes during the past ten years or so. Many radio inventions and devices have passed into oblivion, and many more will do so as new developments arise. But what of the valve?

Development

Consider for a minute the history of valve development. Next year we shall celebrate the thirtieth anniversary of the birth of the first valve—Fleming's two-electrode oscillation valve used originally as a diode detector. This was evolved from the well-known "Edison effect," and Fig. 1 illustrates a lamp, now many years old, which shows very clearly, by the "electron shadow" on the bulb, the important discovery which led Sir Ambrose Fleming to undertake his experiments. Two years later America added the control grid and gave us valves which would also amplify. Up to the year 1922, radio receivers used only a single type of valve—a "general purpose" bright emitter valve—in every stage. In that year, however, power amplifying valves were developed, for use in the last stage of sets employing loud-speakers.

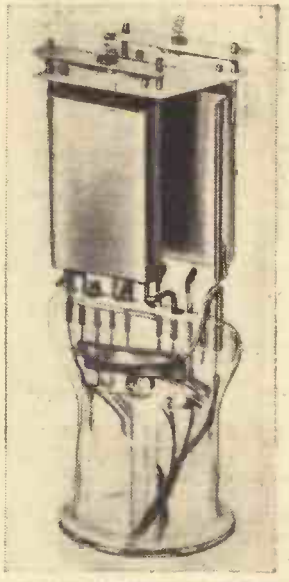


Fig. 2.—Showing the interior construction of a class "B" valve.

Only a few months later the valve again showed its ability to evolve and improve when improvement was called for. General purpose types split into two sub-types—H.F. valves for use as radio-frequency amplifiers or for detection; and L.F. valves for audio-frequency amplification. Side by side with these improvements in functional characteristics, valves responded readily to the demand for working economy. At a time when four, five, six or more valves were necessary for efficient reception, bright emitters, each taking nearly three-quarters of an ampere of low-tension current, were

Fig. 1.—An electric lamp, over twenty years old, which clearly shows the "electron shadow" on the bulb.

costly to run. From 1923 onwards, dull emitter filaments of successively more efficient types evolved until, to-day, valves vastly more sensitive than the best bright emitters operate with only 0.1 amp. low tension at 2 volts, or 0.2 watt, as compared with .75 amp. at 4 volts (3 watts) for bright emitter types.

Amazing Improvements

These figures in themselves show the valve as a virile and accommodating device, but much more was to follow. Listeners wanted better long-distance reception, and long-distance reception conditions became worse. But the valve grew another grid and the screen-grid valve was born, not only restoring long-distance reception to its previous quality, but effecting amazing improvements.

Economy—a reduction in the number of valves—increased output from the receiver; these were the next demands of the insatiable listener, and the valve grew yet another grid and became a pentode, capable, for a given input, of providing an output previously requiring two stages of amplification.

Next, people whose homes were wired for electric light clamoured for radio sets which could be operated from the mains without the use of batteries. The accommodating valve responded nobly, surrounded its filament by an indirectly heated cathode, and operated, without the faintest fifty-cycle murmur of complaint, on the A.C. mains.

By now the diversity of valve types was very great. Screen-grid valves for high-frequency amplification, triodes for detection and low-frequency amplification, output triodes and pentodes—all were available in a variety of types for both battery and mains operation, and the actual characteristics were constantly being improved.

When component makers developed better or more efficient couplings, valves with improved characteristics, calculated to take the fullest advantage of the new components immediately appeared. Indeed, sometimes improvement in valve technique has actually set the pace for component manufacturers, the technical possibilities of new valve types calling for all the ingenuity of the makers of coils, transformers, and so forth.

Recent Cases

Two recent and outstanding instances in which the radio valve has, so to speak, broken fresh ground are the high-frequency pentode and the Class "B" valve. In the former, the pentode principle, whereby an earthed grid between the auxiliary grid and the anode acts as a screen to prevent secondary emission from the anode reaching the auxiliary grid, is applied to high-frequency amplification. The resultant valve has a much higher amplification than any ordinary screen-grid valve, and will also handle a larger output without risk of instability. Even in the average receiver a screened pentode provides a bigger overall gain than any screen-grid valve, and is, of course, immeasurably superior when used in conjunction with tuned couplings of the highest efficiency.

The second development, Class "B" amplification, as readers know, is a device whereby a battery set is given output capabilities on a par with those of a mains set without an extravagant use of high-tension current. The Class "B" valve, it should be noted, comprises two valves in a single bulb (actually two high magnification triodes operated in push-pull without bias) and an example of the interior construction of one of these is seen in Fig. 2. Nor is this the only type of "multi-valve" now available. During recent months several types of such valve have ap-

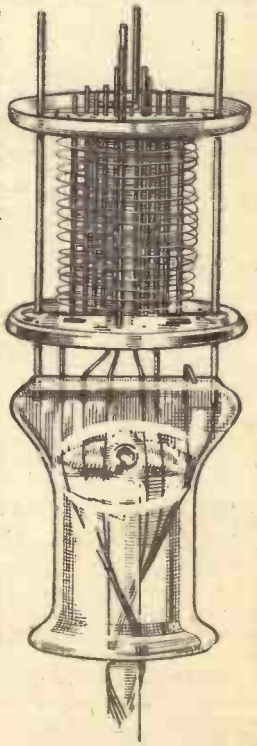


Fig. 3.—The electrode assembly of an octode.

peared, mostly combining one or more diodes with a low-frequency amplifying element.

Multi-electrodes

Of such valves mention must be made of the double-diode-triode comprising two diodes and a triode. The usual application of this valve is to use one diode as a detector, the triode portion as first stage low-frequency amplifier, and the second diode for applying automatic volume control, either amplified or both amplified and delayed to the high-frequency stages.

Another interesting type is the diode-tetrode, which consists of a single diode to be used as detector and a screen-grid valve for low-frequency amplification. Similar to the double-diode-triode is the double-diode-pentode, the two diodes being used as detector and automatic volume control valve respectively, and the pentode, which has variable-mu characteristics, being operated as a low-frequency amplifier. The advantage claimed for this valve is that it permits automatic volume control to be applied both to the high-frequency and to the low-frequency side of the receiver, thus attaining a more uniform volume level.

Other directions in which the multi-electrode valve has developed concern the detector oscillator stage in superhet receivers. The "pentagrid" valve, which has a cathode, anode, and five "grids" is a case in point. While this is not, strictly speaking, two valves in one, it is so in fact. The octode is a similar valve and a section is shown in Fig. 3. Some highly interesting multiple valves have, according to report, been developed in America, and there is no doubt that still more startling innovations will appear in the none too distant future, particularly in connection with valves for superhets.

One result of these developments is that the number of actual valves in receivers is now often less than the number of reception stages, and it is becoming the practice of set makers to rate their sets according to the number of stages, rather than according to the number of valves. This tendency is likely to increase, and there is little doubt that the time will come when a high-powered superhet receiver will possibly be using only three, or even two "valves."

Yes, I think the radio valve is very much alive, has wonderful possibilities for further development, and is fully adaptable to circumstances. Therefore, it will survive—changed greatly indeed from the original Fleming diode, but recognizable as a valve and gathering up in its more complicated design the best of the various improvements which have been made during thirty full and adventurous years.

AUTOMATIC TIME CONTROL

A Device that can be Set Automatically to Switch Your Wireless Set On and Off

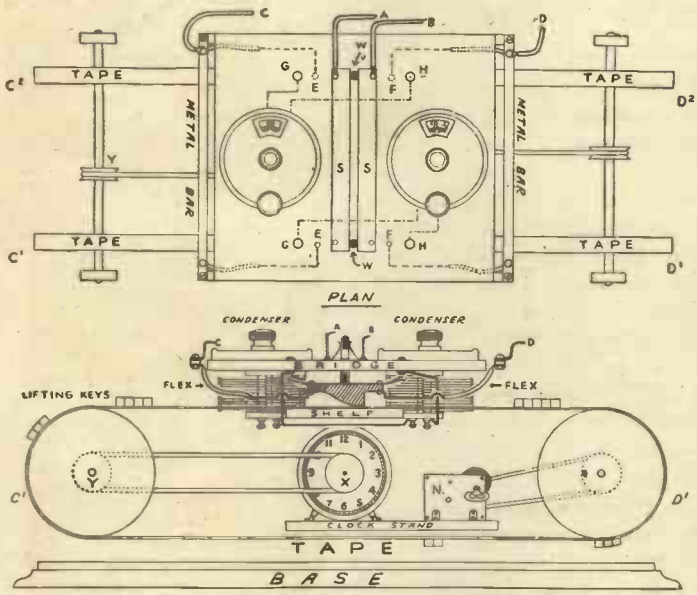


Fig. 1.—Showing the framework, bridge, shelf, clock stand and base.

THE average listener is always desirous of listening to some item of especial interest, but generally finds that he is occupied and thus forgets to switch on at the appropriate time. Many devices have been suggested from time to time to switch on a wireless set at a pre-determined time in order that these special items will not be missed. As a rule this type of device can only be effectively applied to a mains receiver, and an electric clock with separate contacts for a number of different periods of time will enable the set to be switched on and off for definite periods. The battery user, however, is not so fortunately situated, although it is possible to use an old alarm clock to form an automatic switching device. The provision of a contact and a length of wire wound round the alarm key will enable the simplest type of automatic switch to be constructed in a few minutes, but the keen experimenter wishes to have some more elaborate apparatus than this which, whilst working more efficiently, will also present a more attractive appearance. The device described in this article may be made up from a number of odds and ends and may be boxed or included in an existing radio cabinet and will be found extremely useful. It is designed to work on two stations and uses a separate tuning condenser and switch for each station.

The Framework

The framework, which is of wood, consists of a bridge shelf, clock stand, and base as shown in Fig. 1, as well as supports for wheels D1, D2, C1 and C2.

Both the hands are removed from the clock and a pulley wheel X is attached to the hour hand spindle. X is connected by means of a belt to Y. C1, C2 and Y work on one spindle. X revolves twice a day, therefore, if a seven-day clock is used, each tape should be equal in length to fourteen times the circumference of X. They will thus require exactly a week to complete the revolution.

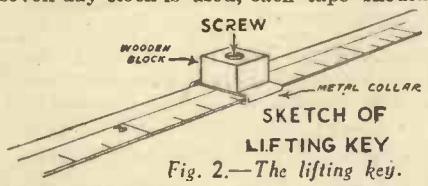


Fig. 2.—The lifting key.

The Tapes and Keys

Attached to both tapes are movable lifting keys. These consist of small wooden blocks mounted on metal collars, through which the tape is free to slide. (See Fig. 2.)

The screw, which must be blunt at the end, passes through the block and the top of the collar.

To fix the key, drive the screw home and the tape becomes jammed between the end of the screw and the inside of the collar.

Fig. 4 shows how the lifting keys function. The switch-holder, which is of wood, normally rests on the tape, and is so shaped that the key moving in the direction shown will cause it to rise.

A piece of ebonite, W, with a metal collar acts as a switch, and is free to slide through a hole in the bridge.

S and S give one an end view of two metal strips which are fixed parallel and bent lengthwise so that they form a slot through which the switch moves up and down. Extra care should be taken when constructing this part of the mechanism.

S and S should not press against the switch, but touch it sufficiently lightly to allow the switch-holder to fall by its own weight.

A and B lead to the two switch terminals on the set.

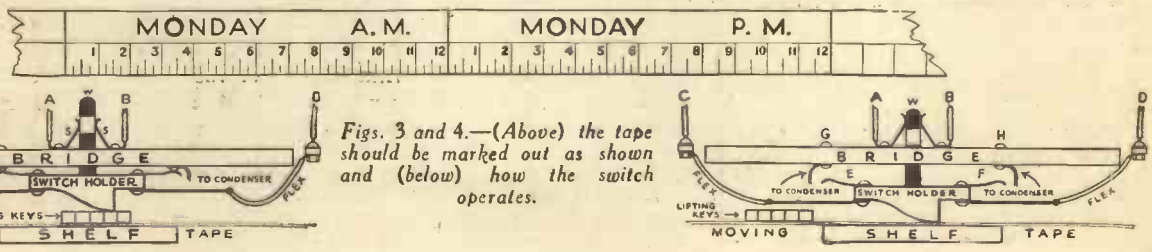
C and D lead to the corresponding variable condenser connections on the set.

How it Works

When the switch rises, the metal collar connects S and S, as shown, thus switching the set on. Simultaneously the pieces E and F rise to touch G and H, thus joining up the condenser with C and D. As soon as the keys have passed, the switch-holder drops again and the connections are reversed. Fig. 3 shows how to mark the tape. Each lifting key should be just large enough to cover one of the hour spaces.

If possible join the two ends of the tape with a hook and eye or some other fastening so that it is possible to remove or add any number of keys. To prevent the clock stopping when the keys come in contact with the switch-holder, an auxiliary clockwork motor, N, may be added.

Although the device as originally built up uses a simple switch of the push-pull type, there is no reason why this should not be replaced by one of the Q.M.B. type, provided that the small contacting block is suitably modified. It will, of course, be necessary to provide a two-way method of switching both on and off, and the extra trouble may be found worth while. Similarly, it may be found desirable for some listeners to modify the size of the lifting keys in order to produce varying lengths of time during which the receiver is switched on and off, and in the case of a receiver fitted with remote control the apparatus could be stowed away in a distant place and the receiver operated through the remote control system. There are, in fact, many applications of the device of the rotating tape and the removable contact pieces, and some interesting experiments may be carried out with it.



Figs. 3 and 4.—(Above) the tape should be marked out as shown and (below) how the switch operates.

SUPPLEMENT TO "PRACTICAL WIRELESS"

AMATEUR TELEVISION

THE TELEVISION RADIO RECEIVER.—PART II.

(Continued from page II of last week's issue.)

By H. J. BARTON CHAPPLE, B.Sc., A.M.I.E.E.

An Article Dealing with the Essentials of Modern Television Receivers

IN the low frequency amplifier, the detected signals obtained from the receiver proper have to be used to release a substantial amount of power which will vary strictly in sympathy with the detected signals, these signals being, of course, an electrical representation of the light and shade of the subject televised as explored by the scanning mechanism at the transmitting end.

Assuming that the high frequency and detector stages have performed their part so well that no sensible degree of distortion has been introduced, it is necessary to ensure that the low frequency stages are equally satisfactory. No matter whether the amplifier is intended for the simplest type of equipment using a small neon lamp, or one of the more advanced type requiring half a dozen watts or so of low frequency output for operating a Kerr or Grid cell, the main ingredients are the same, and can be summed up in the words—"Several stages of low gain amplification." In other words, this is one of the cases in which economy and efficiency for once have to take second place in favour of quality of output if the best results are desired.

Good Reproduction

Really good quality can be assured by correct design of the amplifier combined with care in operation. Those who have built one or two complete radio receivers for sound reproduction are apt to consider the low-frequency end of the set a simple matter in which it is almost impossible to go wrong. But while the technical aspects of amplifier design are somewhat less intricate than those of the radio-frequency stages, there are pitfalls, and particularly in the design of amplifiers intended for television work.

In the first place, as was pointed out in the first article, the eye is not so readily deceived as the ear, so that it is vitally necessary to reduce distortion to a minimum. This necessity is emphasized by the fact that in the case of a sound amplifier the overall fidelity of the output is governed not by the amplifier alone, but also and to a great extent, by the loud-speaker, so that there is a chance of correcting a certain amount of distortion in one direction by a similar amount of distortion in the opposite direction. In television, however, the viewing apparatus reproduces the picture in exact accordance with the electrical impulses supplied by the amplifier, and any distortion introduced at any stage will be shown up.

The most important point about the design of an amplifier for television purposes is the type of intervalve coupling employed. Obviously the most efficient coupling for normal work is the iron-cored transformer, which gives a stage gain several times greater than that provided by the valve itself, depending upon the ratio of turns in the two windings. Unfortunately, however, transformers do not give a very even response throughout the range of frequencies required for television reproduction. Usually they have a fairly level characteristic between a few hundred, and up to a few thousand cycles per second, but below and above these limits the response falls off more or less seriously. These variations in performance are the result of variations in the constants of the transformer at various frequencies, and are inevitable. It is true that very considerable improvements have been made in transformer design since the early days of radio, and that for sound reproduction a good modern transformer leaves little to be desired as an inter-valve coupling, but for television the infidelities of even the best transformer will seriously mar the quality of the picture.

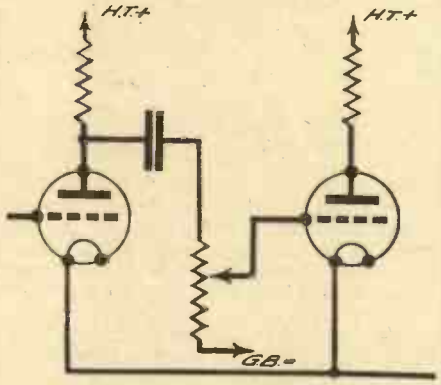


Fig. 1.—The correct position for a volume control in a television amplifier.

R. C. Coupling

It has therefore become standard practice to adopt the resistance capacity form of coupling between the L.F. stages of a television amplifier. Although with this form of coupling the amplification is limited to that which can be obtained from the valve itself, and seldom amounts to much more than two-thirds of the amplification factor of the valve, resistance-capacity coupling correctly applied gives a substantially uniform response throughout a wide band of frequencies.

In view of the smaller stage gain obtained with this form of coupling, it may be necessary to use rather more amplifying stages than would normally be employed. A decision on this point will depend largely upon the input supplied to the amplifier and the type of output valve used. For example, a receiver having efficient high-frequency amplification and a sensitive detector will pass to the low-frequency amplifier signal voltages of very considerable magnitude. In order to load a triode giving an output of some 2 watts, two resistance-coupled low-frequency stages would probably be necessary. With a pentode output valve of similar rating, however, it is possible that only one other low-frequency stage would be required.

If the receiver is not provided with high-frequency amplification, or if for any other reason the output from the detector is comparatively small, three R.C.C. stages will undoubtedly be necessary with a triode output valve, and two with a pentode.

It should be the aim of the designer to obtain in each stage a gain of from one-half to three-quarters of the valve's amplification factor. This proportion is determined by the value of the anode resistance, the stage gain being calculated by dividing the value of the anode resistance by the sum of the anode resistance and the valve impedance. Thus,

$$\text{Stage Gain} = \frac{\text{Anode Resistance} \times \text{Amplification Factor.}}{\text{Anode Resistance} + \text{Valve Impedance.}}$$

Another important point to be borne in mind is that, as the signal passes from stage to stage and increases in strength, the successive valves should be of types capable of handling the increasing signals without overloading. In this connection it is useful to remember that a fairly accurate guide to the signal handling capabilities of various valves is the recommended values of grid bias voltage.

So much for the distortion which might be introduced by the general design of the amplifier. It is, however, necessary to guard against distortion which may be generated within the apparatus itself. One of these forms of distortion has already been hinted at, namely that due to overloading one or more valves by applying abnormally large signals. In order to correct any tendency to overloading, it is wise to fit some form of volume control. To be really effective such a control should be placed at the input end of the amplifier, as in Fig. 1, where the potentiometer also forms a variable leak in the grid circuit of the first low-frequency valve.

(Continued overleaf)

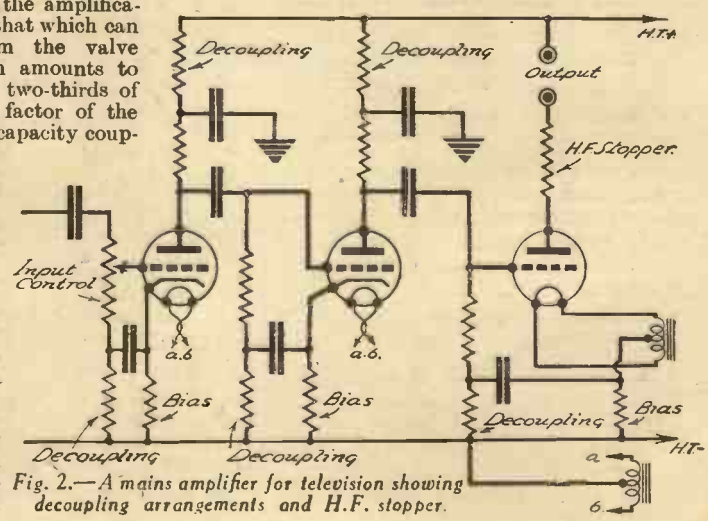


Fig. 2.—A mains amplifier for television showing decoupling arrangements and H.F. stopper.

740

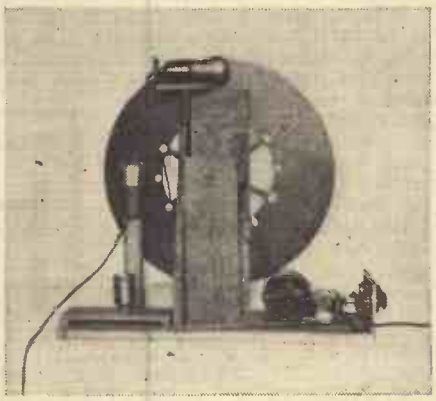
(*Continued from previous page*)

Allied to the above form of distortion is that due to incorrect biasing of individual valves. Normally, each valve should be biased to the amount recommended by the valve maker, but as there is sometimes a tendency to recommend slight over-biasing in order to reduce the anode current drain to a low value, it is as well to experiment with a slightly smaller grid bias than that recommended. Another point which should receive attention in this connection is the anode voltages applied to the various low-frequency valves. It should be recognised that with R.C. coupling there is a considerable voltage drop in the anode resistance, so that the applied voltage at the anode is far from being the same as the nominal voltage of the H.T. supply. If, therefore, the bias voltage is not adjusted to suit the actual anode voltage there is a risk that the valve will again be over-biased.

Instability

Care must also be taken in the design of the amplifier to avoid risk of low-frequency instability of the kind which reveals itself in a sound amplifier as "motor-boating." This and kindred troubles are due to the generation of low-frequency oscillations, a phenomenon made possible by the fact that the resistance of the high-tension supply unit is not inconsiderable, and forms a common part of the anode circuits of several valves, so that any variations of the anode current of one valve, say the output valve, are "reflected" as voltage variations in the anode circuits of the other stages, and these variations are re-amplified cumulatively until serious oscillation occurs, with, of course, fatal results to "quality" pictures. The cure for L.F. instability is complete decoupling in every stage, a device familiar to every home constructor, and which needs no description here. Decoupling circuits are shown at all necessary points in Fig. 2.

Finally, mention must be made of a form of distortion which is liable to occur in amplifiers employing modern high-slope output valves of large power. The trouble is high-frequency oscillation, usually of very short wavelength, due to the output valve and its attendant circuit acting as a small transmitter. The best preventive is a non-capacitative resistance of about 100 ohms inserted in the anode circuit as close to the valve as possible, while a stopper resistance in the grid circuit is also of service.



An amateur-built television receiver, with the lamp positioned for the reception of the continental transmissions.

Recording Television Signals

WHEN using gramophone records for recording television signals the wear on the record has a most marked effect on the results. For this reason it has been suggested that one way of overcoming the defects of this sideline of television would be to record the television signals on a film just the same as sound is recorded with the "talkies." As far as is known, this method has not been tried, and on the surface it appears to offer one solution whereby "phonovised" items could be recorded and supplied to the public. Of course the vision equivalent of a sound head would be needed, but this should not unduly tax the ingenuity of research engineers engaged in this work. A scheme remotely resembling this is already used in the intermediate film television system, so perhaps the idea will prove practicable. In any case, if the difficulties surrounding recorded television can be solved really satisfactorily it will prove a boon to every household possessing television apparatus, and stimulate the sale of machines and apparatus very considerably.

Removing Objectionable Disc Lines

WITH television embracing so many newcomers in the home construction field, it is only natural that a certain number of unfamiliar conditions may crop up when the receivers are being tried out for the first time. One of the first to be noticed, when using a disc machine in its simplest form—that is, a motor driving a perforated scanning disc, the holes of which explore or pass over the surface of a neon lamp—is generally unwanted lines.

Each hole in the disc in its passage across the glowing neon area creates a strip of light, and with a thirty holed disc used to receive the present B.B.C. transmissions, each strip should fit exactly against its immediate neighbours. If the strips overlap, a white line will be noticed, while if they do not quite touch at any point, then a thin black line will make its appearance. To overcome the trouble, first of all remove the disc and clear away with a fine camel-hair brush any trace of dust specks in the holes, as these are notorious agents for producing the black lines. If they are still present, note which disc holes are causing the trouble by counting along the strips from the right, remove the disc from the motor shaft, and, using a fine three-cornered file of the jewellers' variety, file the outer and inner sides of the respective holes between which each black line is visible. Only a *very small* amount of metal must be removed, otherwise you will cause the holes to overlap.

To clear the white lines it is necessary to "spread" the metal at the holes' sides which are producing them. This is best done by light hammer taps on a flat punch. The hole sides can then be reopened the correct amount by using the jewellers' needle file once more.

In addition to the disc holes being incorrectly positioned in a radial direction, errors of angulation can arise from unequal 12½ degree separation between each. The effect of this will be to give any straight lines that may be transmitted a "stepped" appearance. The cure is to "spread" the metal as before, but the operation is carried out on the top or bottom of the hole and not at the sides, as was the case with overlap. Then, using the needle file carefully, the angulation errors can be eradicated.

REFLEX CIRCUITS FOR THE EXPERIMENTER

(*Continued from page 723*)

detector. All components are of standard type, and the two tuned circuits may, if desired, be tuned by means of a two-gang condenser, provided that two coils of similar type be employed.

The circuit now in question is an efficient one which is capable of good reception and reasonably good quality, so long as no attempt is made to obtain great volume. A variable bias voltage is applied to the first valve by means of a potentiometer in parallel with a 4½-volt G.B. battery. By this means it is not a difficult matter to find a setting at which the valve will function fairly well in both high- and low-frequency capacities. To avoid overloading, the L.F. transformer is of only 2 : 1 step-up ratio, whilst a ratio of even 1 : 1 might prove better in many cases. No matter which transformer ratio is employed it is important that the component should be of good quality, and having a high secondary impedance. The other constants of the circuit conform to present-day standards, whilst the anode circuit of the detector valve is suitably decoupled so that only one main H.T. positive tapping is required. For convenience and simplicity, a second tapping is used to supply the screening grid of the high-frequency pentode.

If an H.F. pentode is not available there is no reason why an ordinary screen-grid or variable-mu valve should not be used, and although this will not prove quite so effective, it will certainly function quite well. Should the experimenter so desire, he may employ plug-in coils instead of the two tuners mentioned, in which place coils L.1 and L.2 should be of the same sizes as for the circuit previously dealt with. A 75 coil can be used for L.4 for both wavelength ranges, whilst suitable sizes for L.3 are 25 and 100 respectively for the two wavebands.

There are various modifications of the two general circuits dealt with, and, provided that the principles are understood, the experimenter is quite at liberty to try a number of alternative arrangements. It is by no means unlikely that some new phenomena will be discovered, and, at least, the fact of having tried the circuits will add to the enjoyment of wireless experimentation.

By Jace

"Synthetic" Droitwich

THE new Ekco receivers have been designed and tested against a "synthetic" Droitwich which has been in operation at Ekco works for some weeks past. This instrument produces conditions of reception almost exactly identical with those which the new "giant" will bring about. A special night staff is engaged checking production models against the B.B.C. test to ensure that Ekco receivers will give perfectly satisfactory results under the new broadcasting conditions.

Pifco Ltd.: Change of Address

THE firm of Pifco Ltd., the well-known electrical fittings and instrument makers, in step with advancing business, are changing their address. Born with the twentieth century, this manufacturing firm has, during its thirty-four years of business activity, grown until Pifco products are known and used all over the world. Having outgrown Pifco House, High Street, Manchester, the business has been transferred to new and much larger premises. The new address is, Pifco House, Shudehill, Manchester. The telephone numbers remain unaltered—City 4044 and City 0831 (Manchester).

Radio and Army Tactics

WIRELESS played an important part in the Army manœuvres held recently in Surrey. Quite unexpectedly, a baby car would dash up at great speed to a selected spot, a metal rod was raised, and in a few seconds an officer is in communication with a cavalry patrol near the enemy lines and with G.H.Q. in the back areas.

It was a thrilling experience to see a mass of armoured cars and other fighting vehicles moving forward and performing strange evolutions in response to command from a machine some distance away. Co-operation between reconnaissance aeroplane and land forces, too, has been revolutionized by radio telephony.

Sir Edward Elgar's Unfinished Symphony

MRS. BLAKE, daughter of the late Sir Edward Elgar, recently visited Broadcasting House and handed over to Dr. Adrian Boult, Music Director of the B.B.C., the manuscript of the Symphony which Sir Edward was engaged in writing for some months before his death. This work, it will be remembered, was commissioned by the B.B.C. A few bars had been orchestrated, but only a moderately complete sketch of the first movement and fragments of the others are in existence. No attempt, however, will be made to put the work into a form suitable for performance. The manuscript will be placed in the B.B.C. archives.

Empire Service Developments

ACCORDING to a recent announcement by the B.B.C. in connection with the development in the coming autumn and winter seasons of Empire broadcasting, Mr. Eric Fogg has been appointed to the position of Empire music director. Mr. Fogg has been associated with Northern broadcasting since 1923. In the following year he became station accompanist at Manchester. He was appointed assistant to the music director of the North Region earlier this year.

The B.B.C. will in future be able to provide, by means of a new orchestra which Mr. Fogg will conduct, special concerts for parts of the Dominions where the big English-speaking communities would otherwise rarely, if ever, hear "live" performances from England. Apart from conducting the orchestra and supervising music programmes, Mr. Fogg will have opportunities of finding Empire music so far unheard or unknown in this country, and he will devote special attention to artists visiting this country from overseas.

FERRANTI WORKS OUTING.

This composite illustration shows six of the trains which were necessary to take some of Ferranti's employees away on their annual outing. All the trains, with the exception of one, went to Blackpool.

Mr. J. B. Clark, Empire programmes director, states that while the simultaneous radiation from the Empire station of many programmes heard in this country will continue, another stage will be reached in the step-by-step development of the Empire service. Cecil Madden, who has had considerable experience of broadcasting and whose plays will be known to theatre-goers on both sides of the Atlantic, recently joined the Empire Department. He has already been responsible for many individual productions, and for series of programmes and talks. William MacLurg, a Canadian by birth, is also joining the Empire Department as a producer, after some years' experience in other departments of the B.B.C. The dramatic programmes will be more strongly developed; there will be revues with an "Empire angle" and, among other features, gossip hours in which the programme devisers will introduce to the audience overseas pearly kings and queens, composers young and old, artists famous and unknown, shows, films, novelties, and fashions.

Broadcast Talks

MANY of the regular series of talks will not begin until the end of September, and those specially arranged to meet the needs of discussion groups do not start until October. The morning talks, however, will be in full swing from September 3rd, and those on Mondays at 10.45 during the month will be specially interesting. They are called "Family Album," and are taken from records and diaries in the possession of the speaker—Mr. S. R. Littlewood. His maternal grandfather, Thomas Thornton, who was born in 1786, remembered the execution of Louis XVI, saw Nelson, and served as a volunteer against Napoleon in 1803. He left a very full record of the life of his day, and the first talk on September 3rd will be called "Tales of a Grandfather."

The second, "Round Regency London," deals with the days when one took a country walk from Stamford Street, now just south of Waterloo Bridge, to the Elephant and Castle, and the third will be his mother's reminiscences, "When Queen Victoria was very young." The fourth returns to earlier days and tells the story of "Poor Robin," who as a boy of fifteen rode to London with William Kitchener, an ancestor of Kitchener of Khartoum.

Sunny Joy

VARIETY fans in the Scottish Region will be catered for on September 5th, when they will hear an excerpt from Harry Kemp's show, "Sunny Joy," relayed from the Concert Hall, Troon. A popular cast includes Bert Denver and Pete Davis; Herbert Cave and Lillian Denton; Cyril Wakefield; Betty Hall; Nan Kennedy; The Four Sydney Steppers; Bond Rowell; and Eric Fowler and The Rhythm Kings. The whole is produced by Pete Davis.

Motor Race Broadcast

IN the National programme on September 1st a running commentary on the R.A.C. International Tourist Trophy Motor Race from Belfast will be given.

I SAW THE SHOW

MY Dear Constituents,—When I shot into the "Big Tent" on the back of my moth-eaten mule Mike, I expected Signor Spaghetti-Resisti (the ring-master) to introduce me over the 'phone as "Cinder Sall — the cutest thing in stirrups . . . And in stirrup-cups, or in stir—how she stirs you up!"

But he didn't, and—and—aw, gee!—nobody even wanted me to make a record, or to televise me—nobody wanted my advice on "Buying, Building or Begging a New Set for September," or to see my specimen letter "To The Director of Sunday Programmes". . . They didn't even see me!

"See what it's all about, hey?" I sniggered. And here's my diary:—

11.15 (Tuesday):—Followed crowd and found myself at that darn PRACTICAL WIRELESS place. Everybody here admiring sets and asking Qs. Heard one fellah saying: "That Midget Portable's O.K.—but you oughta see them we got in the States! Takes a cart-horse to pull 'em, it does." Technical Staff all smilin' like mad and shootin' answers like "Cheer up, m'boy . . . Fit Class-B, and wifie will stop droning and start the 'Honey' again!" "An' *I* wanna be asked questions," I cried eagerly, vaulting the counter while "The Staff" were still busily explaining—to eager Aberdonians—that "Advice" was not the name of a set! They sniggered when I got up to speak; they laffed all the time I spoke; they cheered and cried "Shucks" when an elderly dame asked me to hold her wool on my eloquent hands; they simply yelled "Yeah?" when I told 'em *I* made all them sets they saw, see? Then the editor of PRACTICAL SURGERY came along—in response to urgent S O S from "The Staff" (who had somehow detected my presence)—and I discovered an urgent funeral I had to attend—or else, my own!

13.00:—Put on a pipe and walked to Stand No. 0 (Boloneyphone Radio). Everyone "Gone Away," apparently—so I just nipped-up on the platform and took a close-up look at the slogans . . . Zowie!—what work!—and oh boy!:—"Boloneyphone Frazzles the Frying and Sure Shells the Crabs!"—"Let Boloneyphone Fill the Night for You and Your's mit Music!"—"Sunday Programmes Are Guaranteed at Great Volume! . . . Are a Riot of Recreation! . . . . When Baloneyphone Fills Your Fireside!"—"Does Your Neighbour Howl? . . . Baloneyphone Gets You Your Own Back! . . . Challenge Your Neighbour NOW!" Then some fool challenged me—said he wanted his money back, or . . . ! (Darn that pipe, anyway! But fags burn your lips, and cigar-getting gives you a pain in the fingers—if you're not quick on the upsnatch!).

15.00:—Put my head in a box with a hole in it, but saw nothing! Then I heard music—harps, it sounded like—so withdrew my head, pronto! Tried to date a slick jane in flannels—on the Cootyvision Stand—but found she had a moustache! Asked for an intro. to Kath. O'Dray, then found I had a new complaint—"Olympia Limp." (They shinned me, see?).

3.00 (Wednesday):—"Migawd, man—where-a you been?" "C-can't you guess?" "No! Can you?" "W-why, m'dear, I bin here all time—tune-in Shtates, see?" "Just like that?" "Jush li' that." "States, hey?—on the chest-o-drawers!"—FRISKY FRANK from FRISCO.

Facts and Figures

Components Tested in our Laboratory

BY THE PRACTICAL WIRELESS TECHNICAL STAFF

The Graham Farish "Max" Transformer

THIS is one of the new season's products, and is undoubtedly one of the most compact components which we have yet seen. Actual dimensions are: length 2¾in., breadth 1¾in., and overall height only 1¾in. The windings are arranged to form an auto-transformer, and the four terminals are numbered 1, 2, 3, and 4 (in place of the more usual P., H.T., G., and G.B.). The method of winding and the tapping-points have been so designed that it is possible to use this transformer

The new Max transformer manufactured by Graham Farish.

in a parallel-fed circuit, with the connections made to the terminals so as to obtain seven alternative ratios, namely 1-1, 1-2, 1-3, 1-4, 1-5, 1-6, and 1-7½. The transformer therefore has great utility for the home constructor and experimenter and should find many adherents on this score alone. The case is of bakelite, and although, as may be seen from the illustration, this is rather thick, the screw holes for mounting purposes are deeply recessed and eyeleted, so that the component may be mounted by a very short screw and no difficulty will be experienced on the score of being unable to find a sufficiently long screw for the purpose. In addition to its characteristics and general small dimensions, it has two other favourable points, the first being the very satisfactory terminals which are fitted and the second its low price. The latter is 4s. 6d., and the terminals have been previously described under the Graham Farish products, and they provide a really satisfactory contact which will not easily pull undone or come loose.

Formo Screened Paper Condenser

THIS is a completely new type of condenser, which has been produced exclusively for the home constructor and which will undoubtedly find many adherents during the coming season. The advance samples which we have seen are finished in grey cellulose, with a terminal inset into a paxolin disc at one end, and a short threaded portion with lock-nut at the other end. These two points form the two poles of the condenser, and thus when it is mounted on a metal chassis one connection is automatically made in the same manner as with the normal electrolytic condenser. There are two points of criticism which we might raise, although it is possible that these will be rectified in the finished product. The first is the length of the fixing thread, which is at present not sufficient to permit of the condenser being easily mounted on a wooden chassis, such as is used exclusively for our receivers. The second is the lack of a satisfactory identification of value. In the samples submitted this is scratched on the paxolin disc, and in the smaller values there is very little room, which prevents the value from being easily read by those whose eyes are not very keen. The name is printed on a paper band which is secured round the body of the condenser, and it would appear a simple matter to use part of this band for recording the capacity by means of a stamp. Apart from these two points, the condenser is very novel and will undoubtedly prove of great value in certain circuits where the screening will play an important part. The range at present covered, together with the prices, is given below :—

.1 mfd., 1s. 6d.	.5 mfd., 1s. 9d.
.2 mfd., 1s. 6d.	1.0 mfd., 2s.
.25 mfd., 1s. 6d.	2.0 mfd., 3s.

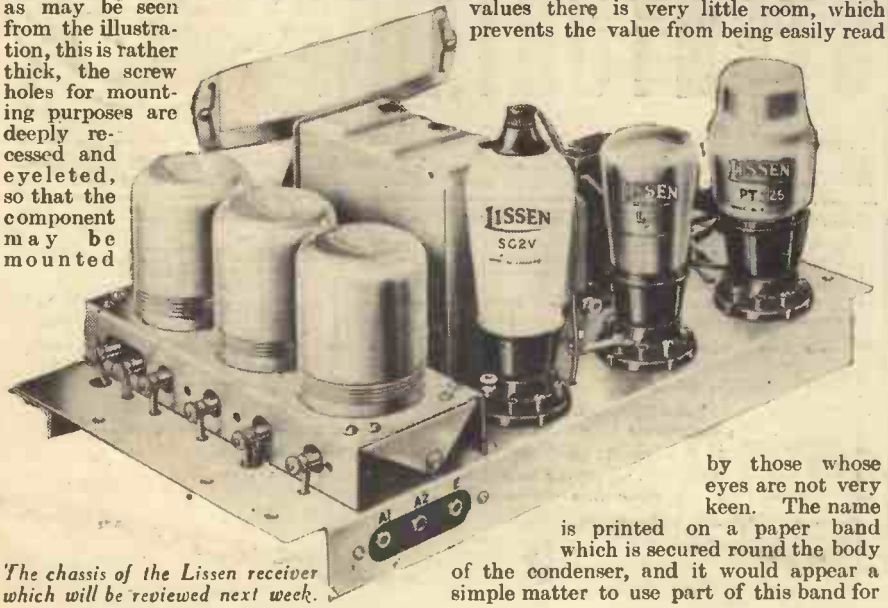
In addition to these condensers the new Formo range of components includes some further novelties, consisting of variable condensers, tuning dials, etc., and these are also very attractive items designed and manufactured exclusively for the home constructor. Test reports on the individual items will appear in these pages in due course.

Two of the new Formo shielded condensers.

A 300-Volt H.T. Battery

A NEW size of H.T. battery has made its appearance this season in the Siemens Full o' Power range, and this has a rating of 300 volts. It has been designed primarily for use with cathode-ray tubes as used in television apparatus, and for this purpose it is necessary to apply approximately 900 volts. Where mains are not accessible, or it is desired to have an absolutely smooth voltage supply, three of these super-voltage batteries are joined in series and thus the battery is supplied with only two sockets, positive and negative. In view of the risk which would attend the touching of these two sockets, the word "Danger" is clearly stamped and filled in red between the sockets, as may be seen in the accompanying illustration. The experimenter will find this battery of use for many other purposes where a high voltage is required, and the capacity of the battery is sufficiently large to warrant a very long life with a moderate load. The price is 30s. The size of the battery is 11¾in. by 2¾in. by 9in.

A 300-volt H.T. battery made by Siemens intended for use in connection with cathode-ray tubes.



The chassis of the Lissen receiver which will be reviewed next week.

RADIO CLUBS AND SOCIETIES

Club Reports should not exceed 200 words in length and should be received First Post each Monday morning for publication in the following week's issue.

INTERNATIONAL SHORT-WAVE CLUB (LONDON)

At the meeting of the London Chapter, held on August 17th, a very interested audience listened to a lecture entitled "Electrical Instruments." Such a subject was very much appreciated by the members who are enthusiastic experimenters.

The London Chapter also held a very successful field day on Westerham Hill, Kent, on Sunday, August 19th, where four receiving stations were installed. The winning station, under the leadership of F. Rand, 2AHC, obtained 173 points, and the runner-up, under J. H. Hunter, 2BJN, obtained 144 points. A. E. Bear, Secretary, 10, St. Mary's Place, Rotherhithe, London, S.E.16.

INTERNATIONAL SHORT-WAVE CLUB (LEICESTER CHAPTER)

A demonstration of short-wave receivers and apparatus is to be held at the Leicester Chapter's headquarters at 4B, Princess Road, Leicester, on Wednesday, August 29th, commencing at 8 p.m. C. Cramp, Hon. Sec., 49, Aveuue Road, Leicester.

INTERNATIONAL SHORT-WAVE CLUB (MANCHESTER CHAPTER)

The tenth meeting of the above Chapter was held at 75, Long Street, Middleton, on July 31st. As winter is now approaching, meetings will shortly be held more frequently. R. Lawton, Secretary, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, near Manchester.

CATALOGUES RECEIVED

To save readers trouble, we undertake to send on catalogues of any of our advertisers. Merely state, on a postcard, the names of the firms from whom you require catalogues, and address it to "Catalogue," PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8/11, Southampton St., Strand, London, W.C.2. Where advertisers make a charge, or require postage, this should be enclosed with applications for catalogues. No other correspondence whatsoever should be enclosed.

DAGENITE ACCUMULATORS

THE makers of Dagenite accumulators, Messrs. Peto and Radford, have had fifty years' experience in the manufacture of accumulators which they make for all purposes. The range includes low-tension accumulators for all types of sets, special unspillable types for portable receivers, and trouble-free high-tension accumulators for home sets, amplifiers, and transmitters. With few exceptions, Dagenite accumulators are fitted with a patented "tell-tale" device which indicates at a glance when the accumulator needs re-charging, thus enabling the user to avoid damage to the cells due to over-running. Certain types are fitted with specially prepared plates for taking a short first charge. This enables such cells to be made ready for service by filling with acid of the correct gravity and giving a first charge, the duration of which will be only approximately one half of the time required for an ordinary long first charge. Readers desirous of obtaining dependable and consistent service from their accumulators are advised to write for a neat folder issued by Peto and Radford giving full particulars and prices of the Dagenite range.

MULLARD MASTER VALVE GUIDE

THE Mullard Wireless Service Co., Ltd., have just issued their valve guide for the season 1934-35. It is a twenty-four page booklet of handy pocket size, with a very attractive three-colour cover, and contains all that the user requires to know about standard types of Mullard receiving valves.

In the first part of the booklet are given brief descriptions and prices of the latest two-volt, A.C., and Universal receiving valves, together with some very interesting illustrations showing constructional details. Following this a large section is devoted to tables containing full characteristics and operating data of the complete range of Mullard receiving valves, including earlier types which may be required for re-valving. The information contained in this section includes filament current, characteristics, anode and auxiliary grid voltages, appropriate values of grid bias voltage, and the corresponding values of anode current. In the case of output valves the optimum load is also given. A useful innovation is a column giving an indication of the type of base fitted to each valve, and another column stating whether the valve is obtainable with metallized bulb. Copies of this valve guide are now available.

PRACTICAL LETTERS FROM READERS

The Editor does not necessarily agree with opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender not necessarily for publication.

"Points about Servicing II"

SIR,—I agree with Mr. Whitehouse that good meters are essential in radio, but why does he contradict himself in his article on page 521? He says, "*cheap* voltmeters, *having only a few hundred ohms per volt*, do not give readings that are anywhere near accurate." Yet, according to his circuit, the meter he illustrates has a full scale deflection of 5 m/a. at 10 volts—a total resistance of 2,000 ohms or 200 ohms per volt. Why does he condemn the one and not the other? Other things being equal, the current drain is the same in both cases; does he not mean that the calibration of a moving-coil meter is more uniform than that of a moving-iron one?—S. HODGE (Glasgow).

[*It would appear that Mr. Hodge has overlooked the fact that a high resistance meter is employed, and shunts and series resistances are included in the circuit.*—ED.]

Suggestions Wanted

SIR,—I have settled in Palestine and am desirous of purchasing a wireless set which will tune in to England with ease, as this is the best means at my disposal for keeping in touch with England. Palestine is approximately 1,500 miles from England and the atmospherics are bad. The climate is semi-tropical. The only English set I have noticed in Palestine does not, in my opinion, function as successfully as the set of G.E.C. (America), which is the most popular set here. I want an all-mains set that is retailed in England at about £25. My flat consists of very moderately-sized rooms, so that I shall sacrifice the strength of the set if it means deafening my neighbours and myself. I shall be obliged if readers will kindly let me have their suggestions.—"INQUIRER" (Jerusalem).

"Local Experts"

SIR,—In reply to "A Service Man's" letter published in the August 4th issue, regarding "Local Experts," I make this appeal to the goodness of these "experts" on behalf of *all* service men.

A service man should be an expert and able to hold his own against any amateur—practice makes perfect. An amateur does not have that constant practice, and all service men do not give the public that service which they expect and should have from the professional; too often a mere boy is sent along to find out the cause of the trouble, one who cannot even talk intelligently about wireless, let alone trace an obscure fault.

What other public service would think of sending an untrained representative to attend to work upon the result of which future orders may depend. Satisfaction is not given, therefore, the next time the "Local Expert" is consulted—with possibly better results and less expense.

I would like to bring to "service man's" notice some instances of service men's work that have come to my notice within the last six months. A man bought a 4-valve portable S.G., det., and 2 L.F. set with a verbal guarantee for one year. The set after six months gave out, the service man was notified, called, took the set away, left nothing for them to listen in by, and returned one month later, and explained that the S.G. and det. valves had had to be renewed also the H.T. and grid batteries. The daughter of the house was the only one at home when the set was returned, and she paid the bill he presented.

When the owner returned he was far from satisfied with either the set or the bill, and promptly wrote the service man who, by the way, lived twenty miles away. To this letter he received no reply and further letters were unanswered. I was asked to give the set a look over (I am not a local expert) but refused to do so until the guarantee had expired.

Two further letters written, were ignored, by this time the guarantee had expired, so I then examined the set.

The new detector valve (?) was an R.C. valve transformer-coupled to the first L.F. stage, including a power valve transformer-coupled to the output stage in which a general purpose valve was fitted. The R.C. valve was left and the transformer replaced by R.C. coupling—the two last valves changed over—this being the cheapest way out and everything was satisfactory. This took only half an hour.

In another case, a relation of mine bought an all-mains set, from a well-known firm, on the instalment plan; a man was sent to fix it. The purchaser having no knowledge of wireless asked me to drop in and pass an opinion on the set.

After transferring the aerial lead from the earth terminal to the aerial, and *vice versa*, I told her that for the money I considered the set satisfactory.

Everything was O.K. for several months, until, on dropping in casually one day, I noticed the set was perched angle-wise across the dresser, partly on and partly off, the part having no support on the dresser was tied round with rope attached to a hook above. Upon asking the reason for this, I was informed that the set had ceased to work some weeks previously; the dealers had been notified, the service man arrived, switched on the set, turned it slowly round until the set was in position described above, when a station suddenly came in. The service man then explained that the set must be turned in the direction of station it was desired to receive.

Well, I switched on the set and tuned in a station, then gradually moved the set back to its original position when signals suddenly ceased with a click. I then took hold of the aerial lead-in and gently shook it. Terrific crackling arose with intermittent reception. Removing aerial plug, I found it to be one of the type in which the lead-in is threaded through an insulating head, and pin screws in clamping wire between top of pin and inside of head.

This pin had become slightly unscrewed, so that when the set was in its original position the aerial lead was forced off the head of pin. The fact of turning the set slightly caused wire to be forced in the opposite direction on to the top of pin.

The same service man, when asked about an extra speaker so that reception could be heard in other rooms, said that it was impossible as speaker was incorporated in the set, and it was only in sets having the speaker separate that this could be done.

These may be exceptional cases, but they only go to show that the heads of firms are not sufficiently careful in their choice of employees.—OBSERVER (Southampton).

CUT THIS OUT EACH WEEK.

Do you know

—THAT the use of a "squelch" valve has not become popular in this country, although still in use in America.

—THAT a separate small cone, cemented inside the existing cone of a moving-coil loud-speaker, will often add to the frequency range.

—THAT the field of a variable condenser can have a considerable effect upon the working of a circuit.

—THAT for the above reason an air-spaced variable condenser should not, generally speaking, be substituted for a bakelite dielectric condenser.

—THAT the use of a very small horn loud-speaker for very high notes is finding increasing adherents in the search for quality.

—THAT the general term given to this small type of speaker is a "tweeter."

—THAT moulded knobs from scent bottles, etc., make novel control knobs if they are filled with plastic wood in which is embedded a metal bush with locking screw.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL WIRELESS. *Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor,* PRACTICAL WIRELESS, *Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.*

Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Radio in Ceylon

SIR,—On page 426 of your June 30th issue, there appeared an article entitled "Radio in Ceylon." We agree, in the main, with your contributor's comments, but it is hardly correct to say that "the whole of the Ceylon Broadcasting Service is run . . . with the modest income of about Rs. 5,000." It would be more correct to say "with a modest sum of about Rs. 5,000 *for provision of programmes*." With regard to the statement that the Ceylon market is held by the Japanese and Americans, the Customs returns do not support this. During the eighteen months ending June 30th, 1934, wireless goods to the value of Rs. 173,284, have been imported into Ceylon; of this total, the United Kingdom was responsible for Rs. 127,960; U.S.A. for Rs. 7,321; and Japan Rs. 5,796. It is conceded, however, that unless British manufacturers take steps to bring their sets before the notice of the Ceylon buying public, they will assuredly lose the market to the United States, Germany, and Japan.

There were two other inaccuracies in the article. Firstly, the duty on *foreign* wireless goods is 25 per cent. (not 15 per cent.), while the duty on *British* wireless goods is 15 per cent. (not 12 per cent.). Secondly, wireless sets for use in Ceylon should be capable of covering a range of from 15 metres to 500 metres (not 400 metres). —H. H. BENNELL (London, E.C.)

LET OUR TECHNICAL STAFF SOLVE YOUR PROBLEMS

REPLIES TO QUERIES and ENQUIRIES by Our Technical Staff

The coupon on Page iii of cover must be attached to every query

If a postal reply is desired, a stamped addressed envelope must be enclosed. Every query and drawing which is sent must bear the name and address of the sender. Send your queries to the Editor, PRACTICAL WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton St., Strand, London, W.C.2.

SPECIAL NOTE

We wish to draw the reader's attention to the fact that the Queries Service is intended only for the solution of problems or difficulties arising from the construction of receivers described in our pages, from articles appearing in our pages, or on general wireless matters. We regret that we cannot, for obvious reasons—

(1) Supply circuit diagrams of complete multi-valve receivers.
(2) Suggest alterations or modifications of receivers described in our contemporaries.
(3) Suggest alterations or modifications to commercial receivers.
(4) Answer queries over the telephone.

Please note also that all sketches and drawings which are sent to us should bear the name and address of the sender.

The New Long-wave Station

"I am building a Quality local station set, but am in a little doubt regarding the new long-wave station that will be in operation soon. I do not wish to incorporate long waves if possible. Will the B.B.C. still broadcast on the medium-wave National? If so, will the quality be up to the same standard as the new long-wave station?"—J. P. (Kilburn, N.W.)

So far as we understand at present, the intention is for the Droitwich transmitter to take the place of the London National transmitter, which will close down. The higher power of the long-wave transmitter will no doubt enable you to obtain better quality, although much depends upon the circuit which you intend to use. The National programme will be radiated from Droitwich, and the Regional programme from the London station, so that you will need medium and long waves to receive the alternative programmes. It would be advisable, however, to wait for full details concerning the B.B.C.'s proposals regarding this before deciding upon your proposed one-band receiver.

Modifying a Choke

"I have built a one-valve set, and although I get very good results on the medium waves, I do not get very loud signals on the long waves. I turn the reaction knob and the set does not oscillate so well on long waves, and it seems that the H.F. choke is not large enough. I am not certain regarding this, however, and should like your remarks concerning whether I should add any turns to it, and, if so, how many."—T. R. (Leicester).

We do not think your solution is the correct one, as the choke should function satisfactorily on both bands. It is more probable that the reaction winding is not large enough, and if you use a coil with a single reaction winding, operating on both bands, the coil may be spaced too far from the long-wave grid winding, or if separate reaction windings are in use, then the long-wave reaction winding needs more turns. Try also an increase in H.T. voltage.

Screening a Pick-up

"I am using an electric motor with a pick-up which has a bakelite case. I get a lot of hum from the motor and I prove this by putting the pick-up over the turntable with no record, and you can hear the hum very loud. Can I stop this in any way?"—Y. W. S. (Brighton).

A great deal depends upon the type of motor. If this is of the standard type it may be found quite sufficient to place a sheet of metal or metal foil between the motor-board and the motor and to earth this. If, however, the motor is of the synchronous type this will not be of any use and the only satisfactory solution is to use a pick-up fitted with a hum-bucking winding. It may be found possible to cut a disc of thin tin, as large as the turntable, and to mount this on the present turntable, and to cover the tin with felt, but the difficulty of providing an effective earth connection to the tin renders the device rather impracticable.

Condenser Punctures

"I have made up a mains unit which has been in use for about eight months. I am, however, continually having trouble with the smoothing condenser across the choke. This keeps on puncturing, and I have always used a good make. Can you tell me how to prevent this trouble? Does it indicate that the mains unit is wrong somewhere?"—J. N. (Doncaster).

The most likely cause of the trouble is that the condensers which you are buying are not of the correct rating. We presume that by the term "across the choke" you mean between the H.T. positive and negative lines. The condenser should be of the type designed for a working voltage which is double that of the rectified output of the rectifier. By using this rating you will be assured of freedom from breakdown. You have probably chosen condensers having a rating equivalent to the rectified output.

A Dual Circuit

"I have been looking up some old books, and have seen a reference to dual circuits. I cannot find any trace of the meaning of the word "dual," and should be glad if you could explain it."—K. H. Y. (Durham).

The term is another expression for what was once a popular circuit, namely, the Reflex circuit. In this arrangement a valve acted as an H.F. amplifier as well as an L.F. amplifier, rectification being carried out by means of a crystal detector. An article is included in this issue dealing with this type of circuit, and you will no doubt find this of interest.

Valve-holder Adaptor

"I am very keen on experimenting and have an experimental three-valve set. I want to be able to use seven-pin H.F. pentodes and Class B output valves, etc., without the necessity of changing the valve-holders and the wiring each time. Can you tell me whether there is on the market a four- or five-pin to seven-pin adapter which could be plugged into my present four-pin holder so that the seven-pin valve could go into the adaptor without any more wiring?"—W. R. (Bolton).

We do not know of any adaptor of this type. The extra connections required with the seven-pin valve will necessitate certain connections to the adaptor and you will not be able simply to remove a four-pin valve and plug in a seven-pin valve in the adaptor without making other modifications.

Messrs. Bulgin are marketing a multi-valve tester in which a similar arrangement is employed, and the new Avodaptor employs a 7-pin adaptor and plug.

Probably the Bulgin parts will be obtainable separately at a later date.

A Low-pass Filter

"Can you please explain what a low-pass filter is? The term was mentioned in one of your articles recently, and I find that the whole purport of the article is lost to me as I cannot understand what is meant by this type of filter."—W. S. (Bodmin).

A low-pass filter is an arrangement of impedances, designed to pass low frequencies and to stop high frequencies. The name is therefore self-explanatory. A typical example of a low-pass filter is to be found in the anode circuit of a standard detector valve, where an H.F. choke is wired in series with the anode and a fixed condenser is joined between anode and earth. The choke prevents the passage of high frequencies, but permits low frequencies to pass on, and the condenser acts in the opposite manner. The smoothing circuit of a mains unit (choke and condensers) is a similar example.

THE QUERIES COUPON APPEARS ON PAGE iii OF COVER.

Miscellaneous Advertisements

Advertisements are accepted for these columns at the rate of 3d. per word. Words in black face type and/or capitals are charged double this rate (minimum charge 3/- per paragraph). Display lines are charged at 6/- per line. All advertisements must be prepaid. Radio components advertised at below list price do not carry manufacturers' guarantee. All communications should be addressed to the Advertisement Manager, "Practical Wireless," 8, Southampton Street, Strand, London.

PREMIER SUPPLY STORES

Offer the Following Manufacturers' Surplus New Goods at a Fraction of the Original Cost; all goods guaranteed perfect, carriage paid over 5/-, under 5/- postage 6d. extra, I.F.S. and abroad, carriage extra. Orders under. 5/- cannot be sent C.O.D. PLEASE SEND FOR ILLUSTRATED CATALOGUE POST FREE.

STUPENDOUS Purchase of Set Manufacturers' Stock. All electric 3 Valve (S.G. Det. Pen.) Set in Walnut Cabinet with moving-coil speaker 200-250 volt 40-60 cycles. Chassis built. 200-2,000 metres with 4 valves, £4/19/6.

ALL Electric 3-stage Amplifiers, 200-250v., 40-60 cycles, 10 watts, undistorted output, complete with 5 valves, £7/7/-. Suitable speakers, pick-ups and microphones can be supplied.

SPECIAL Offer of P.M. and Energised M.C. Speakers. Purchased from well-known gramophone co.

TYPE 10971C, 9in. diameter, 2000 ohm field, 40/70 m.a., Pentode transformer. Handles 4 watts, 17/6.

TYPE 10955F, 9in. diameter, 11,650 ohm field, 20/30 m.a. auditorium type power transformer. Handles 10 watts, 30/-.

TYPE 10955H, 9in. diameter, 115 ohm field, 350/400 m.a., auditorium type Pentode transformer. Handles 10 watts, 30/-. A.C. Kit, 20/-.

TYPE 4480, 9in. diameter, permanent magnet. Handles 4 watts. 7 ohms speech coil, 13/6. Multi-ratio transformer, 4/6 extra.

PREMIER SUPPLY STORES Announce the Purchase of the Complete Stock of a World Famous Continental Valve Manufacturer; all the following standard mains types, fully guaranteed, 4/6 each, H.L., power, High, Medium, Low magnification, Screen Grid. Directly heated Pentodes, 1 watt, 3 watt and 4 watt A.C. outputs.

THE following Type, 5/6 each; 350 v. and 500 v., 120 milliamp full wave rectifiers, 2¼ watt indirectly heated pentode.

THE Following American Types at 4/6; 250, 227, 112, 171, 210, 245, 26, 47, 24, 35, 51, 58, 55, 37, 80 and the following types, 6/6 each; 42, 77, 78, 25Z5 36, 38, 83, 39, 44, 53, 6A7, 6B7, 2A5, 2A6, 2A7, 2B7, 5Z3, 6C6, 6A4, 6D6, 6F7.

866 Valve, Filament 2.5 v., Filament Current 5 amp Plate volts, Inverse peak 7,500, Plate Current Peak 0.6 amps. Price 25/-.

ELIMINATOR Kits, including transformer, choke, Westinghouse metal rectifier, T.C.C. condensers, resistances and diagram, 120v., 20 m.a., 20/-; trickle charger 8/- extra; 150v., 30 milliamps, with 4v., 2-4 amps. C.T., L.T., 25/-; trickle charger, 6/6 extra; 250v., 60 milliamps with 4v., 3·5 amps, C.T., L.T., 30/-; 300v. 60 m.a. with 4 volts, 3-5 amps., 37/6; 200v. 100 milliamps, 39/6.

PREMIER chokes, 40 milliamps, 25 hys., 4/-; 65 milliamps, 30 hys., 5/6; 150 milliamps., 30 hys., 10/6; 60 milliamps. 80 hys., 2,500 ohms, 5/6; 25 milliamps, 20 hys., 2/9.

ALL Premier Guaranteed Mains Transformers have Engraved Terminal Strips, with terminal connections, input 200-250v., 40-100 cycles, all windings paper interleaved.

PREMIER H.T.7 Transformer, output 135v. 80 m.a. for voltage doubling, 8/6; 4v. 3-4a., C.T. L.T. 2/- extra; with Westinghouse rectifier giving 200v. 30 m.a., 17/6.

PREMIER H.T.8 and 9 Transformers, 250v., 60 m.a., and 300v. 60 m.a. rectified, with 4v. 3-5a. and 4v. 1-2a. C.T. L.T. and screened primary, 10/-; with Westinghouse rectifier, 18/6.

PREMIER H.T. 10 Transformer, 200v. 100 m.a.; rectified with 4v. 3-5a., and 4v. 1-2a. C.T. L.T., and screened primary, 10/-; with Westinghouse rectifier, 19/6.

PREMIER Mains Transformer, output 250-0-250v. 60 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.) with screened primary, 10/-.

PREMIER Mains Transformers, output 350-0-350v. 90 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 1-2a. (all C.T.) with screened primary, 10/-.

PREMIER Auto Transformers, 100-110/200-250v. or vice versa, 100-watt, 10/-.

WESTERN ELECTRIC Mains Transformers, 300-0-300v. 65 m.a., 4v. 1-2a., 4v. 2-3a., 6/6; 500-0-500v. 150 m.a., 4v. 3-5a., 4v. 2-3a., 4v. 2-3a., 4v. 1a. C.T., 4v. 1a. C.T., 19/6; 1,000-0-1,000v. 250 m.a. 4v. 3a. C.T., 4v. 3a. C.T., 49/6; 2,000-0-2,000v. 150 milliamps, 49/6.

SPECIAL Offer of Mains Transformers, manufactured by Phillips, input 100-200v. or 200-250v., output 180-0-180 volts 40 m.a., 4v. 1 amp., 4v. 3 amps., 4/6; 200-0-200v., 4v. 1a., 4v. 3a. 4/6.

PREMIER L.T. Charger Kits, consisting of Premier transformer and Westinghouse rectifier, input 200-250v., A.C., output 8v. ½ amp., 14/6; 8v. 1 amp., 17/6; 6v. 2 amp., 27/6; 30v. 1 amp., 37/6; 2v. ½ amp., 11/-.

B.T.H. Truspeed Induction Type (A.C. only) Electric Gramophone Motors. 100-250v.; 30/- complete.

COLLARO Gramo. Unit consisting of A.C. motor, 200-250v. high quality pick-up and volume control, 49/-; without volume control, 46/-.

SPECIAL Offer B.T.H. Gramophone Motors, A.C. and D.C., 100/250v., 30/-. Listed £3/3/-.

EDISON Bell Double Spring Gramophone Motors, complete with turn-table and all fittings, a really sound job, 15/-.

SPECIAL Offer of Wire Wound Resistances, 4 watts, any value up to 50,000 ohms, 1/-; 8 watts, any value up to 15,000 ohms, 1/6; 15 watts, any value up to 50,000 ohms, 2/-; 25 watts, any value up to 50,000 ohms, 2/6.

WIRE Wound Potentiometers, 15,000 ohms, 1/6; 50,000 ohms 2/-; 500,000 ohms, 3/-; 1,000 ohms wire-wound semi-variable resistances, carry 150m.a., 2/-.

CENTRALAB Potentiometers, 400 ohms 1/-, 50,000, 100,000, ½ meg. any value, 2/-; 200 ohms, wire wound, 1/-.

POLAR Star, manufacturers' model, 3-gang condensers, fully screened, 7/6; with trimmers.

AMERICAN Triple Gang 0.0005 Condensers, with trimmers, 4/11; Utility Bakelite 2-gang 0.0005 screened with uniknob trimmer, 3/6; Polar Bakelite condensers, complete with knob, 0.00015, 0.00035, 0.0003, 0.0005, 1/-.

ORMOND Condensers, 0.0005 2-gang semi-shielded, 2/6; brass vanes, with trimmers, 3/6. British Radiophone 110 kc/s Intermediate, 3/-.

MAGNAVOX D.C. 152, 2,500 ohms, 17/6; D.C. 154, 2,500 ohms, 12/6; D.C.152 magna, 2,500 ohms, 37/6, all complete with humbucking coils; please state whether power or Pentode required; A.C. conversion kit for above types, 10/-; Magnavox P.M. 7in. cone, 18/6.

RELIABLE Canned Coils with Circuit, accurately matched, dual range, 3/- per coil; ditto, iron-cored, 3/6.

RELIABLE Intervalve Transformers, 2/-; multi-ratio output transformers, 4/6.

HELLESEN 8 mf. Electrolytic Condensers, 435 volts working, 2/3; Mershon ditto, 1/9.

POLAR 2-gang Uniknob Condenser with Trimmers and complete slow-motion Dial, 6/-.

WESTERN ELECTRIC Condensers, 250v. working, 2 mf., 1/-.

T.C.C. Electrolytic Condensers, 550v. working, 650v. peak, 8 mf., 4/-.; 4 mf. or 8 mf. 440v. working, 3/-; 15 mf. 50 v. working, 1/-; 25v. working, 25 mf., 1/3; 6 mf. 50v. working and 2 mf. 100v. working, 6d.

T.C.C. Condensers, 250v. working, 2 mf., 1/9; 2 mf. 1,500v. working, 6/-.

H.M.V. Condensers, 400 v. working, 4+4+1+1+1+1+0.1+0.1+0.1+0.1, 4/9; 4+2+1+1+1+1+0.5, 3/9.

DUBILIER Condensers, 8 or 4 mfd. dry electrolytic 450v. working, 3/-.

VARLEY Constant square Peak Coils, band-pass type BP7, brand new in maker's cartons with instructions and diagrams, 2/4.

VARLEY H.F. Intervalve Coils, BP8, band-pass complete with instructions in original cartons, 2/6.

SCREENED H.F. Chokes by One of the Largest Manufacturers in the Country, 1/6.

PREMIER British-made Meters, moving irons, flush mounting, accurate, 0-10, 0-15, 0-100, 0-250 m.a., 0-1, 0-5 amps, all at 6/-.

A LARGE Selection of Pedestal, table and radiogram. cabinets, by best manufacturers, at a fraction of original cost, for callers.

THE Following Lines 6d. Each, or 5/- per dozen.—Chassis valve holders, 5-, 6-, or 7-pin, screened screengrid leads, any value 1-watt wire end resistances, wire end condensers, 0.0001 to 0.1 Bulgin 3-amp. main switches. Cyldon capacitors, double trimmers.

PREMIER SUPPLY STORES

20-22, High St., Clapham, S.W.4. Telephone: Macaulay 2188. Nearest Station, Clapham North Underground.

VARLEY Constant Square Peak Band-Pass Coils, type B.P. 5. Complete, all accessories and instructions. New, boxed, 2/4. (List, 15/-.)

POLAR 3-gang Star Minor Condenser, full screened, trimmers, new, 7/-. (List, 18/9.)

ERICSSON 3-1 L.F. Transformers, new and guaranteed, 2/3. (List, 17/6.)

COLLARO Electric Gramo Motor A.C. 100-250v. with pick-up and volume control. Auto Start and Stop. Brand new. List price, £4. Our price, 47/6 carr. paid. Bankrupt set maker's stock.

VOLUME Controls, 50,000 ohms, New, 1/3.

CELESTION Energised M.C. Speaker, 2,500 ohms. Model D.C. 2054, with universal transformer. List price, £2/5/0. Our price, 12/6.

PIONEER RADIO CO., LTD., Coptic Street, London, W.C.1. Museum 9607.

ELIMINATORS, 25 m.a., D.C., 10/-, A.C., 21/-. Transformers 3-1, 5-1, 1/9. British-made valves, H.F., L.F., and Dect., 1/9. Power 2/-. S.G. 5/-. Carriage Paid Cash with Order.—Radio Electrical Supplies, 237, Camberwell Road, London, S.E.5.

SOUTHERN RADIO'S Bargains.—Set manufacturers' guaranteed surplus.

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FRAME Aerials.—Lewcos dual wave superhet, 9/- each (list 27/6).

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