THE MONITOR—THE 2ND. STAGE!

Practical and Amateur Wireless

AND PRACTICAL TELEVISION

3D. EVERY WEDNESDAY

Edited by F. J. CAMM

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February 22nd, 1936.

Making a Useful VALVE VOLTMETER

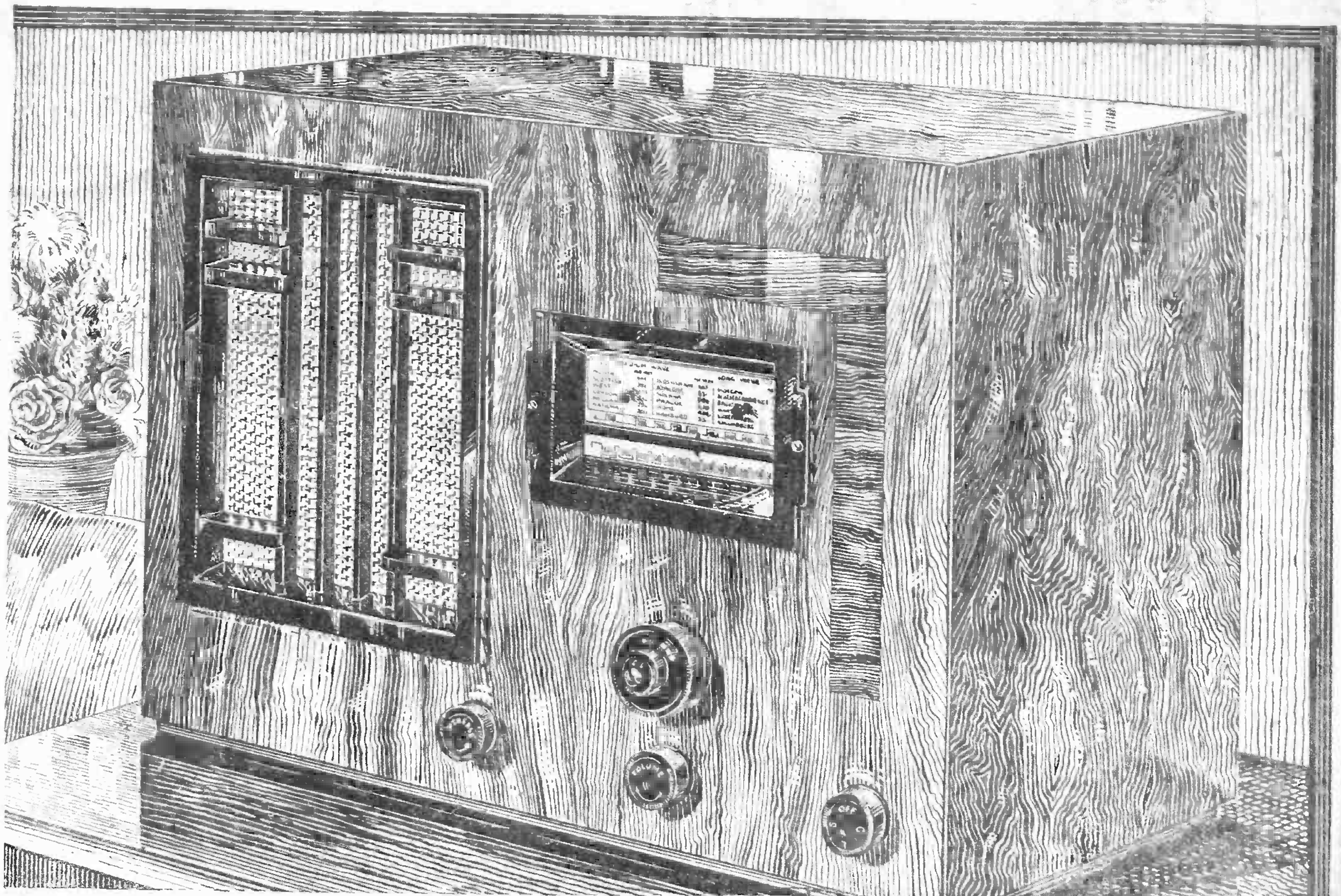

Illustration shows model 368. Models 363 and 369A are generally similar.

F. J. CAMM'S MONITOR—TOP OF ITS CLASS!

Practical and Amateur Wireless
Edited by F. J. CAMM
Technical Staff: W. J. Delaney, H. J. Barton Chapple, Wh.Sch., B.Sc., A.M.I.E.E., Frank Preston.
VOL. VII. No. 179. February 22nd, 1936.

ROUND *the* WORLD *of* WIRELESS

Radio for the London Fire Brigade

EXPERIMENTS are being carried out in radio transmission from cars equipped with apparatus to permit communication with headquarters when the brigades are dealing with fires. This would supplement the telephone system now existing between H.Q. and the various stations.

Improved Reception of U.S.A. Broadcasts

THE recently resumed series of B.B.C. broadcasts featuring *Five Hours Back* from the U.S.A. have demonstrated the progress made in the reception of transatlantic transmissions during the past few months. At the B.B.C. Tatsfield station three separate receivers coupled to three different aerials are used to pick up the broadcast, and by this means much fading has been eliminated.

Round-the-World Radio

PREPARATIONS are being completed by the B.B.C. for a special celebration of Empire Day in May. Not only shall we be taken round the Empire, but may be given as an " extra " a relay of a broadcast from the new Radio Jerusalem station.

Proposed Move of Radio-Paris

WITH the inclusion in the French State Network of the new P.T.T. high-power Paris station, the Authorities are seriously thinking of transferring the transmitter of Radio-Paris to a site in central France and thus provide a long-wave relay for the whole country.

Radio Television and Publicity Programmes

IN view of the cost of the new television service in France, a suggestion has been made to the Ministry of Posts and Telegraphs to defray a portion of the expenses by organising sponsored televised programmes, at least during the months in which experimental tests are to be made. Offers from publicity firms have already been made, by which the Government can be guaranteed a fixed monthly revenue of half a million francs!

Interesting Statistics

ACCORDING to figures published in the United States of America, it is computed that at present there are 56,221,784 radio receiving sets in the world. Of these North America alone owns 25,632,881, with Europe a close second possessing 22,897,981. Asia is represented by 2,553,396, of which Japan's share is 2,190,040. South America, notwithstanding its great number of stations, can only show 1,088,374, and Africa is last on the list with 209,201.

Proposed Television Transmissions in Sweden

FOLLOWING the example of Germany, England, and France, Sweden is shortly to have its first television service.

ON OTHER PAGES

The *Svenska Radioaktiebolaget* has erected two transmitters at Stockholm and will shortly carry out tests.

The Salzburg Music Festival

THIS annual festival will take place in the period July 25th-August 31st, and as in previous years the most important concerts and operatic performances will be broadcast through most European and American transmitters. Four of the leading conductors have already been engaged for the Festival; they are Toscanini, Weingartner, Bruno Walter and Monteux.

Another Station for Paris

RADIO MIDI (Beziers), is to close down shortly and the plant transferred to the French capital. It has been acquired by a Paris daily, *Paris Soir*, which is the third newspaper to own a private broadcasting station. The Radio Midi transmitter will be re-erected at Rueil-Malmaison. Whether it will be allowed to work on its wavelength of 209.9 metres (1,429 kc/s) is a moot point, as the channel is very close to that used by the Eiffel Tower, considering the respective sites of the stations. The power employed is 300 watts.

Radio Telegrams to Yachts

ON 163.3 metres, the channel used by coast stations for calling ships, the G.P.O. transmits telegrams in telephony at specified times, for the benefit of yacht owners whilst cruising. The service is carried out by all post office coast stations with the exception of those at Rugby and Portishead.

Nearly 7½ Million British Listeners

WITH a total population in Great Britain and Northern Ireland of roughly forty-six million inhabitants, the British Isles can boast of nearly 7½ million licensed listeners. Taking an average of four persons to each receiver, we can assume that thirty million people hear the B.B.C. programmes daily.

At the Bottom of the Band

FREQUENTLY below the Bournemouth and Plymouth channel (203.5 metres), broadcasts may be occasionally picked out of the welter of small Belgian and Spanish stations working on wavelengths between 201 and 203 metres. Of these the Belgian are the most frequently heard, and from their calls may be identified as Radio Wallonie (Binche) on 201.8 metres, Châtelineau-Charleroi, Radio Anvers (Antwerp) on 201.1 metres, which have different time schedules.

Viennese Nights

WITH the New Year, the Austrian stations have extended their daily transmission until midnight, and offer, from roughly G.M.T. 22.25, dance music relayed from the most popular hotels, restaurants, and palais de danse in the capital. In addition, on certain nights a visit is made to some of the resorts of the Prater, the " Earl's Court " of Vienna.

ROUND the WORLD of WIRELESS (Contd.)

INTERESTING and TOPICAL PARAGRAPHS

Festival Choral Society's Concert

THE Birmingham Festival Choral Society is one of the oldest musical societies in Birmingham, having been founded ninety-one years ago, and it has nearly 200 active members. For its annual concert this year, to be broadcast on February 20th from the Midland Regional, the City of Birmingham Orchestra has been engaged, and the work to be given is Dvorak's cantata "The Spectre's Bride." Harold Gray is the conductor. The soloists are May Blyth (soprano), Parry Jones (tenor), and Watcyn Watcyns (bass)

THE NEW COSSOR ALL-MAINS SET.

Eddie Hapgood, the well-known back of the Arsenal football team, and International captain, tunes in on his new Cossor receiver. This is an all-mains model (367) and is priced at 9½ guineas.

"Blackbirds" in Carlisle

THOSE two popular coloured comedians, Battie and Porter, who scored such a hit in "Blackbirds," head the variety bill at Her Majesty's Theatre, Carlisle, on February 26, when an excerpt from the show will be broadcast to Northern listeners.

"I Remember"

IN the series of personal recollections from Wales and the South West, the fifth talk will be given by E. J. Plaisted in the Western Regional programme on February 22nd. Mr. Plaisted has fought two Parliamentary Elections: the Isle of Thanet in 1929, and Salisbury in the General Election last November. He worked in the coal-mines for twenty-five years and has been unemployed for five years. Mr. Plaisted possesses a voice with unusual vibrations, and it was always a source of amusement to his parents in his childhood when the sound of his voice caused objects to vibrate in sympathy. In his own words: "When I came near the bath in my home my voice invariably made the bath give forth a terrific rumble."

Dance Music

BILLY GAMMON and his Star Players, a recent addition to broadcasting dance bands in the Midland region, will give a programme in the evening of February 27th. This combination has had contracts for resident seasons at Cheltenham and Malvern. It was begun by Billy Gammon and Ken Lancey. Three of the members—Ken Lancey, Al Brown and Jim Donnelly—also form a vocal trio.

Debate on Land Settlement

THE question whether land settlement offers an effective alternative to mass unemployment has been brought into prominence by the talks given by S. L. Bensusan after a rural survey of the Midland counties. Under the chairmanship of Lord Phillimore, this question is to be discussed at the microphone in the Midland regional programme on February 21st. Mr. Bensusan leads off for the affirmative, and is seconded by Robert Aldington, J.P., who farms in the Vale of Evesham, and has contested the Evesham Division in the Labour interest. For the negative, the first speaker is a well-known authority on agricultural economics, C. S. Orwin, Director of the Research Institute of Oxford University, author of a number of books, and a former President of the Agricultural Section of the British Association. His seconder, F. S. Milligan, comes from the North. He has had experience of urban unemployed at a social service centre on Merseyside.

Rugby Town Band

THIS popular band, which was founded sixty years ago, will give a programme of marches and overtures; William Compton will conduct. One of the oldest Midland broadcasters, Charles Dean, of Birmingham, is to sing a group of baritone solos. Just before the band concert, which will be given on February 28th, one of the popular original entertainments by Ronald Gourley, who is a Warwickshire man, will be broadcast.

Cinema Organ Recital

THIS relay of a cinema organ, which is to be broadcast on February 24th, is a new feature in Midland programmes. The Forum Theatre, Coventry, was opened about sixteen months ago, and Lew Harris, then at the Commodore, Southsea, was appointed organist. Mr. Harris, who is to give this recital, studied under Reginald Foort at Bournemouth. In childhood he was keenly interested in music, but on leaving school he qualified as a marine engineer and draughtsman, and it was not until he was twenty-two that he became a professional musician as pianist-leader of the resident dance orchestra at the Empress Rooms, Portsmouth. In the days of the British Broadcasting Company, he broadcast two pianoforte recitals from the Bournemouth station.

Music-hall Memories

MIRIAM FERRIS, the popular music-hall artist who has been well known in radio for many years, will, on February 22nd, produce the second of her amusing programmes called "Music-hall Memories." The idea of these programmes is based on Miriam's unique connection with Savoy Hill and early radio. They entail considerable research work. This versatile artist first has to find out what Savoy Hill music-hall stars will be available on a certain date and then to discover what material they used in those far-off days. After arranging her programme—with frequent disappointments owing to cancellations—she, eventually, writes up her commère material and presents it to the Variety Director at St. George's Hall. As a rule the whole programme is perfectly balanced and a gem of production, for Miriam Ferris knows her music-hall from "gods" to stage door. She will have the assistance of Alma Vane, now so well known for her "All Girls Together" parties, Tommy Handley, Jean Allistone, Foster Richardson, John Rorke, and Florence Oldham.

SOLVE THIS!

PROBLEM No. 179.

Jackson built a 465 kc/s superhet, but was disappointed to find that the selectivity was not as good as he had expected. What steps should he take to improve the selectivity? Three books will be awarded for the first three correct solutions opened. Address your letters to the Editor, PRACTICAL AND AMATEUR WIRELESS, Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, London, W.C.2. Envelopes must be marked Problem No. 179 in the bottom left-hand corner, and must be posted to reach this office not later than the first post Monday, February 24th, 1936.

Solution to Problem No. 178.

The whistle which troubled Jones was due to the fact that the internal wiring of the L.F. transformer was reversed. Reversal of the external leads to the G. and G.B. terminals of this component should provide a remedy.

The following three readers successfully solved Problem No. 177, and books are accordingly being forwarded to them: William Eastham, 172, Wellington Rd., Eccles, Manchester; G. Wooldridge, The Limes, South Rd., Stourbridge, Worcs.; J. A. Milton, 45, Tyzack Rd., Sheffield 8.

An Efficient Valve-Voltmeter

An Easy-to-build Portable Type of Meter which has Many Useful Applications to the Keen Experimenter

Fig. 1.—The complete instrument being placed in the neat carrying case.

MANY constructors purchase a simple type of voltmeter in order to make various test readings of batteries under working conditions and also in order to ascertain whether or not the valves in a receiver are receiving the correct working potentials. But a voltmeter, or a measurer of voltages, can be made to perform a very much greater service than this, provided that it is designed in a certain manner. In a cheap meter, the visible indication of the voltage applied across the ends is carried out by the movement of a piece of iron suspended in a magnetic field, and, owing to the fact that the resistance of a meter of this type is very low, a high current is passed and thus in many circuits and tests a false reading is obtained.

A better class of instrument employs a moving coil connected to the pointer, and this particular type of instrument is wound to a very high resistance and thus operates with a very small current. Consequently, it has a much greater field of utility and can be used under more general conditions. There are, however, certain conditions under which even an instrument of this nature is of little use, and then it is essential to call to aid the valve voltmeter, in which the measurement of voltage is carried out by applying it to the grid circuit of a valve and measuring the change in anode current.

How it Operates

For the benefit of those to whom this type of instrument is not familiar, it may be briefly stated that a valve gives a certain emission of current when the filament, grid, and anode voltages are adjusted to definite values. Any change in any one of these voltages will result in a change in the current flowing in the anode circuit, and it is found that by maintaining the filament and anode voltages constant and changing the applied grid voltage, it is possible, by a simple law, to ascertain the degree of change in such voltage simply by the change in the anode current.

The usual difficulty with such an instrument is to maintain a constant setting of the anode current with a deteriorating H.T. or L.T. supply, and this is one of the defects which has been overcome in the instrument now being described. This has been developed in the Graham Farish Laboratories and, in view of the novelty of the complete arrangement, we thought that readers would be interested in the design, and accordingly we have made arrangements to publish the full wiring diagram and constructional details.

A Portable Instrument

From the photographic illustrations it will be seen that a neat carrying case is provided, and this may be obtained, with the necessary internal supporting structure, direct from Messrs. Graham Farish. The valve which is employed is of the screen-grid type, and it has been found that this

(Continued overleaf)

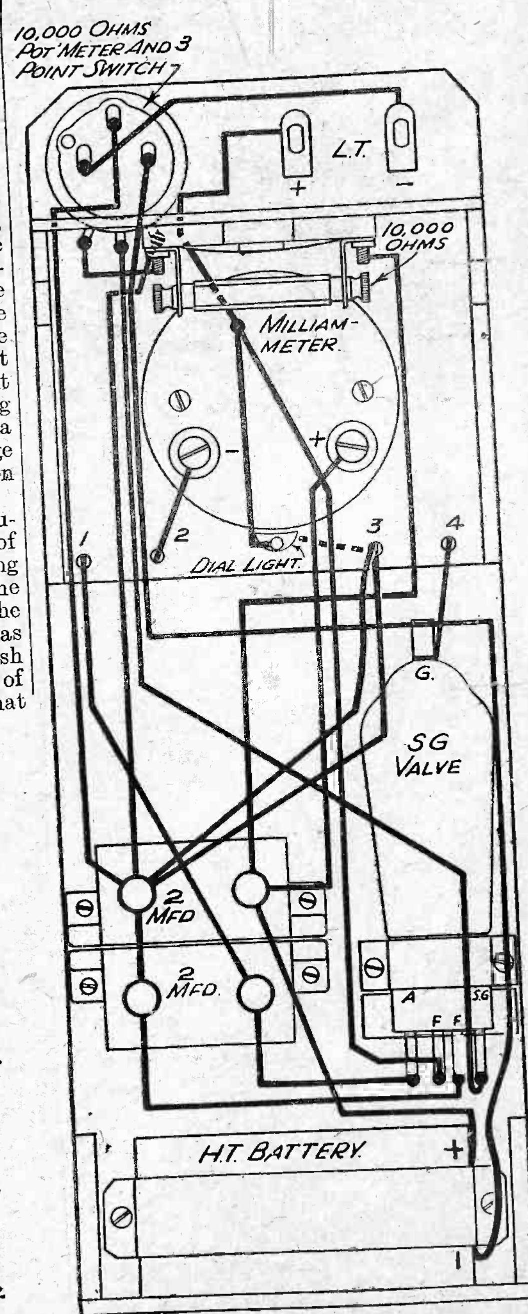

Fig. 3.—Wiring diagram showing all the connections.

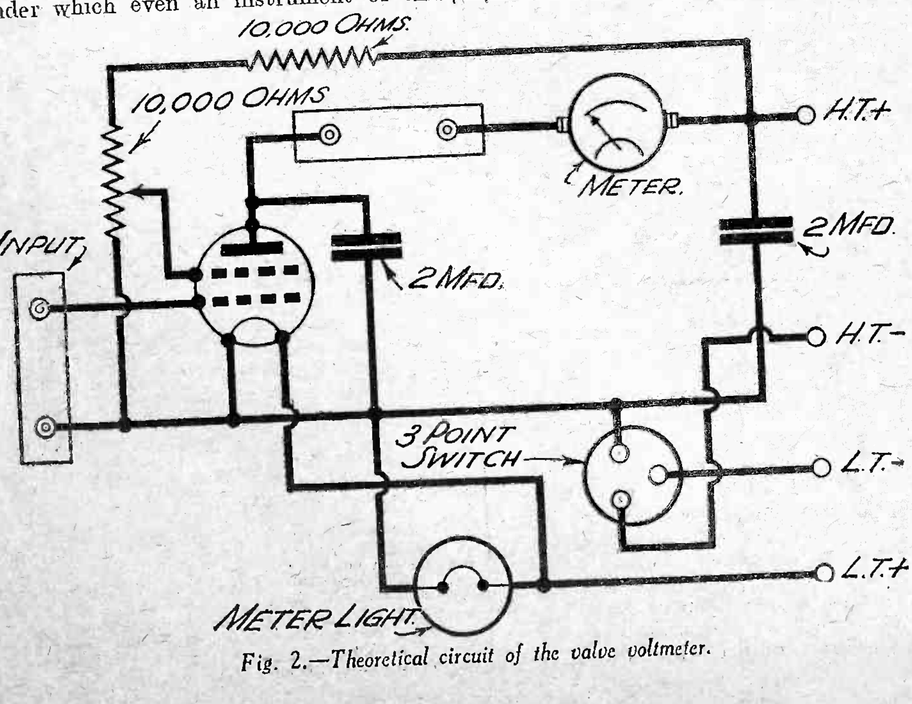

Fig. 2.—Theoretical circuit of the valve voltmeter.

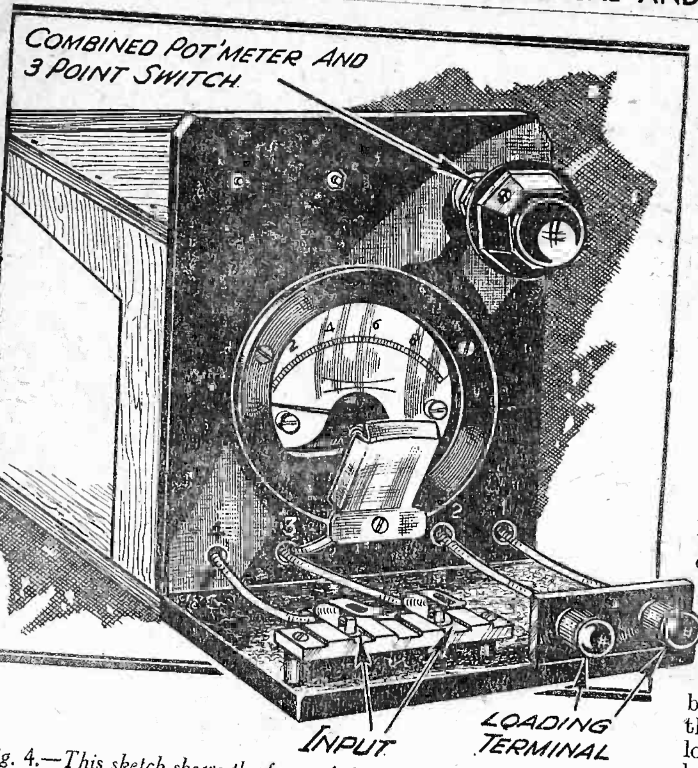

Fig. 4.—This sketch shows the front of the instrument and the connections to the input and loading terminals.

may be employed with a varying screen voltage to compensate for the falling H.T. supply, as well as to set the meter to zero for use when taking measurements. No valve-holder is specified for this valve, and it is simply held on the bottom of the cabinet by means of a strip of brass or other metal bent across the ceramic base of the valve and screwed direct to the wooden cabinet base. The leads from the valve are soldered direct to the valve legs and the terminal cap, and to simplify construction these connections should be made before the valve is placed in position.

The small L.T. battery is held in position on the upper shelf, whilst the H.T. battery must be retained by means of a clip constructed from a strip of brass or aluminium. This may be made up to any individual idea, provided that it holds the battery firmly in place, and, as this will not need renewing very often, there is no necessity to introduce any form of quick release.

The Dial Light

In order to facilitate easy reading, the original model is provided with a small bulb enclosed in a metal screen arranged at such an angle that the light is thrown on to the face of the meter. This light is operated from the L.T. battery and, in view of the very small capacity of this battery, it is essential that the additional load imposed by the lamp shall be extremely low. A special bulb must, therefore, be employed, and on no account should a pocket lamp bulb be used for the purpose.

Using the Voltmeter

The meter may be employed for measuring the output voltages of amplifying stages, pick-up characteristics, valve characteristics, and numerous other purposes where it is essential that the additional load of the measuring instrument must be extremely small. The source to be measured is joined to the two clips, and the reading obtained on the meter is used as the basis for computing the voltage applied across the clips. In the instrument as described the maximum reading is 2 volts, and it is, therefore, necessary to ascertain roughly the magnitude of the applied voltage in order that suitable adjustments may be made to accommodate any voltage which is in excess of that shown by the meter. For this purpose, the anode circuit is broken and two terminals are provided on the front of the instrument. Normally, for the low ranges these terminals will be kept bridged by means of a piece of wire, and in the original model this is mounted on a small strip of paxolin provided with two lugs, so that it may easily be slipped into the terminals and held in position. Resistances may be similarly mounted for inclusion in this part of the circuit in order to modify the range, and a number may be made up on small strips and kept handy, with a suitable indication on the paxolin strip to indicate the difference in the meter reading. A calibration chart would be very useful with this instrument in order to avoid working out each range, and these may be included in the form of a small booklet kept with the instrument.

LIST OF PARTS FOR USEFUL VALVE-VOLTMETER

One "Laurence" cabinet (Graham Farish).
One SWG2 short-wave valve (Graham Farish).
One 10,000-ohm combined potentiometer and 3-point switch (Dubilier).
One milliammeter type M.C.1 (Bulgin).
One terminal mount "Pop" with two terminals (Graham Farish).
One Formo clip mount (Formo).
Two 2-mfd. fixed condensers (Graham Farish).
One 10,000-ohm Ohmite resistance and holder (Graham Farish).
One low-consumption dial light (Graham Farish).
One 2-volt dry cell, type Gel-Cel PRP3 (Exide).
One H.T. battery, Type X.325 (Exide).
Wire, strip, brass, screws, etc.

PROGRAMME NOTES

"Tale Twisting"

WEST COUNTRY folk who had such extraordinary experiences to tell listeners in the programme called "Tale Twisting" on January 29th last will come again to the microphone on February 26th, to tell of the adventures they have had in the interval. Honest John Plym is flying back from the Pacific so as to be in time to spin his latest yarn, and perhaps the item of greatest West Country interest will be the story of King Arthur and what he did with the Round Table. "Tale Twisting" will be repeated on February 27th in the Regional programme.

Theatre Variety

A RELAY of a variety bill on February 26th from Aston Hippodrome will be preceded by reminiscences of the history of this theatre, which has been a home of variety since 1908. The Aston Hippodrome is under the same ownership as the Coventry Hippodrome, and Charles Shadwell, who conducts the orchestra at the latter theatre for broadcasting, is also in charge of the music at the Aston theatre. The resident conductor is Ernest Moss. The theatre has recently been renovated so as to provide up-to-date amenities but without sacrificing the intimate atmosphere of the old music-hall. In the variety bill to be broadcast, Henschel Henlere is the chief turn.

"The Dreaming Man"

THIS is the title of a play, by Leonard Crabtree, which will be broadcast from the Regional on March 5th, and from the National on March 6th. The spirit of the play is very similar to the now famous radio comedy "Matinée." In this case, a rather Wellsian character, the same type of man as the hero of "The Purple Pileus," rather disgruntled with his life both domestically and otherwise, experiences in an intermittent dream one summer afternoon a more complete wish fulfilment of worldly success than most of us are able to conjure up in similar dreams. The audience goes with him in the impossible and entertaining situations which his dreaming mind conjures up, as he leaps to wealth and power without having to undergo any of the intermediate processes which are unavoidable in the world of real fact. The producer, Lance Sieveking, is going to treat the play in somewhat the same manner as he treated his radio version of "Emil and the Detectives," where the nightmare in the train attracted so much attention among listeners. The fact that the hero is dreaming will be conveyed in a most convincing manner.

"Nets in the Sea"

THE second talk in the series called "Nets in the Sea," under the general editorship of Lieutenant W. B. Luard, will be given on February 28th in the Western Regional programme. This series of talks deals with West Country fishing. In Cornwall there are about two thousand men employed in various forms of fishing, of which the pilchard drift fisheries, the herring fishery, long-lining, and shell fishing (crab, lobster, and crayfish) are undoubtedly among the best known.

Police Musicians

THIRTY-FOUR Yorkshire police constables, constituting the Military Band of the City of Sheffield Police, will broadcast from the Leeds studios on February 25th. The band was originally formed as a brass band; it passed out of existence during the War, and in 1926 was reorganised as a military combination. In 1933 Major F. S. James, the Chief Constable, secured the appointment of E. W. Hesse, of the Seaforth Highlanders, as bandmaster. Since then the band has progressed and now ranks as one of the country's leading military bands. Sir Henry Coward, Sheffield's "Grand Old Man" of music, has always taken a keen interest in the band, and has on several occasions acted as its "guest" conductor.

Simple Wireless Arithmetic

It is Not Necessary to be a Mathematician to Make the Few Simple Calculations Entailed by Wireless Constructional Work, and This Article Deals With the Most Important of the Calculations Involved. By FRANK PRESTON

THERE are many constructors who do not enjoy their hobby to the full because they will not take the small amount of trouble necessary to enable them to make the few simple calculations required to determine, say, the correct value for a decoupling or bias resistance, the wavelength range which can be covered when using a certain coil and variable condenser, or the sizes of resistances required to form a fixed potentiometer. It is often thought that the arithmetic involved is of a difficult nature, or that the equations are for mathematicians only, whereas the calculations are often a good deal simpler than those required to draw up a cricket analysis or in working out the sums that are regularly done at school by boys of twelve; the only real difference is that a little knowledge of wireless practice is required in addition to that of arithmetic.

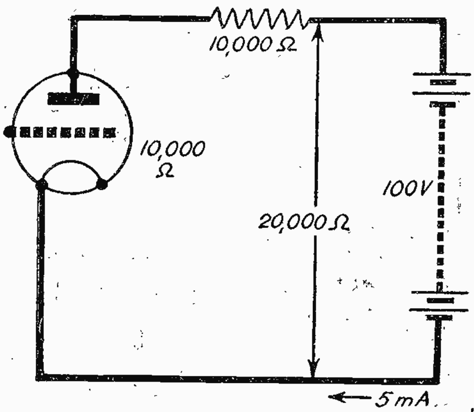

Fig. 1.—A simple circuit which shows the relationship between current, voltage and resistance.

Ohm's Law

Of all the calculations that must be made time after time that in connection with resistance values is the commonest, as well as being the easiest. All calculations involving resistance, current and voltage, are based on Ohm's Law, which states that the current flowing in a circuit is always equal to the voltage causing the flow divided by the resistance which tends to oppose it. Thus, if a voltage of 100 were applied to the simple circuit shown in Fig. 1, the current passing through it would be 100 divided by 20,000, which is 1/200 of an amp. It is generally more convenient to work in terms of milliamps, which are one-thousandths of an amp., so that the figure becomes 5 m.A. The simple circuit shown is typical of all valve anode circuits, and the fixed resistance might be a coupling resistance or it might represent the resistance of a transformer or other component.

The formula for Ohm's Law which we have just used is written, in mathematical terms, thus: $I = \frac{E}{R}$, where I is the current in amps., E is the voltage, and R is the resistance in ohms. This simple and useful formula can be re-written in at least two other ways in order to make it more convenient when the voltage or resistance is required, the other two factors being known. For example, we could write: $R = \frac{E}{I}$, or $E = I \times R$.

Bias Resistance Value

Let us see how it works out when we want to find the value of the bias resistance shown in Fig. 2. In this case it is known that the current passed by the resistance (the anode current of the valve) is 10 m.A., and that the required voltage drop across the resistance—the bias voltage—is 20. The required resistance is obviously found by dividing 20 by 10 and multiplying by 1,000 (to change the milliamps into amps.), and the answer is 2,000 ohms.

A SPECIAL ARTICLE FOR THE BEGINNER. FACTS AND FIGURES SIMPLIFIED.

Now suppose that in the circuit shown in Fig. 1, we know that 5 milliamps is required to flow through the valve and that the resistance of the valve is, say, 5,000 ohms, while the anode resistance has a value of 10,000 ohms; we want to know the voltage necessary to ensure the correct current. All that we need to do is to multiply the current in amps. by the resistance in ohms, and we get 5/1,000 × 15,000, which is 75 volts.

Once we have seen these applications of Ohm's Law it is not difficult to apply it to all resistance, voltage and current calculations, when two of the values are known and the third is required.

Resistance-Wattage Rating

There is another application of Ohm's Law which must be used when it is required to find the correct wattage rating for a resistance. Power, in watts, is actually the product of the voltage and the current, in amps., but we often know the current passing and the resistance value of, say, a coupling resistance, without knowing the exact voltage dropped across the resistance. But it is not difficult to see from the above equations that wattage can be determined from the formula: $W = I^2R$. In words, this formula reads: the wattage is equal to the current in amps. multiplied by itself and by the resistance in ohms. Thus, in Fig. 3 we have a resistance value of 25,000 ohms and a current of 10 m.A.,

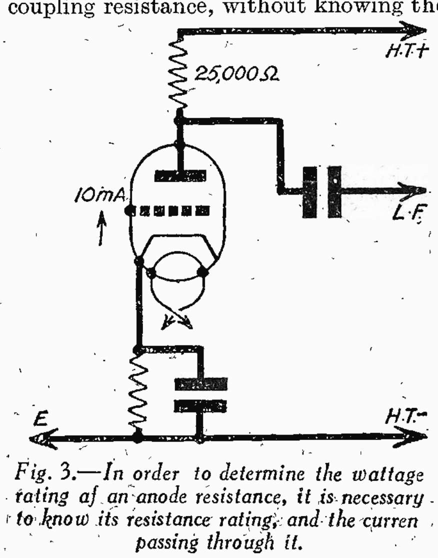

Fig. 3.—In order to determine the wattage rating of an anode resistance, it is necessary to know its resistance rating, and the curren passing through it.

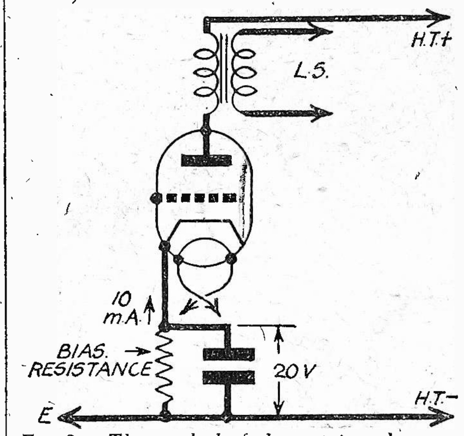

Fig. 2.—The method of determining the correct value of a bias resistance can be understood by reference to this circuit.

or 1/100 amp. We see, therefore, that the power in watts which is dissipated (or lost) is 1/100 × 1/100 × 25,000, or $\frac{25,000}{10,000}$ which is obviously 2.5 watts. Having made this calculation we know that the resistance used in this circuit must be rated at not less than 2.5 watts, and we should generally use a 3-watt component to provide a sufficient factor of safety; a resistance of lower wattage rating would be liable to burn out in use, due to the resistance being overloaded.

It might not be clear to some readers how the expression I^2R was found from the original Ohm's Law equations to be the same as ER—voltage multiplied by resistance—or, in other words, how I^2 was found to be the same as the voltage drop. But we

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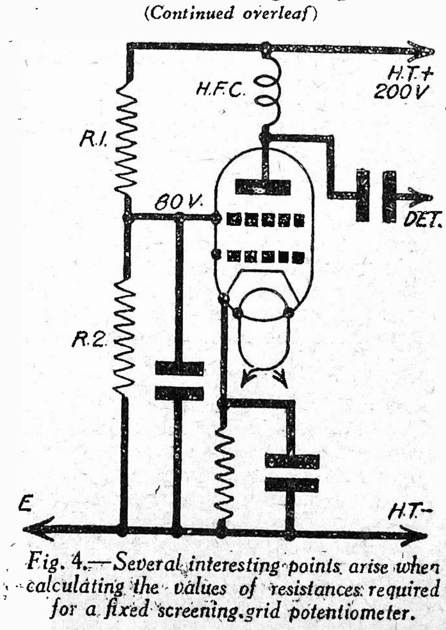


Fig. 4.—Several interesting points arise when calculating the values of resistances required for a fixed screening-grid potentiometer.

SIMPLE WIRELESS ARITHMETIC

(Continued from previous page)

saw that the voltage drop (E) is equal to I multiplied by R, and if also we multiply this by I we get the expression I^2R.

Finding the Wavelength Range

Now let us turn to another simple piece of arithmetic which is not difficult to follow. Suppose it is required to find the highest wavelength that can be reached when a coil of 2,200 microhenries (a typical long-wave coil) is used in parallel with a .0005-mfd. tuning condenser. The wavelength is found by using the equation : wavelength $= 1{,}884\sqrt{L \times C}$ where L is the inductance of the coil in microhenries, and C is the capacity of the condenser in microfarads, the wavelength being in metres. We have first of all to multiply together the inductance and capacity, and then to find the square root of the result, and finally to multiply this by 1,884. Taking the first step we get 2,200 × .0005, or

$$\frac{2{,}200 \times 5}{10{,}000}$$

which works out to 22/20; when this is multiplied by 1,884 we get as the result 2,082.4, this being the wavelength in metres.

If the required wavelength and coil inductance were known, the correct capacity could be found by reversing the calculation, and in the same manner the correct inductance could be determined from a knowledge of the wavelength and capacity. These calculations are slightly more involved, however, and since it is rarely necessary to use them, we will not consider them further.

Screening-grid Potentiometers

In the opening paragraph mention was made of finding the values of resistance required in forming a fixed potentiometer, and this is a problem which often crops up in connection with an S.G. valve of which the screening grid is supplied from a potentiometer as shown in Fig. 4. If the screening grid did not pass any current, the two resistances would have values proportional to the maximum supply voltage and the voltage required. In other words, if the H.T. supply delivered a voltage of 200 and 80 volts was required for the screening grid, the upper resistance, marked R.1, could have a value of 60,000 ohms and the lower one, marked R.2, a value of 40,000 ohms. Alternatively, values of 30,000 and 20,000 ohms could be used. It will be seen from this that the first step is to decide upon the approximate total resistance; with a mains set a maximum value of 50,000 ohms is generally suitable, and with a battery set, 100,000 ohms can be used successfully.

In the above assumption of no current we simply made the lower resistance of such a value that its proportion to the total was the same as the proportion between the required voltage and the total H.T. voltage—2 to 5, but let us see what would happen if the screening grid passed 1 m/A. The voltage drop occasioned by the upper resistance would be 1/1,000 multiplied by, say, 30,000, or 30, and thus, the voltage actually applied to the screening grid would be 80 less 30, or only 50 volts. Consequently, either the resistance marked R.1 must be reduced in value, or that marked R.2 must be increased. This apparent peculiarity is due to the fact that the cathode screening-grid circuit is in parallel with the lower resistance, thus reducing its effective value. It is possible to evolve an equation from which the exact values of resistance could be determined, but it is generally better for the non-mathematical constructor to use trial-and-error calculations, and working on the lines indicated above, until suitable values are found.

Series and Parallel Resistances

In dealing with resistance calculations above we did not consider the effect of connecting resistances in series and in parallel. If resistances are placed in series the effective value is, as might be supposed, equal to the sum of the resistances. Thus, if resistances of 500, 1,000, and 20,000 ohms were joined in series, the total value would be 21,500 ohms. When they are joined in parallel the result is entirely different, and the effective resistance of the combination is, mathematically speaking, equal to the reciprocal of the sum of the reciprocals. This expression is simplified if written :

$$\text{Total R} = \frac{1}{1/R1 + 1/R2 - 1/R3}$$

etc. This means that if the three resistances mentioned above were connected in parallel the effective value could be found by adding together : 1/500, 1/1,000, and 1/20,000, which equals 61/20,000, and reversing this to 20,000/61, which gives the result as approximately 330 ohms. It will be noticed that this is less than the value of the smallest resistance.

Condensers in Series and Parallel

When two or more condensers are used together the effective capacity is found by reversing the methods described in respect of resistances. Thus, when condensers are joined in parallel, the total capacity is equal to the sum of the capacities of the individual components. When condensers are in series the resulting capacity is equal to the reciprocal of the sum of the reciprocals. If, for example, a .0005-mfd. condenser is connected in series with one of .0003-mfd., the resultant

$$\text{capacity is } \frac{1}{1/.0005 + 1/.0003}$$

$$\text{which is } \frac{1/8}{.0015} \text{ or } \frac{.0015}{8} \text{ which}$$

is .0002-mfd. approximately.

Popular Radio Turns

EDGAR WALLACE'S "On the Spot," "Mrs. Buggins Sees Stars," and the "Air-do-Wells" were the three most popular radio turns of the week ending December 14th according to the results of the second of the competitions organised by the Radio Co-operative Advertising Committee.

A play has again come out on top; in the first competition Clemence Dane's "A Bill of Divorcement" received by far the most votes. Radio comedians, who in the first week were accused of being dull and out of date, have made a triumphant come-back. More than 25 per cent. of the entrants favoured Variety performances, and specially commended the comedians.

Old-fashioned dance music was preferred to jazz; Geraldo's orchestra in "Dancing Through" and Hamer's in "Old Time Dance Tunes" had three times as many votes as Ambrose, Henry Hall, and Jack Payne. This apathy for modern dance music may be due to the fact that the best time for broadcasters was clearly established as between 8 p.m. and 9 p.m., when all the five most popular turns were on the air. Light classical music was much appreciated, particularly that in "The Table under the Tree."

Lord Snowden's account of Keir Hardie was the most popular talk. Otherwise there was little enthusiasm for talks or the news, though a number of women chose the announcement of the safety of the three girl hikers as the happiest turn. Several listeners regarded broadcast services as the most important item of the week.

HERE and THERE

B.B.C. Symphony Orchestra to Visit Leicester

THE B.B.C. Symphony Orchestra, under the direction of Adrian Boult, will appear twice in the provinces in the spring before starting on its Continental tour to Paris, Zurich, Vienna, and Budapest.

Its first visit will be to Leicester on March 11th, when Dr. Boult will conduct an attractive programme. Opening with Weber's Overture to "Euryanthe," a piece of romantic music that time has not robbed of its freshness and appeal, the orchestra will then play Beethoven's Sixth Symphony (the "Pastoral"), which will be the main item in the programme. In the second part, modern music will be represented by four numbers from Gustav Holst's "The Planets," and Ravel's "Pavane" and "Bolero," all of which works will afford the full B.B.C. Symphony Orchestra every opportunity to exhibit its fine qualities. The four Planets chosen are Mars, Mercury, Saturn, and Jupiter, representing the contrasting moods of ferocity, sprightliness, serenity, and joviality. Midland music-lovers will welcome especially this opportunity of admiring once again the B.B.C. Symphony Orchestra's rendering of "Bolero," which is being played on this occasion in response to a general demand. This brilliant orchestral "tour de force" brings a well-chosen programme to a fitting close.

Here is Stanelli, of Hornchestra fame, listening to his Cossor radiogram.

FOR THE EXPERIMENTER

SERVICING SETS FOR PROFIT

7—A Method of Calibration, and Some of the Uses of the Valve-Voltmeter Described Last Week are Dealt With in this Seventh Article of the Series

THE previous article in this series dealt with the theoretical considerations and constructional work necessary in the manufacture of a simple type of valve-voltmeter, and it is now proposed to show the method by which this instrument may be calibrated, and a scale produced to enable voltages of any frequency to be read on the 0-1 milliammeter incorporated in the multi-range meter.

It will be observed that we have provided a space on the front panel of the instrument or a calibration scale to be gummed on, and also, that a circular white paper scale is to be gummed to the panel under the knob of the 1-megohm multiplier potentiometer. Alternatively, if the surface of the panel is matt-finished aluminium, it is quite possible to omit these paper scales and draw the calibration points on the metal itself in Indian ink, afterwards covering the markings with a coat of colourless cellulose lacquer.

Before we commence calibration it will be necessary to procure a 6-volt accumulator, and a 250-ohm variable potentiometer. If it is inconvenient to get a 6-volt accumulator, four large-capacity dry cells may be used to supply the calibration voltage, as their voltage will remain reasonably constant with a current drain of 24 milliamperes, over the short period which we shall use to make measurements. The accumulator or dry cells, and the 250-ohm potentiometer, should be connected up as shown in Fig. 3, but the actual connection to one terminal of the voltage supply should only be made when calibration is in progress in order to limit the current drain imposed and maintain the voltage as stable as possible.

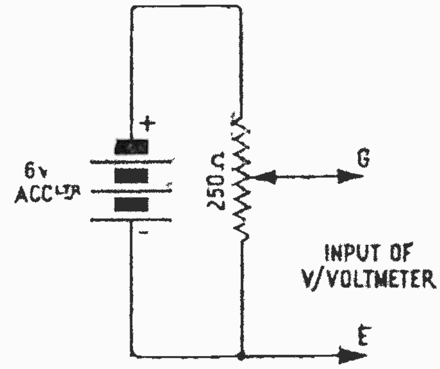


Fig. 3.—Theoretical circuit of the calibration apparatus.

Connections and Adjustments

Now connect the H.T., L.T., and G.B. batteries to the valve-voltmeter, making sure that the switch is "off" before doing so, and connect the milliamp. terminals of the universal meter to the "meter" terminals of the valve-voltmeter. The positive terminal of the universal meter should be connected to the "meter" terminal of the valve-voltmeter which is connected internally to the H.T. positive plug, and the switch should be set at 1 m.A. The multiplier potentiometer is then rotated in a fully anti-clockwise direction, *i.e.*, to ratio 1, and the 20,000-ohm variable anode resistance mounted on the base-board set until the whole of the resistance element is in circuit. Now switch on the valve-voltmeter, and it will be noticed that the pointer of the universal meter gives a little "kick" and then returns to a very low reading on the scale. It might be thought that the 25-ohm zero-adjusting potentiometer on the front panel should now be set so that zero was actually indicated on the milliammeter, but this is not the case, owing to difficulty in ascertaining the exact setting at which the milliammeter reads zero. A much more satisfactory method, and the one adopted in this case, is to adjust the 25-ohm potentiometer until the pointer of the milliammeter reads .02 milliamp., or, in the case of the Ferranti instrument used by the writer, to the first small division on the scale. This point will now become the zero point for the voltage scale of the valve-voltmeter, and the meter should always be checked before making measurements to ensure that, under the foregoing conditions, a true zero is indicated.

The valve-voltmeter should now be switched off, the multi-range meter disconnected, and its 10-volt D.C. range

(Continued overleaf)

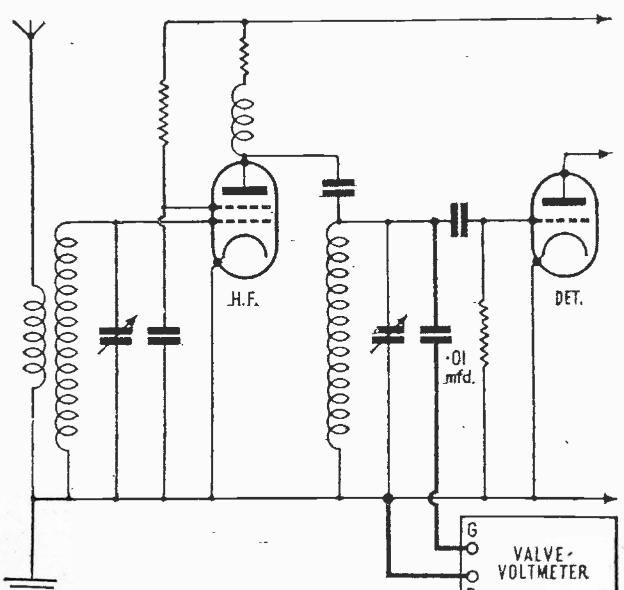


Fig. 1.—Method of measuring the voltage developed across a tuned circuit.

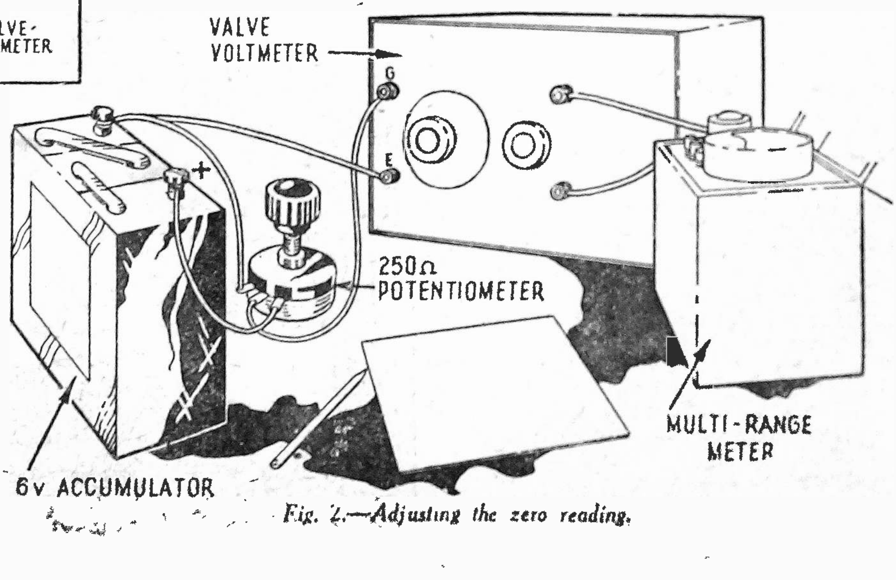


Fig. 2.—Adjusting the zero reading.

FOR THE EXPERIMENTER

(Continued from previous page)

connected across the leads from our calibrating voltage supply marked G and E, and the 250-ohm potentiometer varied until *exactly* 5 volts (or half-scale deflection) is registered. Then re-connect the universal meter to the "meter" terminals of the valve-voltmeter and the calibration leads G and E to their appropriate input terminals as shown in Fig. 2. Switch on the valve-voltmeter, and it will be found that the pointer of the universal meter will now give a reading somewhat higher than the zero reading which we previously selected. By rotating the 20,000-ohm resistance on the baseboard until the universal meter reads exactly 1 milliamp., the scale will be set to read 5 volts between .02 milliamps. and 1 milliamp. It may be advisable now to disconnect the calibration voltage by removing one of the leads from the accumulator, or dry batteries, and to note that the pointer of the milliammeter falls immediately to our previously selected zero position. If it does not do so, a slight readjustment of the zero-adjusting potentiometer will be necessary. The internal 20,000-ohm resistance will not need re-setting unless the characteristics of the

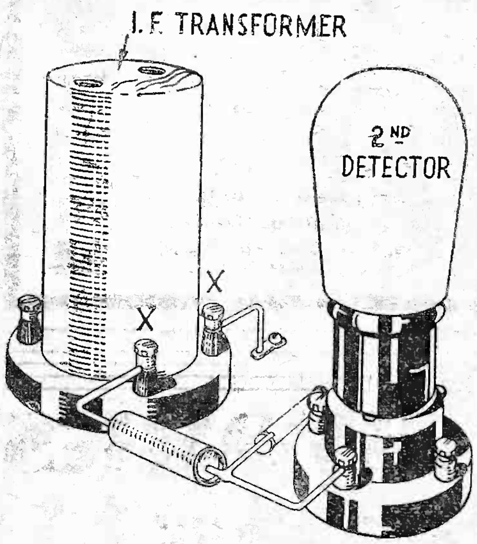


Fig. 4.—The meter is connected to the points XX, across the secondary of the I.F. transformer nearest the second detector.

P2 valve change considerably, and with the limited periods of use which we are likely to give the instrument, the life of the valve should be almost indefinite. It has also been found that the replacement of the valve has very little effect on the calibration of the instrument, provided the instrument is reset for zero and maximum readings whenever it is necessary to make this replacement.

Checking the Deflections

All that remains now is to make a note of the deflections given by the milliammeter for various voltages between 0 and 5 volts applied to the input terminals, and to obtain these readings the required voltage is selected by adjustment of the 250-ohm potentiometer with the 10-volt range of the universal meter connected across leads G and E and then noting the deflection given by the milliammeter when this voltage is applied to the valve-voltmeter. Some readers may care to plot a graph of these readings, and so be able to measure intermediate values directly, but I have found that the valve-voltmeter calibration is nearly linear, and a chart prepared in the same way as the capacity chart described and illustrated in Part 4 of this series is quite suitable.

Having prepared the graph or chart it only remains to calibrate the multiplier potentiometer. This is quite a simple matter, and should present no difficulty. First apply 5 volts to the input terminals of the valve-voltmeter so that a full-scale deflection is given by the milliammeter, then rotate the multiplier knob in a clockwise direction until the milliammeter indicates 2.5 volts in accordance with our calibration chart. Mark the position of the multiplier pointer and call it X2, then if the pointer is left in this position all the readings obtained on the valve-voltmeter will be multiplied by two, and we have extended our range to 10 volts maximum. Again rotate the multiplier knob until 0.83 volts is indicated and mark this point X6. This extends the

FOR THE NEW READER.

Previous articles in this series have dealt with a D.C. Multi-Range Meter; Adapting it for reading A.C. Voltages; and the Construction of a Simple Valve-voltmeter.

range to 30 volts maximum, and all readings obtained with the multiplier knob in this position must be multiplied by six. Finally, carefully rotate the multiplier until 0.5 volts are indicated, and mark this point X10. We shall now have extended the scale to 50 volts maximum, and all readings must be multiplied by ten.

Using the Valve-voltmeter

The calibration is now complete, and we can start to make use of the valve-voltmeter. It will not be out of place here to describe a few of the more obvious of its uses, although later articles in this series will describe it in use in conjunction with other apparatus. It will find its major application in the measurement of voltages in circuits where the current flowing is too small to actuate any other type of voltmeter; for instance, it will measure the voltage developed by a steady signal across the load resistance of a diode detector —a very useful guide to A.V.C. efficiency. Also it will measure accurately the voltage developed by a signal of any frequency across the secondary circuit of an output transformer.

To measure the radio-frequency voltages across tuned circuits it will be necessary to prevent the H.T. voltages from reaching the grid of the P2 valve, and mica condensers of .01 mfd. capacity should always be connected in series with the input terminals before making measurements in any circuit where D.C. currents are also flowing. When measuring A.C. voltages existing across, say, the anode resistance of an L.F. amplifier, the capacity of the condensers should be increased to as large a value as possible, though care should be taken to see that the insulation of the condensers chosen is high. Fig. 1 will show the connections to the valve-voltmeter when measuring the H.F. voltage developed across a tuned circuit, in this case the tuned-grid coil of an H.F. amplifier, and it will be noticed that the "G" terminal is connected to the high potential end of circuit and the "E" terminal to earth. This procedure should always be followed wherever possible because it is advisable to keep the metal case of the valve-voltmeter at earth potential to eliminate stray pick-up effects. The valve-voltmeter connected as shown in Fig. 1

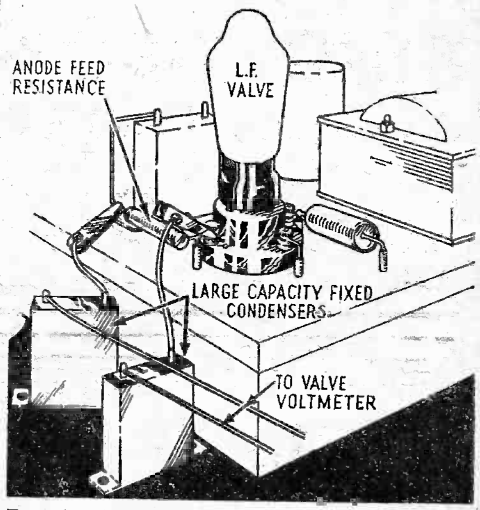


Fig. 5.—Measuring the A.C. volts developed across an anode feed resistance.

will actually measure the H.F. voltage presented to the grid of the detector valve if the set is tuned to a powerful local station, and by experimenting with the voltages applied to the H.F. valve and, incidentally, by making any modifications to the aerial coupling coils, etc., it is possible to see the result of such experiments as a gain or loss in voltage. The I.F. and frequency-changer circuit of a superheterodyne could also be experimented with using the meter connected across the secondary of the I.F. transformer nearest to the second detector (Fig. 4), and, if the magnification is not too great, it is possible to measure the amplification of a valve, and its coupling components, by first adjusting the voltage across its grid circuit by an H.F. volume control to 0.5 volts, then transferring the valve-voltmeter to the coil in the anode circuit of the same valve and again measuring the voltage. If the reading given is, say, 45 volts, then the stage gain is $\frac{45}{.5}$ or 90.

Many other uses will no doubt be apparent to the experimenter, but a fuller description of the uses of the instrument will be given when we have constructed an L.F. and H.F. oscillator to provide the energy required to make our measurements. The L.F. oscillator will be the subject of the next article.

Practical Television

THE TWO TELEVISION STANDARDS—I

By "CRITIC"

THE publication of the Television Committee's report dealing with the chosen site for the first high-definition television station in London, namely, the Alexandra Palace, together with the information that the two companies who are to supply the transmitting equipment (that is Baird Television, Ltd., and Marconi-E.M.I Television, Ltd.) are to work on quite different standards, has provoked considerable discussion. This has centred very primarily round the whole question of these two different standards.

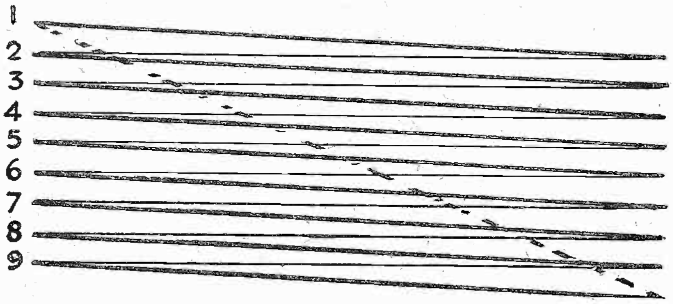


Fig. 1.—A nine line scan greatly exaggerated, showing how an orthodox sequential scan is built up.

Two Scanning Schemes

In the case of the former the system adopted is a picture definition of 240 lines scanned in sequence at 25 picture traversals per second and 25 complete frames per second. With the latter, however, it is proposed to use as a standard 405-line definition, 25 pictures per second interlaced to give 50 frames per second each of 202½ lines. It is further stated that the Committee have satisfied themselves that television sets can be constructed capable of receiving both sets of transmissions (they will be radiated alternately) without unduly complicated or expensive adjustment. The tenders submitted by the companies have been accepted, and each firm has furnished the technical information regarding the characteristics of the television signals radiated, so as to facilitate the design of receiving equipment capable of picking up these signals.

At first sight these rather bald facts appear quite satisfactory, but actually they have been instrumental in promoting many discussions, primarily in connection with the reason for "interlacing" and how such scanning operates, and also whether the higher line standard is a reasonable proposition at the moment.

The object of the scanning process is to dissect the scene or object to be televised into a series of lines sufficiently great in number that quite small detail will be recognisable in the received picture, assuming perfection in the scanners, amplifiers, radio transmitter, radio receivers, and final picture reproducers. Any form of amplitude or phase distortion in a single link of this chain of events will naturally mar the picture, but this is a factor which lends itself to remedy, once the technique which is involved is mastered.

Cinema Comparison

In assessing the pictorial or entertainment value of television, it is a common practice (although in my opinion a wrong comparison) to compare the results with modern talking films. In any cinema the detail which is observed on the screen depends very primarily upon the picture illumination provided by the arc lamp and optical system, the photographic grain of the film itself and, lastly, upon the mechanical precision with which the recording and reproducing processes work. The Society of Motion Picture Engineers published in March, 1934, the standard of performance laid down by the Projection Practice Committee in the following terms: "If the projector is in first-class condition and the intermittent movement and picture gate are properly adjusted, the picture jump should not exceed one-third of one per cent. of the picture height."

This standard can be interpreted literally in one or two ways. First of all, if the projector is in first-class condition, then working to the standard limits, an otherwise perfect picture is blurred to the extent of one-third of one per cent. or, in other words, any object which is so small that it occupies only one three hundredth of the total picture height is blurred into non-recognition. This precision is really an extremely good one, for taking, say, a screen 15ft. high the non-recognisable object only represents three-fifths of an inch. Furthermore, when seated in a cinema the audience is occupied in discerning (and no doubt enjoying) the central figure or figures, together with the action portrayed and the story being unfolded, and has little thought for such minute details as have been quoted.

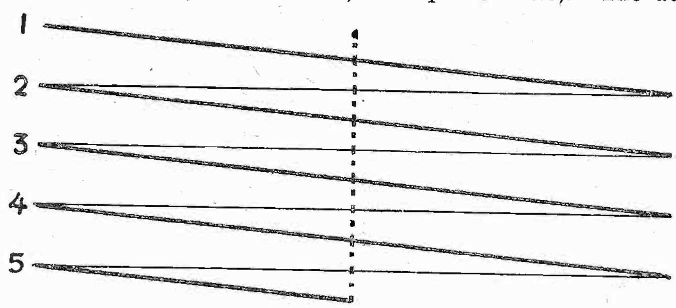


Fig. 2.—Showing how the first section of an intercalated scan is built up in a similar manner to the orthodox, or sequential, system.

Conversion to Television

The human element must, and will, play an important part in assessing the value of a television picture in terms of line definition, so if we convert the cinema standard to one of television, the limit is a loss of detail identity to the extent of one-third of one per cent., that is a single scanning line in a complete picture of 300-line definition (this being the reciprocal of one-third of one per cent.). When the Television Committee produced its report, their recommended minimum standard was given as 240 lines, which is only 20 per cent. below the cinema limit just explained.

Communication Channel

Quite apart from this, however, there is the all-important point of whether the wavelength which is to be used for the radiation of the television signals, that is 6.6 metres, is capable of accommodating a line definition standard which is in excess of 240 lines. While it is impossible to arrive at a hard and fast form of calculation to obtain the frequency spread involved in a complete television signal, it is a simple matter to see how the limiting factors impose conditions which must not be exceeded if satisfactory results are to accrue.

Considering for a moment a picture built up of alternate pure white and black strips, the scanning spot or exploring aperture will just fail to reproduce the effect or become blind in the television sense when the spot size is equal to the width of two strips (one black and one white). The actual response will be the average of these two extremes and a grey colour will be seen. When this condition occurs, it can be said that the extreme frequency limit has been reached. Taking as an example, therefore, a picture repetition frequency of 25 per second, picture ratio of four horizontal to three vertical and 240-line horizontal dissection, the limiting frequency becomes 240 x (240 x $^4/_3$) x 25 which equals 1,920,000 or 1.92 megacycles.

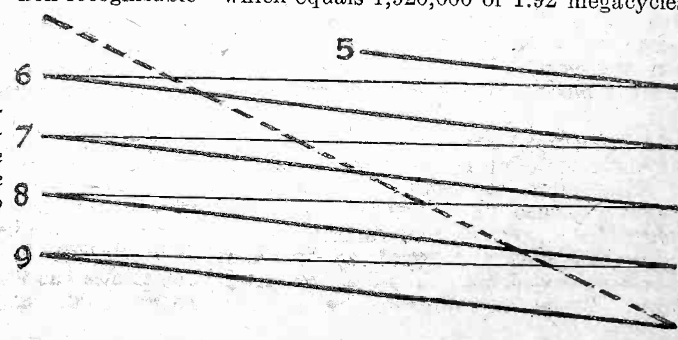


Fig. 3.—The second or intermediate section of an intercalated scan, where, on the completion of the final line trace, both time bases trip together.

On Your Wavelength

By Thermion

A Danger Signal

I SEE that music from one of the popular French stations is being heard by the signalmen in boxes on the Great Western Railway between Paddington and High Wycombe—and this in spite of the fact that there are no receivers in the signal boxes. The trouble is said by experts to be due to leakage from rediffusion wires attached to telephone poles near Wembley. It seems rather hard on the railway officials that even when at work they are unable to escape from the "plugging" of somebody's soap or some other item which is being mentioned in the English programmes from this particular station. Imagine the plight of a signalman, anxiously awaiting an "all clear" signal, but who receives instead an injunction from the announcer to take Green Pills, or who is confronted by the "strains" of a crooner. It must be enough to make him set all the signals at danger or to send the Cheltenham Flyer to Margate!

Assistance from a Club

AT a certain church in the Midlands the acoustics were so bad that it was found that only the front few pews were within range of the pulpit, and the padre, being one of the modern go-ahead ministers, decided that a good public-address equipment would prove extremely valuable. He also conceived the idea of fitting a standard receiver in the vestry so that on occasions when there was no service in the church he could pick up relayed services and similar items and broadcast them in the church. To obtain the money to purchase the necessary apparatus he hit on the original idea (?) of holding a bazaar.

The mothers met, and over the parochial cup of tea they decided that it would be an "ungodly act to place such a modern invention in the precincts of the church" and refused to help with the bazaar. Luckily there was a broad-minded reader of PRACTICAL AND AMATEUR WIRELESS in the district and he came to the aid of the padre by collecting discarded apparatus from the local club members, and a really excellent piece of apparatus is now installed.

A crooner in the signal box.

"Calling All Cars"

I WAS trying out a new short-waver the other night and whilst on the lower ranges I picked up a transmission from Police Headquarters in an American city, giving directions to a patrol car regarding a certain suspicious car in a shoppng centre. It was most thrilling, but I failed to hear the scream of the syren or the magic words of the movies "Calling all cars."

Quoth a Reader

MY remarks sometimes seem to upset some people, although others must take my writings to bed with them. Here is a short and to-the-point epistle from Mr. A. Jones, of Leicester: "I read your remarks about not being able to tell the difference between a highbrow violinist and a street musician, and I think you have a very poor taste for music. You owe a sincere apology to the street musician. P.S.—But I agree with you about crooners." But what about this from Mr. G. Gay, of Hereford. He says: "I was pained to read your remarks on violinists in the current issue (*sorry to have caused you any pain*), but I know you are—from your remarks—extremely unmusical and thus unfortunate. (*Am I unmusical?*) I have studied the violin and have played first violin in the best amateur orchestras in London and Leeds, and also in dance combinations, and I can assure you that the difference between street musicians and a £1,000 concert violinist is very real. Do you know that it takes ten years or more of hard work—eight hours a day—to play the simplest of things really well? (*Yes, I do, and so do many poor folk who live in flats. There should be a law against it!*) Street violinists would not be on the street if they were any good (*I seem to have heard of such misfortune*). I have heard all the leading violinists and many street 'musicians,' but my only reactions to the latter are ones which make me think of rat poison. Well, this is only a small part of what I feel when I hear and read remarks such as yours, and I think you ought to give us news of the B.B.C., etc.—talk of something you understand." The italics are mine! And that's that.

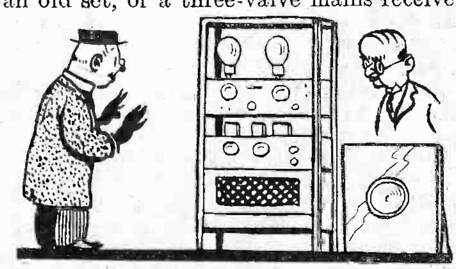
The Foundations of Music

THE other day a radio critic tabulated the "for and against" letters which he has received. I was not surprised to see that there was an unanimous vote against crooners and the Foundations of Music (why do the B.B.C. continue to lay these very heavy foundations? They must be the most unpopular feature of all the broadcast programmes. Although I did see a letter in a book the other day praising them—from Sacheverell Sitwell); but I *was* surprised to see a heavy vote *against* Henry Hall, mentioning particularly the Glee Club with its "churchy atmosphere."

Those Junk Parts

MEMBERS of the Technical Staff are constantly telling me of those readers who write to ask for a wiring plan suitable for using a number of components which they bought cheaply at a junk shop. Sometimes the letters are accompanied by rather crude sketches of the coils and similar components, but otherwise there is nothing to guide those genii whose work it is to design some of those excellent receivers that are products of the PRACTICAL AND AMATEUR WIRELESS laboratories. They have therefore asked me to refer to this matter in these notes, in the hope that they may reach the eyes of a large number of "junk-shop" merchants. The fact of the matter is that second-hand and discarded components are rarely of any real practical value to anyone except those who are capable of designing a complete set; to the inexperienced constructor they are often worse than useless, since they may result in damaged valves and other good components due to incorrect use.

I should, of course, point out that the Free Advice Service offered so willingly by this journal does not apply to the provision of complete wiring diagrams or designs for receivers. Such a service could not operate satisfactorily, because designs must be thoroughly tested before they are offered to the public, and it is obvious that the hard-working Technical Staff could not possibly make up, test, modify, and re-design those hundreds of sets a day for which readers ask! It might be asked why the policy of this journal is to refrain from giving wiring plans for untried receivers. The reason is that every PRACTICAL AND AMATEUR WIRELESS receiver is covered by a very valuable guarantee, and the Editor has rightly considered it most undesirable to pass on to any reader details of an instrument which has not been fully tested and which cannot be guaranteed to function in a perfectly satisfactory manner, without the need for further experiment by the constructor. Therefore, dear readers, do not be annoyed if, in reply to your query, you receive a letter politely informing you that the Technical Staff cannot undertake to supply wiring diagrams and lists of components for a seven-valve all-wave superhet, to be built from parts taken from an old set, or a three-valve mains receiver with A.V.C. constructed from a collection of components bought for five shillings in Farringdon Market.



A gift from the local radio fans.

Believe me, it does pay—and pay well—to buy new and guaranteed components in the first place, if only because these can be used over and over again with full assurance that they will not let you down.

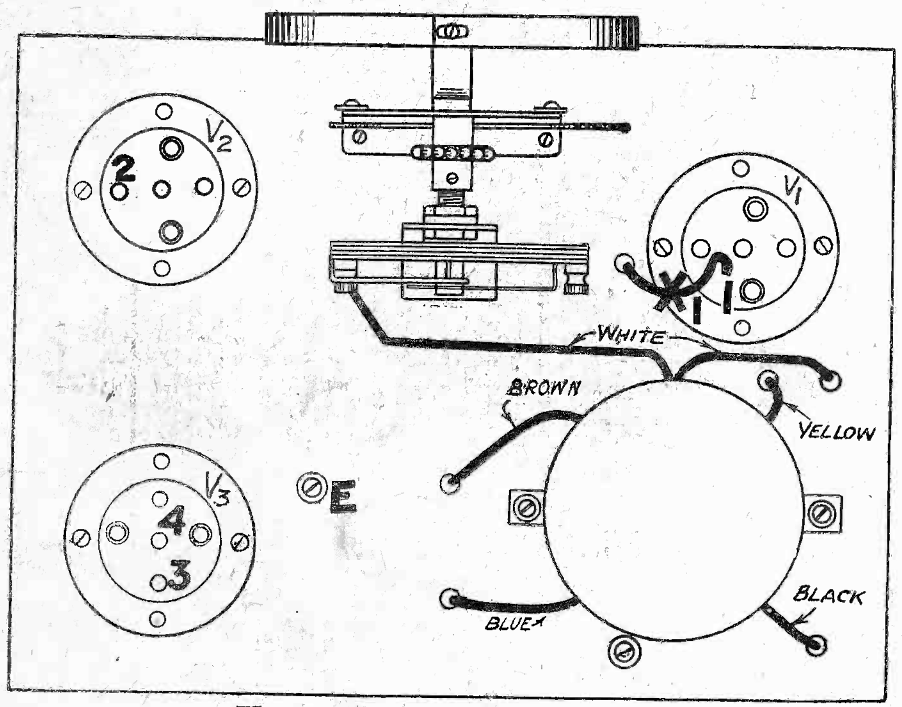
My Quality Set

A NUMBER of readers have written for details of my quality receiver which I mentioned in these notes recently.

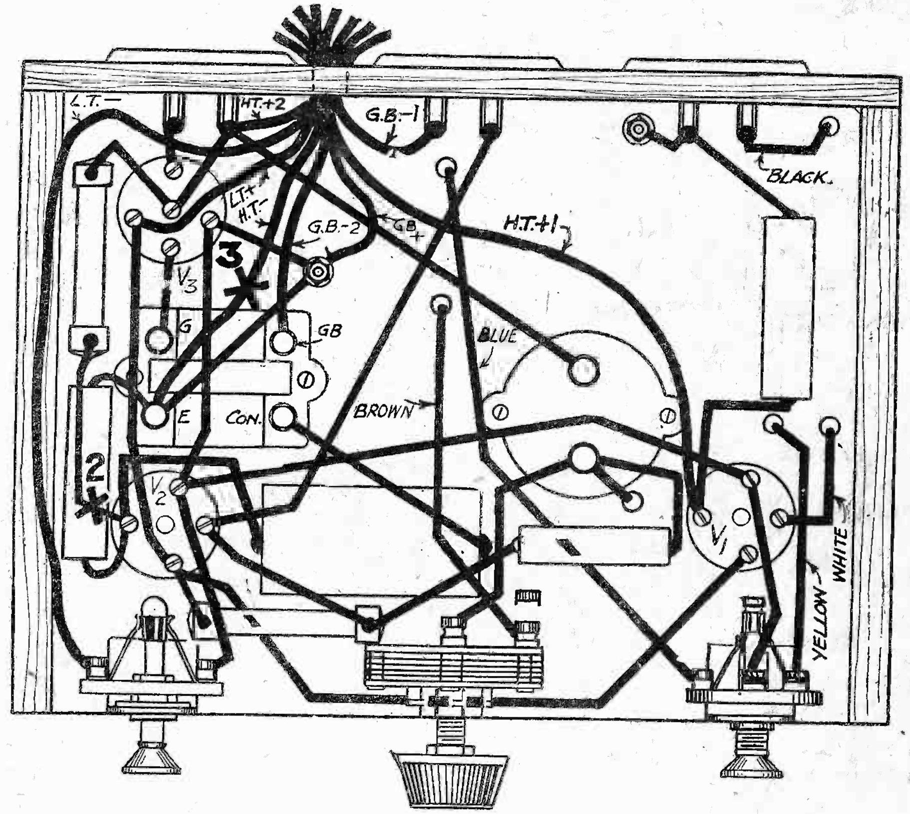
(*Continued overleaf*)

Practical and Amateur Wireless SERVICE DATA SHEET No. 18 FOR THE MONITOR THREE

FULL-SIZE BLUEPRINTS OF ALL "PRACTICAL AND AMATEUR WIRELESS" RECEIVERS ARE AVAILABLE. SEE PAGE 748.



Top of Chassis View



Underside of Chassis

Approximate Voltage Readings

Voltmeter—to E

" + to 1=120 volts.

" + to 2=60 volts.

" + to 3=115 volts.

" + to 4=120 volts.

Approximate Current Readings

Milliammeter connected at ×1=1½ m.A.
" " " ×2=1½ m.A.
" " " ×3=7 m.A.

Approximate Resistance Readings

Coil

Ohmmeter connected across white leads and screening can =17 ohms.

Ohmmeter connected across white leads and yellow lead =3 ohms.

Ohmmeter connected across black lead and screening can =16 ohms.

Ohmmeter connected across black lead and blue lead =½ ohm.

Ohmmeter connected across brown lead and screening can =1½ ohms.

L.F. Transformer

Ohmmeter connected across G and GB=2,250 ohms.
" " " Con. and E=750 ohms.

F. J. Camm's Monitor 3

THE SECOND STAGE

By F. J. CAMM

EASY TO BUILD— —AND GUARANTEED!

This week we describe how to Modify the Novel Monitor Receiver in order to Proceed a Stage Farther in the Development of this Interesting Educational System of Construction, and Notes are given concerning the Future Developments

THOSE readers who have built the Monitor will undoubtedly have found that they now possess a really efficient little three-valve receiver which, under average conditions, will give all that is desired in the way of broadcast reception. Obviously, in such a simple form it cannot be expected to provide station separation of the order of 9 kc/s, nor can it be expected to deliver sufficient volume to fill a small hall. For general use, in the average home, however, it will in its present condition fulfil the rôle of the domestic receiver. The idea underlying the design of this receiver, as was pointed out in our issue dated February 8th last, was to take a small more-or-less standard arrangement, which would be capable of development by easy stages, until a really powerful modern superhet would be obtained, and the various stages would provide really sound ideas concerning the function of the circuit and components. Thus, we may at this point consider the next step in the conversion of the Monitor, and as may be seen from the illustrations accompanying this article, there are still only three valves in use, but the design of the tuning circuits and the general arrangement of the chassis has now been improved, and a higher standard of performance will be obtained.

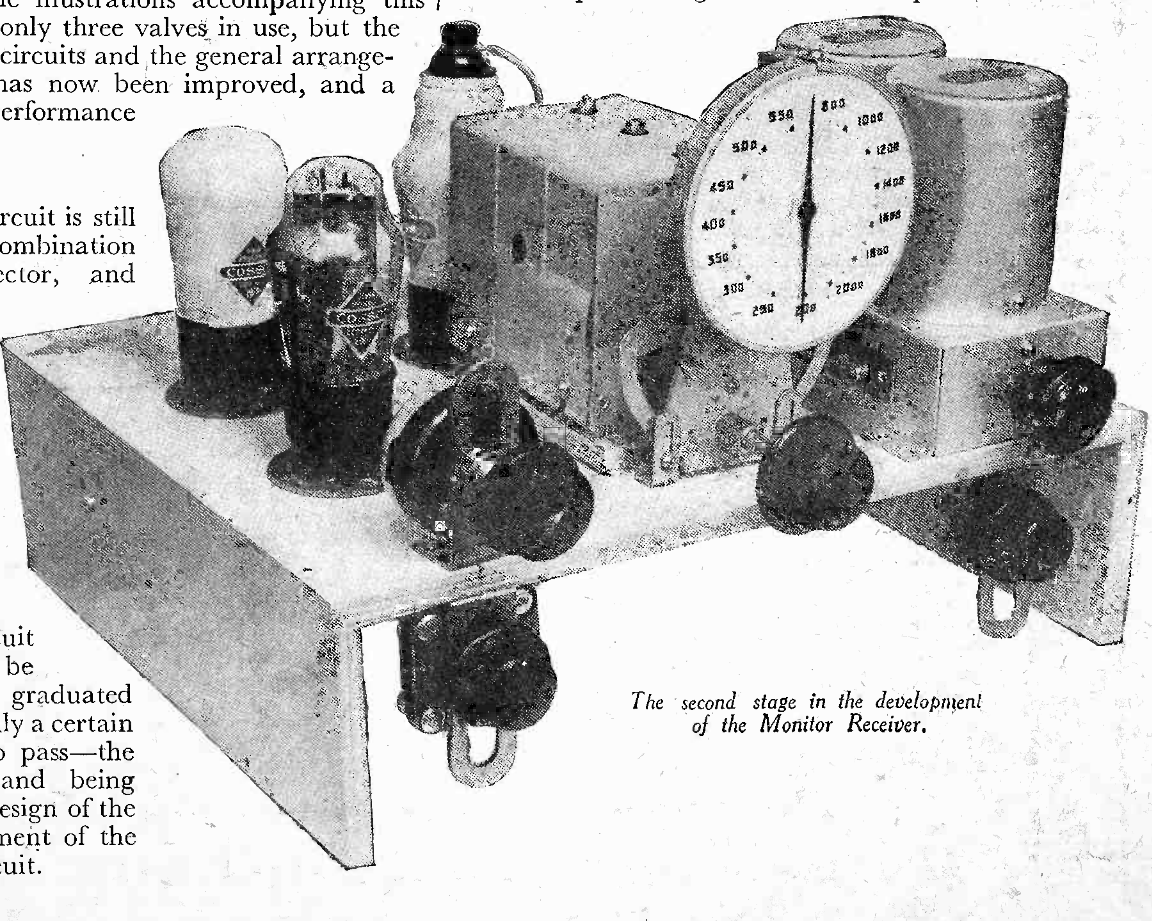
The Circuit

The fundamental circuit is still unaltered, and the combination of screen-grid, detector, and pentode stages remains. It will be seen, however, that the grid circuit of the detector stage is now provided with a complete tuning circuit consisting of a coil and condenser, and this addition will provide greater selectivity. The incorporation of any tuned circuit in a receiver may be likened to the use of a graduated sieve, and it permits only a certain band of frequencies to pass—the narrowness of the band being dependent upon the design of the coil and the arrangement of the remainder of the circuit.

In addition to this increased selectivity, however, there will be a slight increase in volume in view of the fact that the coil which is employed is wound in the form of a high-frequency transformer, and the secondary winding (which is joined in the grid circuit of the detector valve) is larger than the primary winding (which is included in the anode circuit of the H.F. valve), and thus there will be a step up in the voltage which is transferred from primary to secondary. It will thus be seen that the modifications now introduced will result in the acquisition of a more powerful receiver without any increase in running costs, and to enable full advantage to be taken of the improvements in tuning a control has also been included, so that the benefits of volume control may be obtained and the local station thus kept within the limits set by the output valve to avoid distortion due to overloading.

The New Components

Before purchasing the extra components which are



The second stage in the development of the Monitor Receiver.

required for the modifications it is necessary first to consider to what stage you ultimately wish to take the receiver. In its final stage it will incorporate the superhet principle, but it is, as has been pointed out in the introductory articles, possible to leave the receiver at any stage and it will be complete in that form. The modifications which are introduced this week will demand that a new chassis is obtained, in addition to an extra coil and a further tuning condenser. The coil should be ordered complete with a special chassis which is designed to accommodate *three* of these coils. There will thus still be room for a further coil at a later date, and this may take the form of a similar coil or a special oscillator circuit coil. If you do not intend to carry the design any farther after this week you will need only a two-gang condenser, but if you desire to proceed farther, you should obtain a three-gang model to avoid the scrapping of any part at some future date. The present single condenser which is in use should be placed on one side for the time being, but it will, together with the two-point on-off switch, which is also dispensed with for the time being, be required later on.

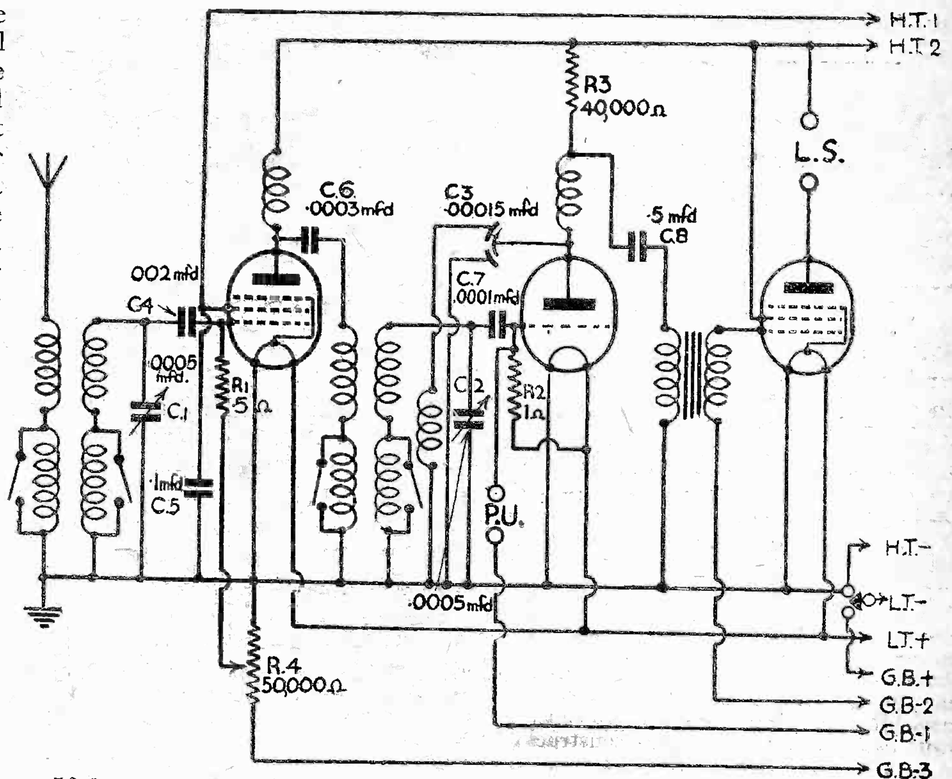
In making your choice of circuit you will be guided in your selection of the correct type of three-gang condenser. If you wish to proceed to the superhet receiver, you should obtain a three-gang superhet condenser having a specially-shaped oscillator tracking section, designed for use on an intermediate frequency of 465 kc/s, and this section should be at the rear of the condenser—that is, farthest from the operating spindle. If, however, you do not wish to make a superhet but would desire to incorporate a band-pass tuning circuit, the three-gang condenser must be of the "straight" type. As mentioned previously, however, if you are content to retain the receiver in the form described this week, only a two-gang model will be needed. A volume control must also be obtained, and this will be mounted on a bracket in place of one of the switches now used, and the three-point switch is now employed for switching on and off the battery circuits in order to break the G.B. circuit and avoid waste through the volume control potentiometer.

Constructional Work

The modifications now incorporated will necessitate the use of a new chassis and this will have to be drilled in accordance with the Wiring Diagram which will be given next week.

In spite of the increase in selectivity which has now been obtained, it must not be assumed that finality has been reached. In very congested areas it may be found that a number of distant stations are lost on wavelengths close to the local high-powered stations, but this difficulty will be overcome quite definitely in the final stages of the receiver. For instance, in the next stage to which the receiver is to be taken a further tuned circuit will be added to introduce band-pass tuning, and, as most amateurs are now aware, this will provide adequate selectivity for practically every case, although it does not surpass that obtained in the superhet arrangement.

THEORETICAL CIRCUIT OF THE MONITOR—2nd STAGE



No Further Chassis

It may also be mentioned at this point that no further modification to the chassis will be required, as all future circuit alterations may be carried out with the receiver in its present arrangement. The final arrangement of the controls will form a symmetrical layout, using the brackets already employed.

LIST OF COMPONENTS

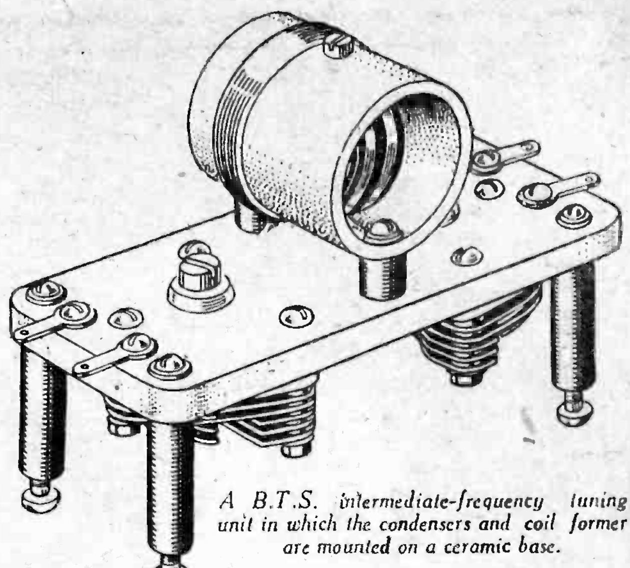
One coil (B.T.S.).
One .0005-mfd. Compax condenser (Polar).
One airplane drive (J.B.).
One .00015 mfd. differential reaction condenser (Polar).
Four fixed condensers : .5 mfd., .1 mfd., .002 mfd., .0003 mfd. (T.M.C.).
Two fixed resistances : 40,000 ohms, 1 megohm (Dubilier).
One H.F. choke, type HF9 (Bulgin).
One Senator L.F. transformer (Bulgin).
One three-point switch, S36 (Bulgin).
One two-point switch, S22 (Bulgin).
Three socket strips : A/E, L/S, P/U (Belling-Lee).
Three valve-holders : two 4-pin, one 5-pin (Clix).
Four component brackets (Peto-Scott).
Six plugs : H.T.—, H.T.1, H.T.2, G.B.+, G.B.—1, G.B.—2 (Belling-Lee).
Two spades : L.T.+, L.T.— (Belling-Lee).
One metallised chassis, 8in. by 6in. by 2½in. (Peto-Scott).
Three valves : 210VPT, 210Det., 220HPT (Cossor).
120-volt H.T. battery.
9-volt G.B. battery.
2-volt accumulator (Exide).
One "Pix" Indoor Aerial.
Speaker, Stentorian, model 36/S (W.B.)

ADDITIONAL COMPONENTS REQUIRED FOR THE MONITOR 3—2nd STAGE

One Monitor coil, with special 3-coil chassis (B.T.S.).
One two-gang .0005 mfd. condenser (Polar), or
One three-gang .0005 mfd. condenser (Polar), or
One three-gang superhet 465 kc/s condenser (Polar). (See Text.)
One .0001 mfd. fixed condenser (T.M.C.).
One .5 megohm 1 watt resistance (Dubilier).
One H.F. choke, type H.F.9 (Bulgin).
One 50,000 ohm volume control (Polar).
One metallised chassis, 12in. by 10in. with 3in. runners (Peto-Scott).

Modern Coil Connections-4

An Article dealing with Short-wave Units, Permeability Tuners, and General Mechanical Constructions such as Coil Mountings, Incorporated Switchgear, and Screening Cans. By G. V. COLLE



A B.T.S. intermediate-frequency tuning unit in which the condensers and coil former are mounted on a ceramic base.

OWING to the fact that most tuning coils for home construction purposes are fitted with terminals, which in turn must be screened, the screening cans have to be removable, in order to allow the terminals to be accessible. A present tendency is to dispense with terminals, and to provide bottom soldering lugs such as on set-makers' coils.

Stripped Units

Where the home constructor can make neat soldered joints these stripped units offer definite advantages, in that they are less costly, are slightly more compact (the diameter of the screening can may be reduced without a noticeable loss of efficiency), and possess lower dielectric and capacity losses due to the smaller amount of insulating material and metal used in their construction.

A number of firms supplying stripped types of coils arrange them, where required, on switch chassis, thus obviating one source of difficulty to constructors possessing only limited kits of tools. It will be perceived that the alternative use of a separate switch allows more ambitious constructors to arrange the control knobs in a symmetrical manner, assuming such is not otherwise possible.

Switch mechanism, which forms an integral part of a coil kit, is often sandwiched between the coils and the receiver chassis. In the event of a high resistance contact developing due to oxidisation or dirt at the contact points it is obvious the complete coil assembly must be removed, a somewhat laborious proceeding. Easy inspection and accessibility of vulnerable radio components is an essential in the interests of service work on a modern commercial receiver, and hence constructors are enjoined, where possible, to follow a similar method of assembly, even if this necessitates a larger degree of initial labour in fitting a separate switch.

These remarks apply, of course, particularly to the stripped tuning units, because the majority of coil assemblies for constructors still embrace their own switch mechanisms, and cannot be obtained in the form indicated. There are already indications that component manufacturers are to list an increasing number of stripped-type coils without switches which will be equally suitable for home construction, and small set-makers' purposes (the mass production companies usually make their own coils).

Screening Cans

Metal screening cans average about three dozen in sizes and in gauge from about 18 to 24 s.w.g. The most popular fixing method is to attach two eye-screws by rivets to opposite sides of the can, and pass the screwed portions through corresponding holes in the metal chassis, the latter acting as the base of the can and thereby completely enclosing the coil unit. The coil itself is attached to the chassis by a single screw engaging with a screwed flat brass strip which rests in two slots made near the bottom of the coil former.

Another scheme whereby both can and coil are mounted simultaneously is to provide a cupped metal base and indent a round recess in it, as well as one in the top of the can, so that the projecting metal fits into the inside spaces at the ends of the coil former. With this latter method the can and base are permanently locked together to prevent the coil becoming loose. The coil ends are joined to tags projecting through holes in the cupped base or flex leads are fixed prior to "canning."

Switch Construction

Reverting to the question of switching, there seems a definite trend towards the use of the flat disc type, a number of makes of which have recently appeared in the radio market. The contacts are attached to each disc in circular formation, and edgewise to each other, resulting in a compact and low capacity construction. Numbers of these switch units are controlled by a single knob, each switch being mounted immediately facing (and usually below) the coil it is intended to wave-change. Apart from the low capacity construction, it is obvious that, by isolating each group of contacts, stray H.F. couplings can be reduced to a mininum, particularly as simple vertical screens can be introduced between successive switch units to render the effect absolute.

Commercial set-makers naturally employ a multitude of different switch constructions for use in H.F. circuits, but it seems that with the introduction of all-wave sets the switch specifications will become more stringent, and eventually lead to the adoption of a type substantially as described.

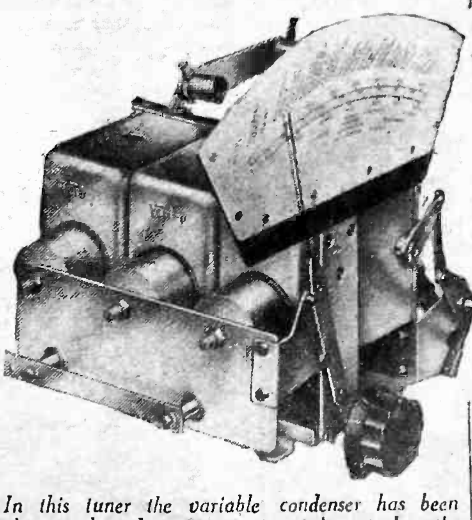
Short-wave Coils

Short-wave coils must be mounted as close as possible to their respective switches in order to avoid undesirable capacity effects, and thereby restricted wave-range coverage. Also, owing to the high radio frequencies covered, the H.F. coil fields spread to a far greater extent than on broadcast frequencies. Close screening by the aid of round or square metal cans cannot therefore be tolerated.

The difficulty is overcome by employing very small short-wave coils and metal screening compartments rather than individual canisters. Ceramic coil formers such as "Frequentite" are extensively used, but ribbed ebonite and moulded low-loss material are equally in evidence.

Most of the all-wave sets introduced at the last Radiolympia were arranged to include only one signal circuit, and an oscillator section for short-wave operation. Owing to the latter circuit "taking charge" of tuning, the aerial section being comparatively flat, close matching of the two coils in their respective spheres was not essential.

In the more ambitious 1936 receivers, attempts will be made to eliminate the "image" response of each station at the alternative dial position by providing two or more signal coil circuits in addition to the oscillator. Hence the time is not far distant when short-wave coils will be made in *matched* sets, representing a new standard of precision in receiver mass production.



In this tuner the variable condenser has been eliminated and tuning is carried out by the variation in inductance caused by the iron core. This is the Varley permeability tuner.

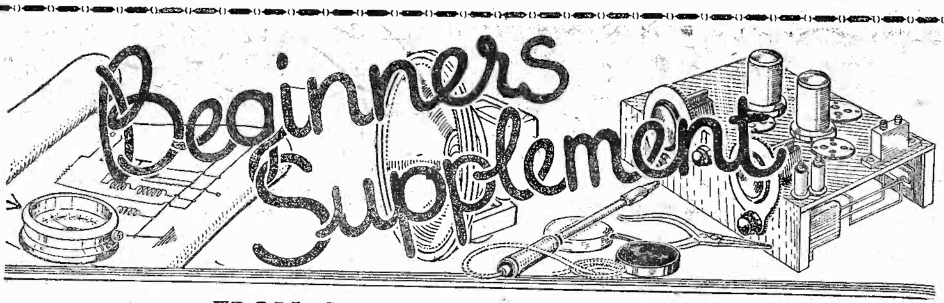
Permeability Tuning

The new system of permeability tuning, as introduced to readers of this journal in the June 24th, 1933, issue, has not yet found a place for itself in commercial receiver design, despite the lapse of two and a half years.

Among the various patents granted on permeability tuners those of Polydoroff, Varley, and S. G. Brown are outstanding by reason of commercialisation. Those firms controlling the patents in question have already evolved practical tuners, which have in turn been incorporated in a few specialised published receiver designs.

The present high cost of permeability tuning units has somewhat restricted their popularity, apart from the question of rendering gang condensers redundant. It

(Continued on page 739)



FROM STUDIO TO LISTENER—5

The High-frequency Amplifier of the Receiver is Briefly Described this Week

By IDRIS EVANS

LAST week it was explained that the ripples produced by the transmitter strike the receiving aerial, and if this is tuned to the same wavelength as the transmitter a current will flow in the aerial circuit of the receiver. Unless the transmitter is very near to the receiver, however, these currents are very weak, and therefore in most cases it is found necessary to amplify them before passing them on to the detector, or, to be more correct, the de-modulator. There are many receivers in use which do not have a high-frequency amplifier, the aerial being connected to the detector stage. This form of connection is only recommended when the receiver is in close proximity to the transmitter, however, as apart from the fact that many of the distant stations are missed, the quality of reproduction suffers unless a reasonably strong signal is applied to the detector; this is especially true of the modern type of diode detector.

Selectivity

The term selectivity is well known to most readers as that applied to the ability of a receiver to separate stations. Generally speaking, the selectivity of a receiver can be improved by adding a tuned H.F. amplifying stage; that is, by making the signal picked up by the aerial pass through more than one tuned circuit before feeding it to the detector. It will therefore be realised that the use of a high-frequency stage serves the double purpose of amplifying the weak aerial currents and providing an improved degree of selectivity.

The H.F. Stage

The H.F. amplifying stage consists of a variable tuning condenser connected across a fixed tuning coil joined to an amplifying valve, this in turn being coupled through another tuned condenser and coil combination to the detector valve. The effective size (capacity) of the condenser is varied by rotating the tuning control, and an easy method of tuning the receiver to the same wavelength as the desired incoming signal is thereby provided. It is pointed out at this juncture, however, that tuning can also be effected by varying the effective size of the coil (inductance), keeping the size of the condenser fixed. This was actually done in the earlier type of receiver and is done at present in what are known as "permeability tuners."

Aerial Coupling

There are two main methods of coupling the aerial-earth system to the first tuned circuit of the H.F. amplifying valve; these are shown in Figs. 1 and 2. Fig. 2 indicates the tap method, in which the aerial lead is directly connected to one of the turns of the coil forming the first tuned circuit. This method is very satisfactory provided that the aerial

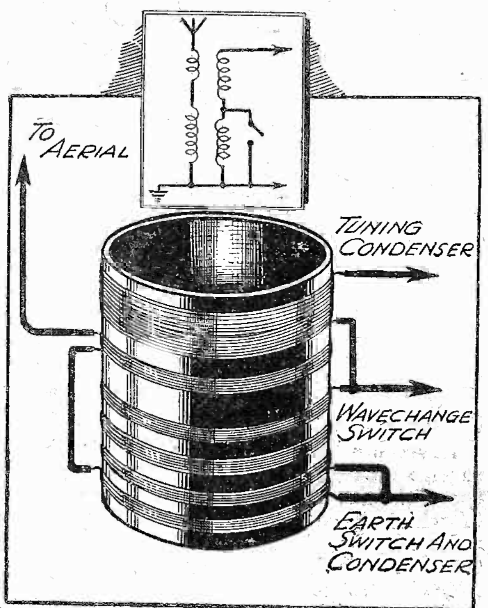


Fig. 1.—Showing aerial transformer coupling.

lead is tapped to a suitable point on the coil. In the older type of coil it was customary to provide one tap near the lower end of the medium-wave winding; this gave satisfactory results on the medium-wave band, but provided very broad tuning on long waves. If the tap method of connection is adopted, a change-over switch should be fitted as shown, so that the best tapping point on both long- and medium-wave windings is utilised.

Fig. 1 indicates the transformer method of coupling. In this case the aerial lead is not directly connected to the first tuned coil, transference being obtained by passing the aerial current through an untuned winding placed near the tuned winding. With this method of connection great care must be taken to provide the correct degree of coupling between the two windings, this being done by placing them the correct distance apart and using the correct number of turns in the primary untuned winding. It is advisable to short circuit a section of this winding by means of a switch if best results are to be obtained.

Band-pass Coupling

In some receivers it will be noticed that the first valve is preceded by two tuned circuits—that is, two tuning condensers working in conjunction with two coils. The extra tuned circuit is employed to improve selectivity, for as previously mentioned selectivity is governed to a great extent by the number of tuned circuits used. These two circuits are coupled together by means of a small coupling coil or a small condenser, and the combination is known as a band-pass coupler. The term band-pass is applied to this form of coupler because a definite band of frequencies can be passed, the width of the band (or in other words the spread of the received signal) being governed by the size of the coupling element (coil or condenser) between the two tuned circuits constituting the complete coupler.

H.F. Valves

Until about eight years ago the ordinary triode type of valve was used as an H.F. amplifier, and unless great precautions were taken in the design of the complete stage, instability was experienced and the actual amplification obtained was very low. In many of the old types of receiver employing this type of H.F. valve, the only advantage obtained from the use of an H.F. stage was that of improved selectivity.

The advent of the screen-grid valve considerably improved matters, as with this type of valve a high degree of amplification can be obtained before instability occurs. The modern H.F. pentode is a further improvement on the screen-grid type of H.F. amplifier, and by using the former in conjunction with suitable components a remarkable degree of high-frequency amplification is obtainable. To obtain the full benefit of this type of amplifying valve, however, it is necessary to screen the components, especially the coils preceding the valve from those following it; inadequate screening results in instability.

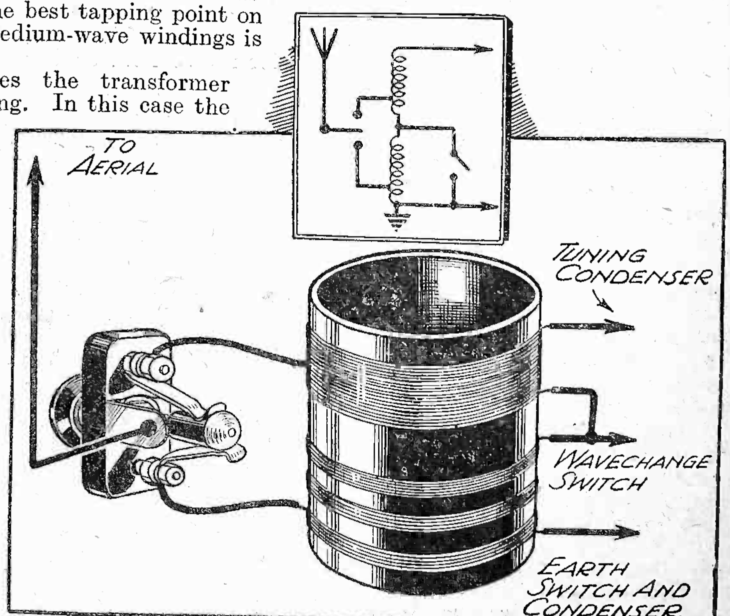


Fig. 2.—Tap method of aerial coupling.

MODERN COIL CONNECTIONS

(*Continued from page 737*)

is a matter of considerable interest to set constructors to learn the reasons for the evolution of this class of tuner. The mere fact that tuning by means of moving iron cores in and out of H.F. coils is a logical step from fixed iron-cored coils is no justification or incentive in itself for scrapping existing apparatus.

Advantages Offered

Permeability tuning must, therefore, offer advantages which normal tuning schemes do not possess. A dual-range coil of fixed inductance values, when tuned by a standard variable condenser, usually exhibits a variable response over each waveband. On the medium waveband, for instance, the sensitivity or amplification is highest at the bottom end of the range, decreasing as the wavelength is increased. With regard to selectivity, this takes the *opposite* course, being low at the low-dial settings and increasing with wavelength.

An examination of the dynamic resistance curve of a typical tuning coil shows that this falls with increasing wavelength. On the other hand, the H.F. equivalent series resistance, which represents selectivity, decreases with increase of wavelength. When it is considered an *increase* in dynamic resistance represents higher amplification and a *decrease* in H.F. resistance higher selectivity, it will be seen the two factors are diametrically opposed.

The provision of a *constant* L/R ratio represents the ideal condition of operation, as its attainment would lead to sensibly constant sensitivity and selectivity. Theoretically, by dispensing with the normal tuning condensers and linking up the movement of the tuning dial with that of the movable cores, the desired effect is achieved. Variation in wavelength is accomplished by gradual change of coil inductance, the iron cores merely increasing or decreasing the lines of force in the H.F. field surrounding the coils. Constancy of H.F. resistance and hence selectivity may be judged in the following manner. From the minimum wavelength, with the cores removed, to the point of maximum wavelength, with the cores fully inserted, the inductance increases in value from 3.5 to five times. Commencing at the lowest tuning point, each coil without its core will possess a certain H.F. resistance, depending on its physical construction and losses due to surrounding materials.

When the cores are moved say, halfway, in, the coils will increase in inductance, which in itself is sufficient to increase their H.F. resistance. At the same time the increase in wavelength tends to counteract these H.F. losses for the reasons previously given, the net result being a fairly constant H.F. resistance value throughout the tuning range.

Amplification Factor

With regard to the dynamic impedance or amplification factor, this is maintained at a constant level by the action of the coil in increasing its inductance and the corresponding lower losses of the powder-iron core with decrease of frequency (that is, increase in wavelength).

To be strictly accurate, a theoretically perfect permeability-tuned coil assumes that circuit and associated valve losses will be constant at all receiving frequencies. The fact remains, however, that some of these losses vary with frequency, particularly when stray capacitative couplings produce slight regenerative effects between H.F. stages. Furthermore, there are certain technical grounds for stating that permeability tuning does not lend itself to band-pass couplings.

The New Twin-Speaker McMichael Radiogram

McMICHAEL RADIO, LTD., have recently released their new radiogram (Model 365), which is designed to provide critical listeners with an instrument of unquestioned quality and reliability, with every worth-while refinement of 1936 technique.

Externally, the design of the new model follows the style initiated in the firm's highly popular 15-guinea twin-speaker superhet (Model 135). The inlaid walnut cabinet is bow-fronted in shape, supported on gracefully curved legs and although of very generous dimensions, has none of the excessive solidity frequently encountered. Thus, whilst not ultra-modern, it is thoroughly in harmony with the surroundings of the home in which it will be placed. Particular care has been taken over the construction and detail finish of the cabinet, and it is interesting to note that its genuine piano-finish is obtained by an entirely new process combining the virtues of both cellulose and french polish, on which an ordinary wax-polish can be used by the housewife; this process, used by piano manufacturers, is here employed for the first time in this country for a radio cabinet.

The Circuit

The circuit is a five-valve eight-stage band-pass A.C. superhet fitted with full A.V.C., and the constant-gain coupling system giving uniform performance over both wave-bands. Multiple valves are employed in conjunction with seven tuned circuits, and an elaborate mains-static filter which gives exceptionally quiet operation, while over 4 watts undistorted output is supplied to the extra large twin-stereophonic speakers. The successful McMichael Giant Dial is, of course, a prominent feature, this time ten inches in diameter, is fitted with colour-changing illumination for the two wavebands, the motor turntable on the opposite side of the cabinet being recessed in harmony with the dial. The high quality turntable and pick-up are provided with a separate system of overhead floodlighting—a most useful innovation—while the volume control, operating on both radio and gramophone, is tone-compensated to a new degree of efficiency.

Model 365 possesses exceptional tone, high range and selectivity, extreme simplicity of operation, and a new low-level of background noise, while its cabinet work is above reproach.

Specification

Circuit.—Five-valve (including rectifier) eight-stage superselective band-pass A.C. superhet employing seven tuned circuits, full A.V.C., mains static suppression and multiple valves. The valve sequence comprises a triode-pentode frequency-changer, an H.F. pentode for I.F. amplification, followed by a distortionless double-diode triode for A.V.C. second detection, and first stage of L.F. amplification; the output is a high-power pentode, while the last valve is a heavy duty H.T. rectifier.

Constant-gain Couplings.—The band-pass input circuits are specially arranged to provide substantially level gain from top to bottom of the scale, and operate in conjunction with an efficient image-suppression device.

Controls.—Four only—tuning, wave-change-gram., volume and tone—neatly disposed round the tuning dial. The tuning dial is 10in. in diameter, with two concentric scales, calibrated in both station names and wavelengths; the medium-wave scale alone is 22in. in circumference, and all names are three times larger than usual; red and green illumination for the different wavebands simplifies tuning still further, and greatly improves appearance.

This illustration of the new McMichael twin-speaker radiogram shows the fine lines of the cabinet work, and the giant dial.

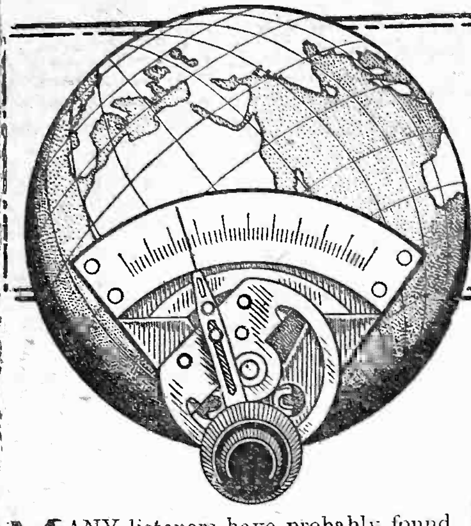
Twin stereophonic moving-coil speakers.—Reproduction from the two carefully balanced energised speakers—an extra large unit for middle and low frequencies, and a second unit for treble—is remarkably fine and very uniformly distributed.

Undistorted output.—Over 4 watts, much above average and enough for a small hall; this is a great aid in the rendering of heavy passages and gramophone records.

Volume Control.—Very efficiently tone-compensated to preserve a constant musical balance at all volumes; the tone control is of the wide-range type with even gradation.

Gramophone Equipment.—High-quality pick-up and electric motor.

Price.—28 guineas.



SHORT WAVE SECTION

THE S.-W. OUTPUT CIRCUIT

In Some Respects the Output Arrangements of the Short-wave Receiver Differ from Normal Broadcast Apparatus, and Some Interesting Points are Here Discussed. By W. J. DELANEY

MANY listeners have probably found, when using a short-wave receiver for the first time, that much difficulty is occasioned by what are loosely termed "hand capacity" effects, but which should more correctly be described as "body capacity" effects. Owing to the very high frequencies which are dealt with in a short-wave receiver it is usually found that the H.F. currents are not stopped or blocked so easily as they are in a broadcast receiver, and it is to this that the troubles may be traced. For the benefit of new readers or those to whom the above statement may be rather obscure it may be stated quite briefly that the frequency of the normal broadcasting stations ranges downward from about 1,500 kilocycles, whilst the short waves will vary in frequency from 6,000 kilocycles upwards (50 metres and below), and thus there is a much greater risk of leakage as distinct from actual stoppage.

We will assume, for the purpose of this article, that the short-waver consists of a straight receiver, as the superhet type of apparatus requires different treatment, due to the change in frequency which takes place. The receiver may or may not employ an H.F. stage, but it may be ignored for the purposes of this article, as the H.F. currents must be passed along to the detector stage in order to provide an audio signal for subsequent amplification, and it is usual to provide adequate insulation on this side of the circuit to ensure that the maximum transfer of these currents takes place without loss.

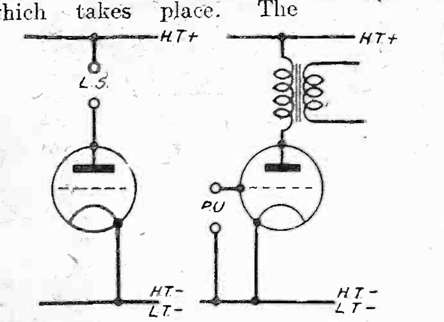


Fig. 2.—The output circuit of an S.W. set and the input circuit of an L.F. amplifier.

The Detector Anode

Thus, we arrive at the point where a large H.F. supply is fed to the grid of the detector stage, and we must assume that the tuning circuit is so arranged that there is no loss and complete rectification takes place. At the anode circuit there will thus be present a rectified signal oscillation, in which will be found a fairly large percentage of H.F., and in the interests of good theory this must be stopped at this point, or, if you prefer it, diverted direct to earth. What happens if this is not done? Firstly, the presence of H.F.

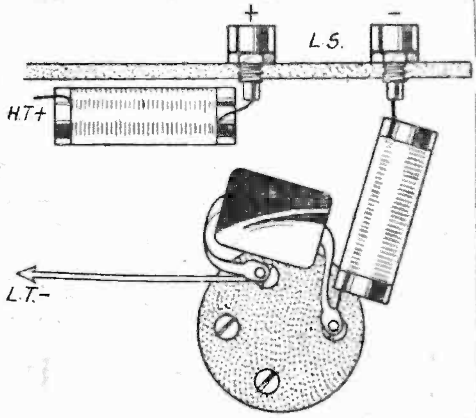


Fig. 1.—An output scheme which will be found very valuable for headphone work.

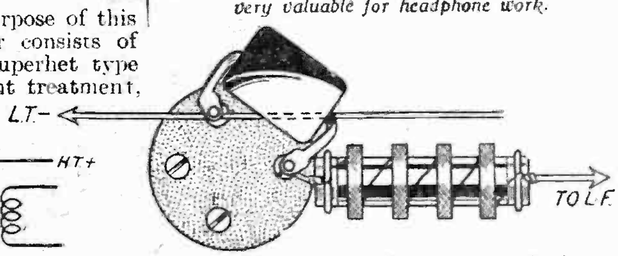


Fig. 5.—The correct method of wiring the detector anode circuit to ensure correct H.F. by-passing.

currents in the L.F. circuits will lead to all sorts of instability and distortion, although the latter is generally unimportant in a normal short-wave receiver. It will, however, become of greater importance when television transmissions are considered. Jumping from the detector stage to the output stage, let us assume that the H.F. currents have leaked right through the set and are to be found at the output valve anode circuit. What difference will this make to the operation of the receiver? Any experimenter who has used a pair of headphones with a short-wave set may have noticed that sometimes when wearing the 'phones it is impossible to hear stations which are heard on the speaker when this is in circuit, or, alternatively, that it is absolutely impossible to obtain any signals whilst the headphones are being worn. In most cases this will be due to the H.F. currents at this point, and it will be found that there is a form of feed-back from the output to the detector stage, due to the capacity effects of the body to earth, and very little transfer of signal takes place through the L.F. circuit.

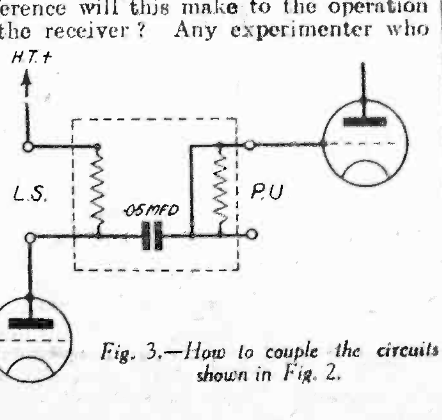


Fig. 3.—How to couple the circuits shown in Fig. 2.

H.F. Filters

As an experiment the listener can incorporate high degrees of insulation to the detector stage (using old glass dishes, etc., to avoid capacity losses to earth) and then connect a coil in series with the 'phones and couple this to the detector tuned circuit. It will, in almost every case, be found possible to obtain strong oscillation by this method, providing proof of the presence of the H.F. currents. Accurate tuning with headphones under such conditions is impossible. Assuming the use of a good short-wave choke in the anode circuit of the detector stage, a by-pass condenser to earth should be adequate to stop the passage of these currents, but where maximum results are required the following precautions will be found desirable and may be arranged on a very inexpensive basis. Firstly, in the detector anode circuit, the usual H.F. choke should be sectional wound on the highest insulation material which can be found, and should be joined direct to the anode terminal (Fig. 5). If you cannot afford to buy one of the modern H.F. chokes wound on a ceramic base, wind your own on a glass tube, using a dab of Chatterton's Compound to retain the ends, and splitting the winding up into a number of small sections. The choke should be as compact as it is possible to make it without introducing too large a self-capacity. This is where the commercial component will score, on account of the fact that a special wave-wound arrange-

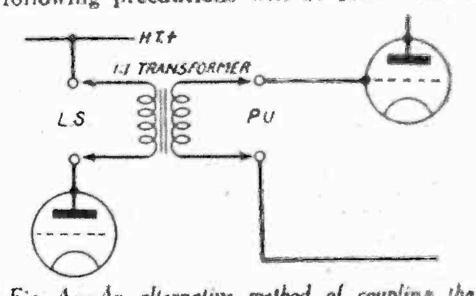


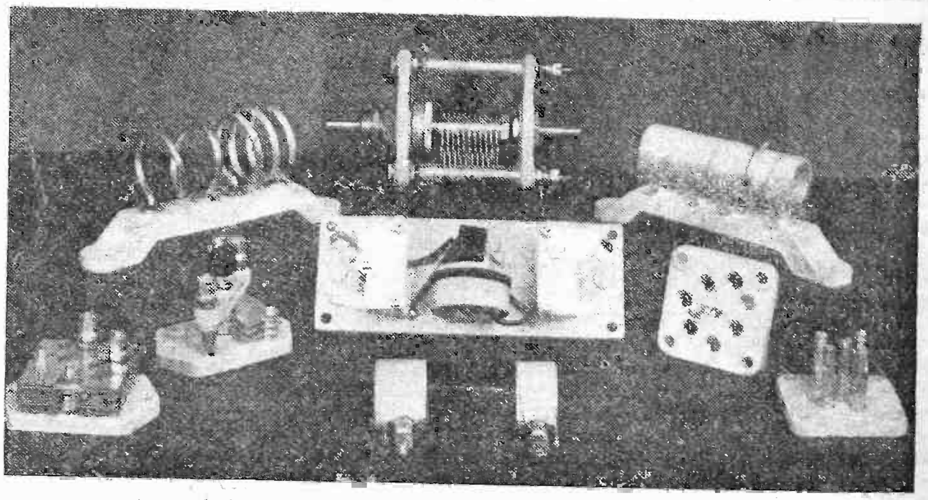
Fig. 4.—An alternative method of coupling the circuits shown in Fig. 2.

(Continued on page 743)

B.T.S. Ultra- and Short-wave Components

Some Details of a Most Interesting Range of Components Designed to Fill a Specific Need of the Short-wave Listener

IN our various articles on short-wave reception we have dealt with the subject of losses which are often incurred owing to the use of apparatus which is not designed for the purpose. The distinction between the design of apparatus used on the short- and ultra-short wavelengths is almost as great as the differences between standard broadcast apparatus and normal short-wave components, and in the illustration below may be seen some of the specially-designed ultra-short-wave items selected from the B.T.S. range. As may be seen in this illustration, no ebonite or other rubber-base material is employed for insulation purposes, and to make perfectly certain of the highest efficiency from the point of view of insulation a new ceramic material is employed and this is known in these components as "Megacite." This has a high-power factor and extremely low losses and may be used right down to 2 or 3 metres without any difficulty in many parts of the circuit.



An interesting group of short-wave components in which every precaution has been taken to avoid losses. These B.T.S. components are characterised by silver-plated metal parts and ceramic material for insulation purposes.

H.F. Resistance

In addition to this use of Megacite, the makers of these components have also carefully studied the question of high-frequency resistance in those components where H.F. currents may be found, and as a result we find that all metallic surfaces of this nature are silver-plated, and this extends not only to inductances and other coil windings, but also to the plates of the small condensers, the valve sockets and terminals. It may thus be taken for granted that all of this apparatus will be found highly satisfactory in the construction of short- and ultra-short-wave receivers or transmitters.

Amongst the items shown in the illustration may be seen a special I.F. unit and this is to be seen in the centre of the group. A piece of the Megacite material carries two special low-loss air-dielectric trimming condensers which are provided with slotted heads on the upper surface of the Megacite, and adjustment may be made by means of a screwdriver-shaped piece of wood. The secondary winding of the I.F. transformer is carried on a tubular former of Megacite, and inside this is a smaller former upon which the primary winding is wound. This, also, is provided with an adjustable control on the top so that the degree of coupling between primary and secondary may be adjusted to provide the necessary band-width determined by the apparatus in which the unit is employed. Thus, for sound reception it may be loosened to prevent interference between adjacent signals, whilst for vision reception it may be set to provide a wide response curve and so avoid side-band losses. The design of the coils is such that a band-width of 2.5 megacycles (2,500 kilocycles) may be obtained. The price of this particular component is 9s. 6d.

Condenser Adjustments

The variable condenser seen in the background is also fitted with silver-plated vanes and the Megacite end-plates, but the most interesting feature in this component is the large adjustable metal bush which is fitted to the centre spindle, and which may be seen close to the left-hand plate in the illustration. This adjusts the tension on the spindle and thus makes it a simple matter to provide just that degree of friction which will enable the condenser to be operated through any type of drive but will still permit of perfect contact being made, and complete elimination of noises whilst the rotor is moving. The extended spindle will enable any number of these condensers to be ganged together, and there will be no likelihood of the weight of the moving vanes causing the setting to vary, due to vibration. The price of this condenser is 7s. 6d.

Other Items

Amongst the remaining items are the tuning coil and oscillator coil, a trimming condenser and padding condenser, an H.F. choke and two valve-holders. The trimming and padding condensers will be found extremely useful for other purposes, although they are intended primarily for use in a superhet circuit. These two condensers may be obtained with practically any capacity, the trimming condenser up to 40 mfds. and the padding condenser up to .0002 mfds.

SHORT-WAVE SECTION

(Continued from page 741)

ment may be incorporated. The by-pass condenser should also be joined to the anode terminal, and the other side of this condenser should be joined to cathode or to the negative filament leg of the valve-holder.

As a further part of the filter, a second condenser should be joined from the other side of the choke direct to the nearest earthed point in the receiver, and both of these by-pass condensers should be of the mica-dielectric type, as it has been found on experiment that a number of peculiar tuning effects have been traced to the tubular type of condenser.

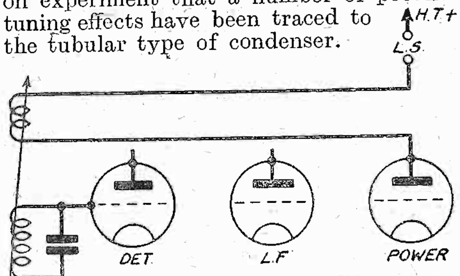


Fig. 6.—A simple method of testing the efficiency of the H.F. arrangements.

Isolating the 'Phones

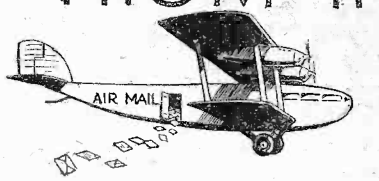
Theoretically, no H.F. currents should now be experienced in the L.F. circuits, but as a further precaution it is worth while to provide a good choke on each side of the 'phone or loud-speaker terminals, again arranging for good components, and this time taking into account the anode current which may be passing. As the valve will be of the power type there will be probably a fairly heavy current flowing, and thus the component does not come within the same category as the detector choke. To construct your own is not so difficult here, and 100 turns of 24 D.C.C. on a 1in. ebonite, paxolin, or glass former will be found quite suitable. The first choke should again be joined direct to the anode terminal on the valve-holder, whilst the second choke should be joined direct to the positive loud-speaker or 'phone terminal (Fig. 1). A fixed condenser should be joined between anode and earth, and again mica should be employed for the dielectric, whilst the capacity may be found to be critical, and thus some experiment should be carried out with a view to finding the most suitable value for the valves and circuit in use.

Using Two Sets

Some readers have built a simple short-wave set and wish to increase the strength of signals by adding the L.F. stages of another broadcast receiver. They have asked whether it is possible to use the pick-up terminals on the standard set for the purpose. In Fig. 2 the output circuit of the average short-wave set is shown by the side of the pick-up circuit generally employed, from which it will be seen that if the L.S. and pick-up terminals are directly connected, the H.T. will be applied to the grid of the L.F. valve, or, if the terminals are reversed, the H.T. supply will be short-circuited. The two pieces of apparatus may, however, be coupled in a very simple manner either by an L.F. transformer or by a resistance-capacity coupling unit as shown in Figs. 3 and 4. The transformer should be of low ratio to avoid overloading the first valve in the amplifying chain, whilst if an R.C. unit is made up the resistance in the anode circuit will have to be of low value to avoid a serious reduction in the H.T. applied to the valve.

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).

Our Simple Short-waver

SIR,—I recently constructed the simple short-wave receiver, particulars of which were published in the issue of September 14th, 1935, and below is a short log of some of the stations I have received :—

W8XK, W2XE, 2RO, WIAXL, EAQ, CTIAA, HBL, VK2ME, W2AXF, PRF5, LKJ1.

To this circuit I have added another valve, and it is now possible to obtain quite a strong signal. Instead of the fixed condenser in series with the tuning condenser, I use a pre-set condenser.—D. LEVEY (Leek, Staffs).

A Good Log on 40 Metres

SIR,—Having noticed from time to time various reports in your paper with regard to Amateur "S.W." Transmission, etc., I thought the following might be of interest. The receiver in use is a simple 2-valve (o-v-1) with very short aerial and earth.

Heard on 40 metres on January 4th to 6th were the following : W3QE, W2ISZ, W8OZU, W1QG, W1RY, W1IIE, W1HOO, W2HTO, W8NPR, W1JNL, W3DAJ, W8FSM, W3EOG, W5CGQ, W9DMF, W2CP, W3AUF, W2BVS, W3CDG, W1DEK, W3EPR, W8AUP, W8FIP, W1IEO, W8LED, W1BBS, W8OQF, W3BUY, W2IOP, W2NTR, W2ABX, W1FH, W3DFX, W1HYV, W9TBW, W3CGG.

It should be mentioned, of course, that the above were "all C.W." I have also noticed recently in your columns requests from readers for articles dealing with amateur transmission.

I beg to agree on this matter. Simple and easily understood articles on this phase of radio would, I am sure, be very welcome to a considerable number of your readers.

Thanking you for a very fine weekly, of which I have been a regular reader since 1924.—S. GEOFFREY WOOD (Rotherham).

Club Membership Wanted

SIR,—I have tried for some time to find a wireless club in this vicinity, but without success. If there is such a club in this district I shall be glad if the secretary will get in touch with me at the address given below.—J. R. WATSON (158, Runley Road, Luton, Beds.).

Jamming on the 40-metre Band

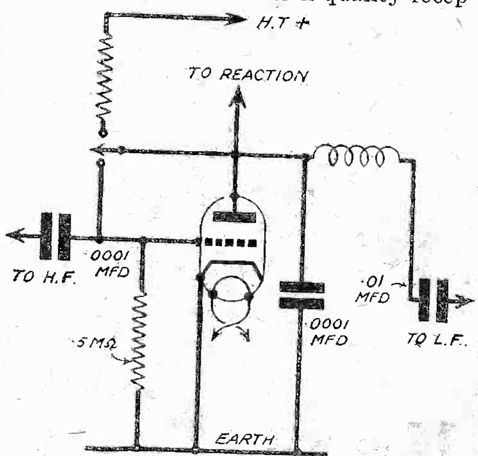
SIR,—*Re* the letter from A. E. Millinchip (Hartlebury) on the subject of "40-metre Jamming," may I respectfully suggest that if the above-mentioned gentleman considers 40 metres too crowded, why not do the most obvious thing—use the 160-, 80-, 20-, 10-, or 5-metre bands. Why use 40 metres ?

In all sincerity I think it is quite possible to carry out a 100 per cent. QSO on 40 metres if good operating is employed. If one takes a percentage of stations working on the 40-metre band on Sunday mornings, I am convinced that the 10-watt amateurs will be found to be about 70-80 per cent. of the total. I am sure there are comparatively few QRO telephony transmitters who use the 40-metre band for work on Sunday mornings.

In conclusion, may I add that patience is a virtue, and good operating an absolute necessity. To grouse is the most obvious way out ; why not try to do something ?—H. J. CHATER, G2LU (Coventry).

An Unusual Circuit

SIR,—Your readers may be interested to know of the unusual circuit I use. The set is a HF.D.LF. mains receiver, which I use for local station quality recep-



A circuit for a combined diode and power-grid detector.

tion with a diode detector. When foreign stations are required, however, a turn of the switch, indicated in the accompanying diagram, changes over to power-grid detection with reaction, giving increased sensitivity.—J. L. SHAW.

The 40-metre Band

SIR,—It would seem that your correspondent "A. E." has been misinformed in regard to several matters affecting the amateur transmitter and the facilities which he may enjoy. In the first place, I must point out that there are six bands from which he may choose and not the 40-metre band, as he appears to think. Some of these offer ample accommodation but are comparatively neglected. Secondly, whilst it is generally admitted that most transmitters are members of R.S.G.B., which is the only organisation which looks after their interests, nevertheless there is no sort of compulsion whereby non-members are penalised. "A.E." stands exactly the same chance of obtaining his transmitting licence, whether he is a member of R.S.G.B. or not.

While not wishing to take up your space unnecessarily, I do, however, think that one or two observations on the state of affairs on 40 metres might not be out of place from an old timer.

The reasons for the congestion can be roughly summarised as under :—

1. Stations using unnecessarily high power to effect local contacts which would be much more reliable on one of the other bands. The 100-watt phone station on a Sunday morning working over twenty miles is a pest.

2. The reluctance to use the portion of the band between 7,200 and 7,288 kc/s owing to its not being in harmonic relationship with the 14 mc. (20-metre) band. A crystal between these limits will, therefore, not "double" into the other band.

3. The general disinclination to work during the week and boldly tackle the problem of interference to broadcast listeners when this occurs.

4. The over-modulated, unstabilised, and bad quality "telephony" emanating from many foreign stations, particularly in France.

5. Many of the transmissions now taking place on open aerials are unnecessary, and could be quite as easily and efficiently conducted with an artificial aerial.

6. The general lack of interest in the 160-metre and 10-metre bands, plus the tendency of certain stations to use their apparatus for conducting a species of family party on the air, instead of getting down to the serious experimental work for which their licences were granted.

I agree there is something wrong, but like poverty, war, disease, and the hundred-and-one other problems of life, the remedy is in the hands of the victims, waiting to be applied.—ARTHUR O. MILNE, G2MI (Maidstone).

(*This correspondence is now closed.*—ED.).

A S.W. Log from Chingford

SIR,—Having regularly read with great interest the logs of other readers, I have never yet seen one from this district, so I append a short log of stations I have recently received. On 40 metres and upwards, W3AL, W8XK, W3XL, W2XE, W9XF, WEN, VE9BJ, YVQ, YV6RV, HJ4ABE, HJ3ABI, HJ1ABB, HCRL RW72, EA8AB. The amateurs are too numerous to mention, and on Sunday mornings on 40 metres it is simply the survival of the fittest. My receiver is a simple 3-valver, using 6-pin home-made coils, and all components came out of the junk box. I should like to see a bigger short-wave section in your excellent paper.—F. ANDREWS (Chingford).

CUT THIS OUT EACH WEEK.

Do you know

—THAT when a tone filter is included in a circuit to compensate for very selective tuners, a switch should be included to eliminate the device for gramophone record reproduction.

—THAT where bare copper wires are employed for short-wave tuners on the ultra-short wavelengths, cleanliness must be observed to avoid H.F. losses.

—THAT for the above reason certain commercial coils are now wound with silver-plated wire to avoid corrosion.

—THAT where a spark-gap is provided on the aerial lead, some form of protection from moisture should be fitted.

—THAT if the above precaution is not taken noises and loss of signal strength may be obtained due to leakage across the gap.

—THAT where incurable H.F. instability is experienced the H.F. valve may be suspected of oscillation.

—THAT to test for the above fault a milliammeter should be included in the anode circuit and the grid terminal earthed. The meter reading will be increased when this is done if the valve is oscillating.

The Editor will be pleased to consider articles of a practical nature suitable for publication in PRACTICAL AND AMATEUR 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 AND AMATEUR 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.

IMPRESSIONS ON THE WAX

By T. Onearm

H.M.V. Records

THE series of short plays presented in triple bill form and grouped under the title of "To-night at 8.30" is having extraordinary success at the Phœnix Theatre, London. Gertrude Lawrence and Noel Coward have recorded scenes from three of the plays, "Shadow Play," "Red Peppers" and "Family Album" on *H.M.V. C*2815-7. They were specially rewritten by the author for gramophone recording. "Red Peppers" is, perhaps, the best of three unusual records.

From the Films

A NEWCOMER to the film world is Lily Pons, the operatic soprano, and she has recorded two of the songs from her new film, "I Dream Too Much," on *H.M.V. DA*1456.

Frances Day's record of "Me and My Dog," from her film "Public Nuisance No. 1" on *H.M.V. BD*323, is sung in her own inimitable style, and mention must also be made of Robert Ashley, the young baritone, who is yet another B.B.C. discovery. His numbers, "Thanks a Million" and "Moon for Sale," on *H.M.V. BD*315 are from the film, "Thanks a Million."

King George's Last Message to His People

IN the past, the real personalities of our Sovereign Ruler have been known to few. With this generation it is different. King George will always be with us. His simplicity and kindliness, his devotion to duty and his steadfast faith in his people are there for all to hear in a record of his last Christmas Day Message. The number of the record is *H.M.V. RCS*2811 and the profits made by "His Master's Voice" from its sale are being given to charities nominated by the late King.

"Dance of the Hours"

A RECORDING that should make its appeal is the "Dance of the Hours" from Ponchielli's "La Giaconda." This is one of the best-known pieces of operatic ballet music and is played by the Boston Orchestra (composed of selected players from the Boston Symphony Orchestra) on *H.M.V. C*2812.

Gigli the famous tenor has recorded "Plaisir d'amour," coupled with the mournful "Elegie" by Massenet, on *H.M.V. DB*2530, and Miliza Korjus, the "Swedish Nightingale," sings two Italian songs, "Funiculi, Funicula" and "La Danza" by Rossini on *H.M.V. C*2813.

Dancing Time

JACK HYLTON'S ORCHESTRA is well to the fore with "She shall have Music" and "Do the Runaround" on *H.M.V. BD*5017, also "My First Thrill" and "May all Your Troubles be Little Ones" on *H.M.V. BD*5018, all of which are from their new film "She shall have Music."

Noel Coward's latest tunes "You were there" and "Family Album" waltz from his new show "Tonight at 8.30" are played by the Phoenix Theatre Orchestra on *H.M.V. BD*5019. The first of these has a vocal refrain sung by Sam Browne.

Decca

HANDEL'S "Samson Overture" appears in this month's list played by the Queen's Hall Orchestra, conducted by Sir Henry J. Wood, on *Decca K*812. I think you will like this.

A record which has no scholarly pretension is Mozart's "Serenata Notturno" on *Decca K*810-11. It is extremely well played by the Boyd Neel String Orchestra.

Columbia

THREE new records in this month's list form an important addition to the Columbia folk dance repertoire. "The Long Eight," "Pipers Fancy," "The First of April," "The Dressed Ship," "Welsh Reel" and "Rhif Wyth" are the tunes which are played in correct dance tempo. The numbers of the records are *Columbia DB*1621-3.

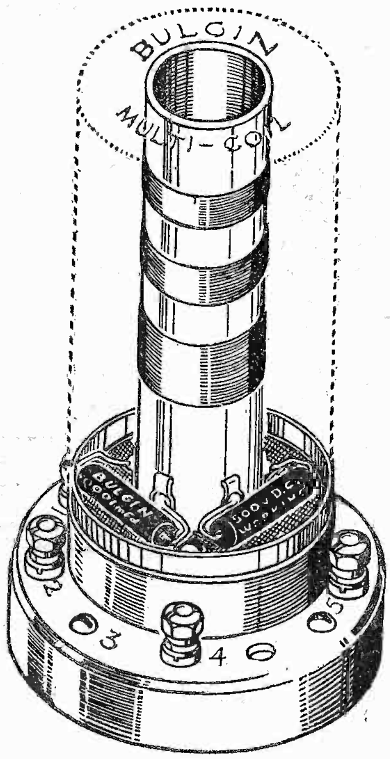
"Music when Soft Voices Die," "Love's Philosophy," "I Dare Not Ask a Kiss" and "The Jealous Lover," are the titles which belong to a little group of Roger Quilter songs that Columbia have just issued. They are settings by Quilter (who himself accompanies on the piano) of poems written by Shelley, Herrick, and the Earl of Rochester, and their interpreter is Mark Raphael, the singer. The number of this record, which will appeal to many, is *Columbia DB*1602.

Facts and Figures

COMPONENTS TESTED IN OUR NEW LABORATORY

Bulgin Community Aerial Coupler

IN the past the experimenter has found it often necessary to arrange for separate aerials in order that the standard family receiver could be used in one room whilst he experimented in another with a different receiver. It is difficult to arrange for separate aerials to prevent interaction, and also to avoid making the house look like a small transmitting station, and thus the new aerial coupler introduced by Messrs. Bulgin will be found especially welcome in such instances. In many modern



A diagrammatic view of the new Bulgin multi-set aerial coupler.

homes it is now the custom to provide a separate receiver in the kitchen, with a larger receiver in the drawing-room, for instance, and perhaps an experimental or short-wave receiver in another room, and this new coupler will enable all these sets to be operated from one aerial without interference. As may be seen from the illustration, the device consists of an ebonite base and screening can, inside which is an inductive unit with separate capacitors. Separate tapping points are provided and five terminals are fitted. A shielded lead-in is taken from the aerial to terminal No. 1, and from the remaining terminals screened leads are taken to the aerial terminals on the additional receivers, with an earth lead to the fourth terminal to complete the circuit. If the receivers are placed near each other and the length of the additional aerial lead is less than twelve feet, the screening may not be found necessary. The coupler is effective over a waveband from 20 to 2,000 metres, and the price is 5s. Screened cable for use with the coupler may be obtained for 6d. per coil, or 2s. 3d. for fifteen feet.

Cosmocord Pick-up

THE recently-introduced 5s. pick-up which was reviewed in our issue dated December 28th last, has been tested with a number of amplifiers and records and found to give every satisfaction. The arm clamp which is provided enables it to be mounted on practically every type of standard acoustic gramophone arm, and no difficulties will be experienced from rattle or looseness at this point. The length of lead provided may be twisted round the arm or passed through a hole in the motor board for connection to the amplifier or receiver, and it was not found necessary in the majority of cases to screen this lead. With one or two receivers, however, it was found desirable to pass the lead through a length of metal braiding and to tie this to the carrier arm, afterwards earthing the metal parts. With the majority of simple broadcast receivers this will not be necessary unless the lead from the pick-up to the receiver is of undue length. The weight of the pick-up is not sufficient to cause any undue wear and it was found, in fact, that it was lighter than certain acoustic instruments. The actual weight is slightly over 4 ozs., but this may, of course, be reduced, if desired, by fitting a counterweight on the rear of the carrier arm. The response curve is, to all intents and purposes, straight when used with a good amplifier, and it is not essential to fit any form of tone compensator. The slight rise in the characteristic at the lower end of the scale compensates for the reduced recording strength of the lower frequencies, and thus produces a well-balanced bass response, whilst a drop which is not sharply accentuated at the upper end of the scale helps to reduce to some extent the surface noise or needle scratch. The volume produced by this neat little component is sufficient to enable it to be satisfactorily employed with a two-valve battery amplifier.

Two New Mullard Valves

THE introduction of two new valves by the Mullard Wireless Service Co., Ltd., is a further contribution to the development of battery-operated receivers. The P.M.22D, listed at 13s. 6d., is a high-sensitivity output pentode, and has been designed to take the fullest consumption of anode current (the rated figure is less than half that of Class "B" or Q.P.P. valves).

The operating data, etc., is given below :—

Operating Data

Filament voltage 2.0 volts
Filament current 0.3 amp.
Max. anode voltage 150 volts
Max. aux. grid voltage 150 volts

Base Connections

Standard B.V.A. 5-pin base.

The second valve which will be released with the P.M.22A is a battery double-diode which will be known as the 2.D.2. The price of this new valve is 5s. 6d.

The most interesting feature of the 2.D.2 is its indirectly-heated cathode which permits the application of delayed automatic volume control, a refinement unobtainable with the directly-heated type of battery valve in which diodes are embodied.

It was designed essentially for quality receivers and will be largely employed in those sets using the P.M.22D into which it can be directly fed without an intermediate stage.

Like the output pentode, the 2.D.2 is exceptionally economical, its filament consumption being no more then 0.09 amp. The valve is fitted with the standard B.V.A. 5-pin base.

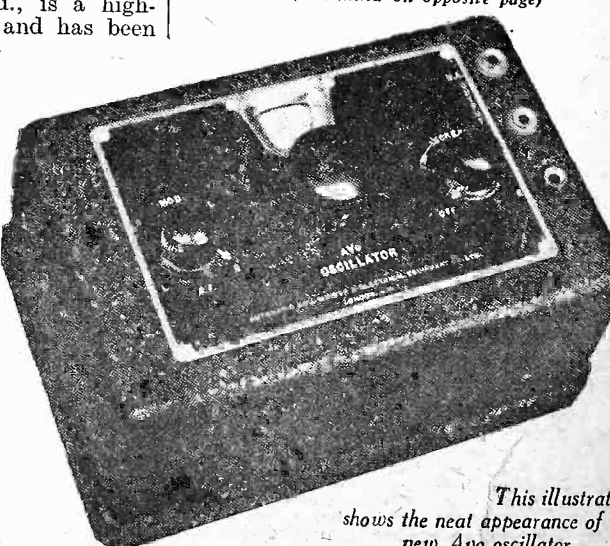
Both the P.M.22D and the 2.D.2 will be generally released in a few weeks.

A new power output valve produced by the Ediswan Company.

Ediswan Power Valve

A NEW power output valve has just been released by the Ediswan Company, and is shown on the left. It is known as the E.S.100 and, as may be seen, is of the high-voltage type designed for use in public address amplifiers or in high-quality home receivers in which the advantage of a very large output is to be taken into account when receiving high quality signals at moderate volume. The question of handling peak voltages has, of course, often been mentioned in these pages, and many listeners prefer to employ a very large power stage, although it is only operated at low volume. In this way one may rely all the time upon obtaining the utmost perfection in response, irrespective of the character of the received signal. The special 4-pin base is fitted, and it is recommended that the valve be employed in a

(Continued on opposite page)



This illustration shows the neat appearance of the new Avo oscillator.

FACTS AND FIGURES

(Continued from opposite page)

vertical position, although if certain precautions are taken it may be used when mounted horizontally. The valve becomes very hot whilst working, and thus ample ventilation is required. The main characteristics are as follows :—

Filament volts	6
Filament current ..	3 amps
Maximum anode voltage	1,000 volts
Impedance	1,750 ohms
Amplification factor ..	$5\frac{1}{2}$
Maximum dissipation ..	100 watts
Optimum load, approx.	7,000 ohms
A.C. power output, approx.	30 watts

List Price, £10 10s.

Characteristic curves and full operating details can be obtained from the Radio Division, The Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2.

Avo Oscillator

THE illustration on page 746 shows the oscillator which has been produced by the Automatic Coil Winder Company, and which was reviewed in our issue dated January 25th last. This particular instrument is now being tested in our laboratories and is being found very satisfactory in every way. It is very neat and compact, the actual dimensions being only 6in. by 4in. by 3in. The price is £5 10s. complete with shielded lead, valve, and self-contained H.T. and L.T. batteries.

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.

THE RADIO, PHYSICAL AND TELEVISION SOCIETY

MEMBERS of this society from all parts of London had the pleasure of hearing a lecture entitled "Advances in Receiver Technique," given by Messrs. L. A. Moxon, B.Sc., A.C.G.I., and J. E. Marshall, M.E.N.G., at a meeting held on Friday, January 24th.

Mr. Marshall, in introducing the lecturer, indicated some of the problems encountered by the designers of modern receivers, and Mr. Moxon outlined the ways in which these problems are being tackled. He dealt lucidly with the superhet circuit and its pitfalls. "The chief fault of this circuit," he said, "is image interference, which takes the form of whistles. The remedy," he explained, "is pre-detector selectivity." The advent of ganged condensers enabled many tuned circuits to be used together, and the screen-grid valve solved other problems.

A.V.C. was dealt with fully and lucidly, while problems, such as noise suppression, valve noises, and interference, were explained. Full particulars of the society may be obtained from the Hon. Sec., M. E. Arnold, 12, Nassau Road, Barnes, S.W.13.

THE SURREY RADIO CONTACT CLUB

THE Surrey Radio Contact Club, which was formed last autumn, has met with a ready response from enthusiastic amateurs.

Formed as it was with the definite object of bringing together those transmitters and listeners who so frequently spoke and listened to each other "on the air" but rarely met in person, it was thought that it would attract but few members. However, its policy of having no "figureheads," having a committee composed of three active transmitters and two "A.A." men, and of providing a programme keeping the members in touch with the latest technical advances seems to be popular with a large number of amateurs.

Recent lecturers have been Mr. H. L. O'Heffernan, G5BY, a well-known transmitter, and also a member of the club, who gave a talk on "Five-Metre Transmitters and Receivers." On December 10th Mr. P. G. A. H. Voigt, well-known P.A. and microphone technician, visited the club, and at the last meeting on January 14th, so that the members should have the latest information possible, Mr. Edwards, of the 362 Valve Co., lectured on the new R.F. pentode recently introduced by his company.

Apart from these regular meetings, visits have been made to the Physical Society's Exhibition on January 8th, and to the Ongar Radio Station on January 12th, and arrangements are being made for visits to the Western Electric Co.'s theatre and to the Dollis Hill Research Station of the G.P.O. A suitable location for a club transmitter is being sought, and if possible a club entry will take part in the A.R.R.L. D.X. Test next March.

Visitors to the club are cordially welcomed, and should communicate with the Secretary, Mr. E. C. Taylor, of No. 35, Grant Road, Addiscombe.

A CLUB FOR WYTHALL !

IT is proposed to start a Radio Society in the Hollywood and Wythall District, nr. Birmingham, and interested readers in this district are invited to write to I. Quilton (2AGV), "Jesmond-Dene," Shawhurst Lane, Hollywood, Nr. Birmingham.

THE CROYDON RADIO SOCIETY.

MEMBERS had been waiting for just such an opportunity as happened at a recent meeting in St. Peter's Hall, South Croydon. It was a Question night, and it was soon apparent that many teasing topics had been saved for the occasion. For instance, Mr. J. T. Haynes, a new member, discussed two aerials which did not "play the game." In other words, they disobeyed all the rules. The first one began all wrong by fixing itself to a water pipe at the top of the house; then it travelled downstairs to the set in the dining-room. Earthing of the receiver was effected normally to a water pipe in the cellar, so that aerial and earth were attached to the same system. Mr. Haynes insisted that the aerial must be earthed as described to get the best results. The second aerial also contravened the tradition of the old school. Its lead-in shocked members by trailing along a wall and ending at its pole with no insulator. Even so it gave better results than another aerial on the same pole properly insulated. Mr. Chubb then described his circuit, and how it was affected by substituting a wire-wound resistance for a choke. Mr. P. G. A. H. Voigt's loud-speaker demonstration, postponed from January 21st, took place on Tuesday, February 18th, and many PRACTICAL AND AMATEUR WIRELESS readers were able to attend the meeting—Hon. Pub. Sec., E. L. Cumbers, Maycourt, Campden Road, S. Croydon.

OUR FREE CATALOGUE SERVICE

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 AND AMATEUR 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.

COSSOR RADIO

A VERY attractive booklet has just been issued by A. C. Cossor, Ltd., which gives full details of their very comprehensive range of wireless receivers. There is a set for every purpose and every pocket. For example, there are the superferrodyne models for battery or mains operation; battery and A.C. mains superhets; and a fine range of radiograms. The receivers range in price from £5 15s. to £14 14s., and the radiograms from £16 16s. to 55 guineas. There are sixteen pages of information, together with full colour illustrations, printed on art paper, and a complete specification of each model is given. A postcard addressed to A. C. Cossor, Ltd., Publicity Dept., B29, Highbury Grove, London, N.5, will bring you a copy of this booklet, post free.

MARCONI VALVES AND RECEIVERS

[illegible]coniphone Company have recently issued [illegible] catalogues, one dealing entirely with the [illegible] valves bearing the Marconi trade mark, [illegible] describing the various types of Marconi[illegible]rs. The valve catalogue gives, in [illegible]omplete guide to each valve, with all [illegible]abulated, a comparative table of Mar[illegible] and various technical details, such [illegible]connections, various A.V.C. circuits push-pull arrangements, and so on. The receiver catalogue is fully illustrated and describes all the present types of receivers, which range from a £7 12s. 6d. battery receiver to a fifty-two-guinea nine-valve automatic radiogram. The list also includes details of cabinet loud-speakers and the new Marconiphone gramophone pick-up. The lists may be obtained free from Radio House, Tottenham Court Road, London, W.1., or direct from this office.

FULL O' POWER BATTERIES

FULL particulars of the complete range of these batteries suitable for battery set users are given in a compact little booklet (No. 667), issued by Siemens Electric Lamps and Supplies, Ltd., 38 and 39, Upper Thames Street, London, E.C.4. In the single capacity type there are two series, the "Cadet," which is suitable for modest sets requiring from 6 to 7 milliamps. of H.T. current, and the "Standard," designed for the more ambitious receiver taking up to 10 milliamps. Where space and weight are of little importance, there is the power and triple capacity series, which is recommended for a discharge rate of 10 to 20 milliamps. There is also the super radio battery intended for use where a discharge rate of from 15 to 30 milliamps is required.

Practical and Amateur Wireless BLUEPRINT SERVICE

PRACTICAL WIRELESS.

STRAIGHT SETS. Battery Operated

	Date of Issue.	*No. of Blueprint.*
One-Valve : Blueprints, 1s. each.		
All-Wave Unipen (pentode) ..	14.10.33	PW31A
Two-valve : Blueprints, 1s. each.		
Four-range Super Mag. Two (D, Pen)	11.8.34	PW36D
Three-valve : Blueprints, 1s. each.		
Selectone Battery Three (D, 2 LF (trans.))	—	PW10
Alpha Q.P.P. Three (D,Q.P.P.)..	25.3.33	PW14
Ferrocart Q.P.P. Hi-Mag Three (SG, D, Q.P.P.)..	25.3.33	PW15
Sixty-Shilling Three (D, 2 LF (R.C. & trans.))	2.12.33	PW34A
Leader Three (SG, D, Pow.) ..	—	PW35
Summit Three (HF Pen, D, Pen)	18.8.34	PW37
All-Pentode Three (HF Pen, D (pen), Pen)	22.9.34	PW39
Hall-Mark Three (SG, D, Pow.)	—	PW41
Hall-Mark Cadet (D, LF, Pen (R.C.))	23.3.35	PW48
F. J. Camm's Silver Souvenir (HF Pen, D (pen), Pen) (All-wave Three)	13.4.35	PW49
Genet Midget (D, 2 LF (trans)) ..	*June* '35	PM1
Cameo Midget Three (D, 2 LF (trans))	8.6.35	PW51
1936 Sonotone Three-Four (HF Pen, HF Pen, Westector, Pen)	17.8.35	PW53
Battery All-wave Three (D, 2 LF (R.C.))	31.8.35	PW55
The Monitor	8.2.36	PW61
Four-valve : Blueprints, 1s. each.		
Fury Four (2 SG, D, Pen) ..	—	PW11
Beta Universal Four (SG, D, LF, Cl. B)	15.4.33	PW17
Nucleon Class B Four (SG, D (SG), LF, Cl. B)	6.1.34	PW34B
Fury Four Super (SG, SG, D, Pen)	—	PW34C
Battery Hall-Mark 4 (HF Pen, D, Push Pull)	2.2.35	PW46
F. J. Camm's Superformer (SG, SG, D, Pen)	12.10.35	PW57

Mains Operated

Two-valve : Blueprints, 1s. each.		
A.C. Twin (D (pen), Pen).. ..	22.4.33	PW18
A.C.-D.C. Two (SG, Power) ..	7.10.33	PW31
Selection A.C. Radiogram Two (D, Pow.)	29.4.33	PW19
Three-valve : Blueprints, 1s. each.		
Double-Diode-Triode Three (HF Pen, D.D.T., Pen)	10.6.33	PW23
D.C. Ace (SG, D, Pen)	15.7.33	PW25
A.C. Three (SG, D, Pen)	16.9.33	PW29
A.C. Leader (HF Pen, D, Power)	7.4.34	PW35C
D.C. Premier (HF Pen, D, Pen)	31.3.34	PW35B
Ubique (HF Pen, D (Pen), Pen)..	28.7.34	PW36A
Armada Mains Three (HF Pen, D, Pen)	18.8.34	PW38
F. J. Camm's A.C. All-Wave Silver Souvenir Three (HF Pen, D, Pen)	11.5.35	PW50
"Allwave" A.C. Three (D, 2LF (R.C.))	17.8.35	PW54
A.C. 1936 Sonotone (HF Pen, HF Pen, Westector, Pen)	31.8.35	PW56
Four-valve : Blueprints, 1s. each.		
A.C. Fury Four (SG, SG, D, Pen)	25.2.33	PW20
A.C. Fury Four Super (SG, SG, D, Pen)	—	PW34D
A.C. Hall-Mark (HF Pen, D, Push-Pull)	—	PW45
Universal Hall-Mark (HF Pen, D, Push-Pull)	9.2.35	PW47

SUPERHETS.

Battery Sets : Blueprints, 1s. each.		
£5 Superhet (Three valve) ..	—	PW40
F. J. Camm's 2-valve superhet (two valve)	13.7.35	PW52
F. J. Camm's £4 Superhet 4 ..	16.11.35	PW58
Mains Sets : Blueprints, 1s. each.		
A.C. £5 Superhet (three valve) ..	—	PW43
D.C. £5 Superhet (three valve) ..	1.12.34	PW42
Universal £5 Superhet (three valve)	15.12.34	PW44
F. J. Camm's A.C. £4 Superhet 4	7.12.35	PW59
F. J. Camm's Universal £4 Superhet 4	11.1.36	PW60

SHORT-WAVE SETS.

Two-valve : Blueprints, 1s. each.		
Midget Short-wave Two (D, Pen)	15.9.34	PW38A
Three-valve ; Blueprints, 1s. each.		
Experimenter's Short-wave Three (SG, D, Power)	23.9.33	PW30A

PORTABLES.

Three-valve : Blueprints, 1s. each.		
Atom Lightweight Portable (SG, D, Pen)	2.6.34	PW36
Four-valve : Blueprints, 1s. each.		
Featherweight Portable Four (SG, D, LF, Cl. B)	6.5.33	PW12

MISCELLANEOUS.

S.W. Converter-Adapter (1 valve)	23.2.35	PW48A

AMATEUR WIRELESS AND WIRELESS MAGAZINE

CRYSTAL SETS.

Blueprints, 6d. each.		
Four-station Crystal Set	—	AW427
1934 Crystal Set	—	AW444
150-mile Crystal Set	—	AW450

STRAIGHT SETS. Battery Operated.

One-valve : Blueprints, 1s. each.		
B.B.C. Special One-valver ..	—	AW387
Twenty-station Loud-speaker One-valver (Class B)	—	AW449
Two-valve : Blueprints, 1s. each.		
Melody Ranger Two (D, Trans) ..	—	AW388
Full-volume Two (SG, Det, Pen)	—	AW392
Iron-core Two (D, Trans) ..	—	AW395
Iron-core Two (D, Q.P.P.) ..	12.8.33	AW396
B.B.C. National Two with Lucerne Coil (D, Trans)	—	AW377A
Big-power Melody Two with Lucerne Coil (SG, Trans) ..	—	AW338A
Lucerne Minor (D, Pen)	—	AW426
Three-valve : Blueprints, 1s. each.		
P.T.P. Three (Pentode-Triode-Pentode	*June* '35	WM389
Class-B Three (D, Trans, Class B)	22.4.33	AW386
New Britain's Favourite Three (D, Trans, Class B)	15.7.33	AW394
Home-Built Coil Three (SG, D, Trans)	14.10.33	AW404
Fan and Family Three (D, Trans, Class B)	25.11.33	AW410
£5 5s. S.G.3 (SG, D, Trans) ..	2.12.33	AW412
1934 Ether Searcher : Baseboard Model (SG, D, Pen)	20.1.34	AW417
1934 Ether Searcher : Chassis Model (SG, D, Pen)	—	AW419
Lucerne Ranger (SG, D, Trans) ..	—	AW422
Cossor Melody Maker with Lucerne Coils	—	AW423
P.W.H. Mascot with Lucerne Coils (D, RC, Trans)	—	AW337A
Mullard Master Three with Lucerne Coils	—	AW424
£5 5s. Three : De Luxe Version (SG, D, Trans)	19.5.34	AW435
Lucerne Straight Three (D, RC, Trans)	—	AW437
All Britain Three (HF Pen, D, Pen)	—	AW448
"Wireless League" Three (HF Pen, D. Pen)	3.1.34	AW451
Transportable Three (SG, D, Pen)	—	WM271
£6 6s. Radiogram (D, RC, Trans)	*Apr.* '33	WM318
Simple tune Three (SG, D, Pen) ..	*June*, '33	WM327
C.B. Three (D, LF, Class B) ..	—	WM333
Economy-pentode Three (SG, D, Pen)	*Oct.* '33	WM337
"W.M." 1934 Standard Three (SG, D, Pen)	—	WM351
£3 3s. Three (SG, D, Trans) ..	*Mar.* '34	WM354
Iron-core Band-pass Three (SG, D, QP21)	*June* '34	WM362
1935 £6 6s. Battery Three (SG, D, Pen)	—	WM371
Graduating to a Low-frequency Stage (D, 2LF)	—	WM378
Four-valve : Blueprints, 1s. 6d. each.		
65/- Four (SG, D, RC, Trans) ..	—	AW370
"A.W." Ideal four (2SG, D, Pen)	16.9.33	AW402
2 H.F. Four (2SG, D, Pen) ..	—	AW421
Crusaders' A.V.C. 4 (2HF, D, QP21)	18.8.34	AW445
(Pentode and Class-B Outputs for above : blueprints 6d. each) ..	25.8.34	AW445A
Quadradyne (2SG, D, Pen) ..	—	WM273
Calibrator (SG, D, RC, Trans) ..	—	WM300
Table Quad (SG, D, RC, Trans)..	—	WM303
Calibrator de Luxe (SG, D, RC, Trans)	—	WM316
Self-contained Four (SG, D, LF, Class-B)	*Aug.* '33	WM331
Lucerne Straight Four (SG, D, LF, Trans)	—	WM350
£5 5s. Battery Four (HF, D, 2LF)	*Feb.* '35	WM381
The H.K. Four	*Mar.* '35	WM384
Five-valve : Blueprints, 1s. 6d. each.		
Super-quality Five (2HF, D, RC, Trans)	*May* '33	WM320
New Class-B Five (2SG, D, LF, Class B)	*Nov.* '33	WM340
Class-B Quadradyne (2SG, D, LF, Class B)	*Dec.* '33	WM344
1935 Super Five (Battery Superhet)	—	WM379

These blueprints are full size. Copies of appropriate issues containing descriptions of these sets can in most cases be obtained as follows:—"Practical Wireless" at 4d., "Amateur Wireless" at 4d., "Practical Mechanics" at 7½d., and "Wireless Magazine" at 1/3, post paid. Index letters "P.W." refer to "Practical Wireless" sets, "P.M." to "Practical Mechanics" sets, "A.W." refer to "Amateur Wireless" sets, and "W.M." to "Wireless Magazine" sets. Send (preferably) a postal order (stamps over sixpence unacceptable) to "Practical and Amateur Wireless" Blueprint Dept., Geo. Newnes, Ltd., 8-11, Southampton Street, Strand, W.C.2.

Mains Operated.

Two-valve : Blueprints, 1s. each.		
Consolectric Two (D, Pen) A.C...	23.9.33	AW403
Economy A.C. Two (D, Trans)A.C.	—	WM286
Three-valve : Blueprints, 1s. each.		
Home-lover's New All-electric Three (SG, D, Trans) A.C. ..	—	AW383
S.G. Three (SG, D, Pen) A.C. ..	3.6.33	AW390
A.C. Triodyne (SG, D, Pen) A.C. ..	19.8.33	AW399
A.C. Pentaquester (HF, Pen, D, Pen) A.C.	23.6.34	AW439
D.C. Calibrator (SG, D, Push-pull Pen) D.C.	*July*'33	WM328
Simplicity A.C. Radiogram (SG, D, Pen) A.C.	*Oct.* '33	WM338
Six-guinea A.C./D.C. Three (HF, Pen, D, Trans) A.C./D.C. ..	—	WM364
Mantovani A.C. Three (H.F. Pen, D, Pen) A.C.	*Nov.* '34	WM374
Four-valve : Blueprints, 1s. 6d. each.		
A.C./D.C. Straight A.V.C. 4 (2 HF, D, Pen) A.C./D.C.. ..	8.9.34	AW446
A.C. Quadradyne (2 SG, D, Trans) A.C. ..	—	WM279
All Metal Four (2 SG, D, Pen) ..	*July* '33	WM329
"W.M." A.C./D.C. Super Four	*Feb.* '35	WM382
Harris Jubilee Radiogram ..	*May* '35	WM386

SUPERHETS.

Battery Sets. Blueprints, 1s. 6d. each.		
"W.M." Stenode	—	WM373
Modern Super Senior	—	WM375
Mains Sets : Blueprints, 1s. 6d. each.		
1934 A.C. Century Super A.C. ..	10.3.34	AW425
Seventy-seven Super A.C. ..	—	WM305
"W.M." D.C. Super D.C. ..	*May* '33	WM321
Merrymaker Super A.C.	*Dec.* '33	WM345
Heptode Super Three, A.C. ..	*May* '34	WM359
"W.M." Radiogram Super A.C...	—	WM366
"W.M." Stenode, A.C.	*Sep.* '34	WM370
1935 A.C. Stenode..	*Apl.* '35	WM385

PORTABLES.

Four-valve : Blueprints, 1s. 6d. each.		
Midget Class-B Portable (SG, D, LF, Class B)	20.5.33	AW389
Holiday Portable (SG, D, LF, Class B)	1.7.33	AW393
Family Portable (HF, D, RC, Trans)	22.9.34	AW447
Town and Country Four (SG, D, RC, Trans)	—	WM282
Two H.F. Portable (2 SG, D, QP21)	*June* '34	WM363
Tyers Portable (SG, D, 2 Trans)	*Aug.* '34	WM367

SHORT-WAVERS—Battery Operated.

One-valve : Blueprints, 1s. each.		
S.W. One-valve converter (price 6d.)	—	AW329
S.W. One-valve for America ..	—	AW429
Roma Short-waver	—	AW452
Two-valve : Blueprints, 1s. each.		
Home-made Coil Two (D, Pen) ..	14.7.34	AW440
Three-valve : Blueprints, 1s. each.		
World-ranger Short-wave 3 (D, RC, Trans)	—	AW355
Experimenter's 5-metre Set (D, Trans, Super-regen) ..	30.6.34	AW438
Experimenter's Short-waver	*Jan.*19, '35	AW463
Short-wave Adapter ..	*Dec.* 1, '34	AW456
Superhet, Converter ..	*Dec.*1, '34	AW457
The Carrier Short-waver.. ..	*July* '35	WM390
Four-valve : Blueprints, 1s. 6d. each.		
A.W. Short-wave World Beater (HF Pen, D, RC, Trans) ..	2.6.34	AW436
Empire Short-waver (SG, D, RC, Trans) ..	—	WM313
Standard Four-valve Short-waver	*Mar.* '35	WM383

Mains Operated.

Two-valve : Blueprints, 1s. each.		
Two-valve Mains Short-waver (D, Pen) A.C.	—	AW453
"W.M." Band-spread Short-waver (D. Pen) A.C./D.C.	*Aug* '34	WM368
"W.M." Long-wave Converter ..	—	WM380
Three-valve : Blueprints, 1s. each.		
Emigrator (SG, D, Pen), A.C. ..	—	
Four-valve : Blueprints, 1s. 6d. each.		
Gold Coaster (SG, D, RC, Trans) A.C.		

MISCELLANEOUS.

Enthusiasts Power Amplifier (1/6)	J	
Newstyle Short-wave Adaptor (1/-)	J	
Trickle Charger	Ja	

his illustration
pearance of the
scillator.