A BEGINNER'S GUIDE TO RADIO

1/-

PRACTICAL WIRELESS

Vol. 29. No. 560
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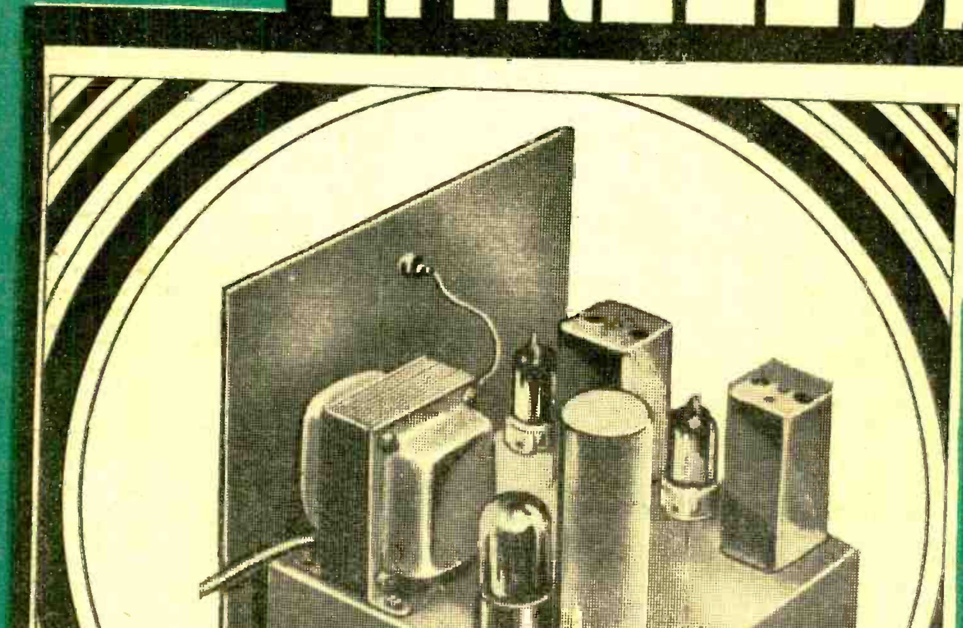
EDITOR:
F. J. CAMM



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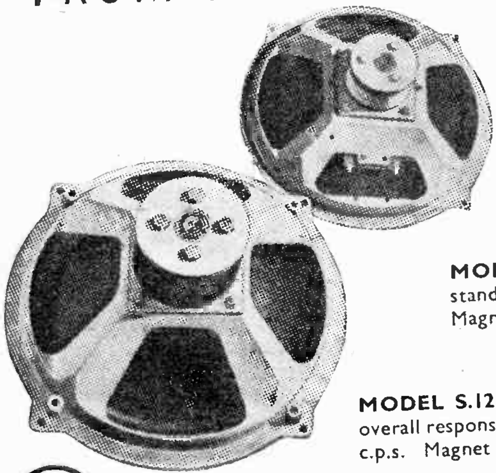

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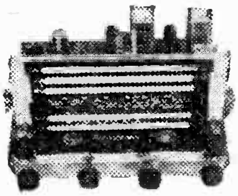

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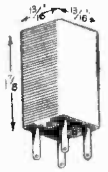
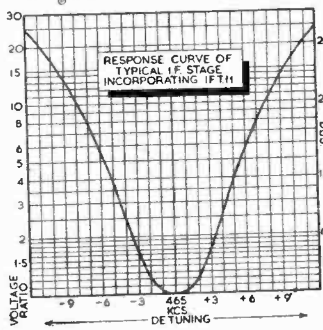
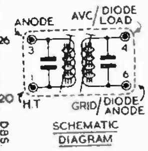
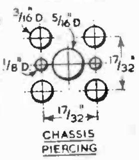
MINIATURE I.F. TRANSFORMER IFT. 11



We do not feel that we can make any further improvements on this I.F. Transformer, as we now offer you the highest possible quality at the lowest retail price of **12/-** per pair. Our New Transformer has: Litz wound coils, Silver Mica Condensers, Iron Core adjustment and Four Solder Lugs. For complete details of this and other products send 9d. for general catalogue.







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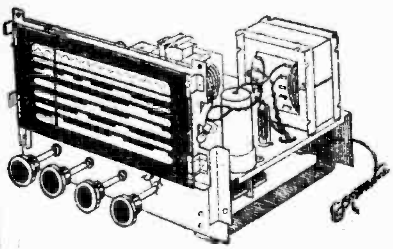

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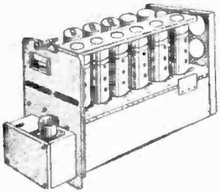

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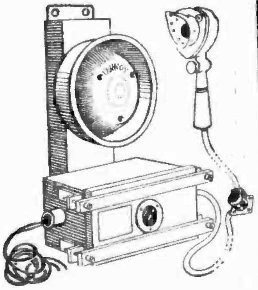

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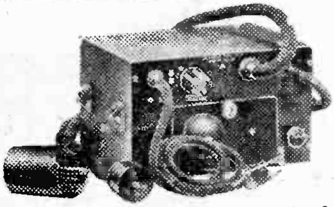

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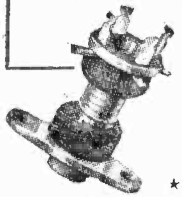

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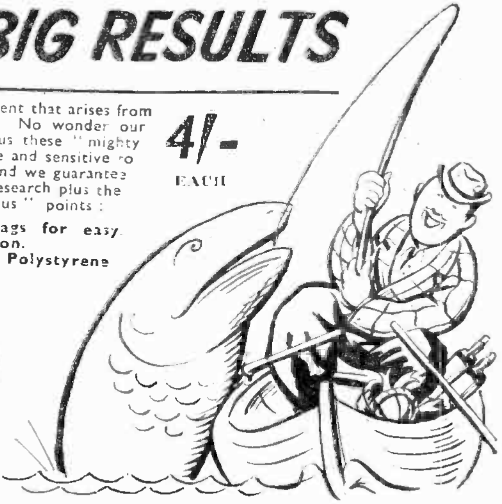

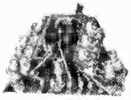

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All metal parts are ready drilled for easy assembly. Full instructions and diagrams.

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5 Megohms—50,000 ohms	50 mfd.—.2 mfd.
100,000 ohms—1,000 ohms	1 mfd.—.01 mfd.
1,000 ohms—10 ohms	.01 mfd.—.0005 mfd.

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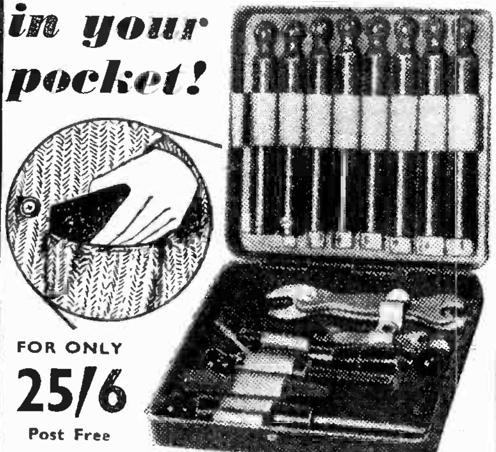

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Practical Wireless

EVERY MONTH
VOL. XXIX, No. 560, JUNE, 1953

Editor F. J. CAMM

21st YEAR OF ISSUE

COMMENTS OF THE MONTH

By THE EDITOR

The BBC and V.H.F.

UNDER present conditions, we are informed, there is no possibility of south-east England being provided with its own regional broadcasting station, although the BBC has alternative plans, based on the use of V.H.F. which will give improved reception if Government approval is obtained.

A statement was issued on the authority of the Head of the Engineering Information Department in reply to a letter from the Chairman of the Association of Bexhill Citizens, who complained to the BBC about sound and television reception in that district. The statement says that the number of transmitting stations which the BBC can operate has to be related to the strictly limited number of wavelengths made available by international agreement, and this prohibits the setting up of more than the present number of Regions. The BBC, of course, is well aware of the fact that reception on the South Coast is not satisfactory, but this also applies to certain other parts of the country, and the BBC has done everything in its power, within the limits of wavelength limitations, to remedy the matter. The statement goes on to say that the point has been reached where no major improvements are possible while broadcasting is restricted to the present long and medium wavebands.

The solution lies with V.H.F. on a nationwide coverage. Plans for such a system were placed before the Government as long ago as 1951 and they have been referred to the reconstituted Television Advisory Committee. The BBC, however, cannot put these plans into effect until Government permission has been obtained.

THE BUDGET AND RADIO

ALTHOUGH the tax concessions in the Budget were not as generous as had been expected, they are none the less welcome, and an indication that we have reached the peak of high taxation and that prices will come down. The reduction is from 66⅔ per cent. on radio and TV receivers to 50 per cent., which means that an all-wave radio model, which costs £26 5s., will now cost £24 5s., and a combined mains-battery picnic portable, selling originally at £19 19s., will now cost £18 5s.

The reduction in battery prices means that a 17s. 1d. battery will now cost 13s. 9d.; a 13s. 1d. battery will be 10s. 6d.; a 9s. 8d. battery 7s. 9d. and a 2s. 1d. battery 1s. 6d.

In brief, the reduction of Purchase Tax means about £10 saved in every £100 and *pro rata*.

NEW F.M. SYSTEM

DR. E. H. ARMSTRONG, Professor of Electrical Engineering at Columbia University, and the original inventor of F.M. radio, recently announced that he has improved his system to a point where two or three different programmes on a single channel can be transmitted simultaneously.

Under this system a set owner would tune his F.M. set once, as at present, and receive the first programme and by the operation of a simple switch receive the other two. Present F.M. transmitters can be modified at a reasonable cost to take advantage of the new system. The availability of two channels on which to transmit from the same station will make possible "three dimensional sound" on radio, or binaural transmission. The heart of the system is known as the Multiplex Radio Transmission, involving the use of a single carrier wave to transmit more than one signal. This system, of course, has been in use for many years in radio communication.

THE RADIO COMPONENTS SHOW

THE tenth Radio Components Show, organised by the R.E.C.M.F. at the Grosvenor Hotel during April graphically illustrated the importance of the components industry. Although it was a private exhibition of British valves, test gear and components for the electronic and telecommunications industries, it was none the less visited by many members of the public. Some of the statistics, however, are illuminating. In 1939 over 90 per cent. of the products of the industry were used in domestic radio and television receivers, but in 1952 although many more receivers were made, they absorbed only 40 per cent. of the output. The value of the exports of components in 1952 was £7,800,000, or nearly a third of the value of the exports of the whole British radio industry. These figures are exclusive of the value of valves which in 1952 were exported to the value of £3,600,000. F. J. C.

ROUND the WORLD of WIRELESS

Transfer of Station

EASTBOURNE'S bad radio reception, which has been the subject of many complaints from its residents for years, may be well on the way towards being solved by the end of the year.

Mr. David Gammans, Assistant Postmaster-General, gave this assurance recently and the "booster" station at Hastings is to be transferred to Bexhill, Sussex, and should be ready before next winter.

Transmitter's Success

MR. GEORGE M. ROSE, of Mountain Lakes, New Jersey, has worked three stations, one over 25 miles away, on a transistor transmitter with power supplied by a small 22½-volt hearing-aid battery.

The transmitter is no larger than a packet of cigarettes.

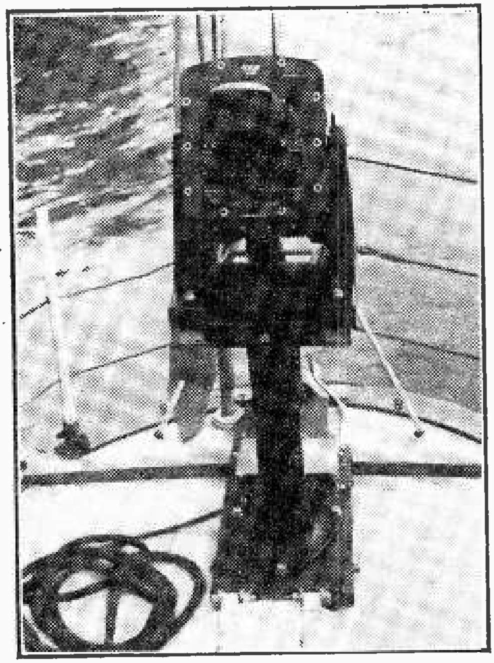
B.I.R.E.

THE following meeting will be held on Wednesday, May 6th: Merseyside Section, 6.45 p.m., at Electricity Service Centre, Whitechapel, Liverpool. Annual general meeting followed by "The Development of the Radio and Electronics Industry in India," by G. D. Clifford.

This completes the programme of institution meetings in the British Isles for this session. The first meetings of the 1953-4 session will be held in September.

One Radio per House

AT the annual general meeting of the Radio and Electronic Component Manufacturers' Federation, Mr. H. V. Slade, chairman, said that Britain had one radio set per house whereas the average home in the United States had two and a half receivers.



The Decca waterproof radar display, type 4207, mounted on the deck of the "Navigator" during the recent demonstration on the Thames.

Waterproof Marine Radar

THE first completely waterproof radar display, for use on the open bridge of a ship, was recently demonstrated by Decca Radar on the Thames between Blackfriars and Greenwich.

The waterproof display, exhibited on the Decca training ship *Navigator*, meets the Royal Navy requirements and operates either as a "master" or "slave" in positions open to heavy seas and rain. The display, type 4207, is completely enclosed in a watertight case with panel controls extending through watertight glands.

Broadcast Receiving Licences

THE following statement shows the approximate number of licences issued during the year ended February, 1953. The grand total of sound and television licences was 12,867,898.

Region	Number
London Postal ...	1,748,112
Home Counties ...	1,478,727
Midland	1,336,858
North Eastern ...	1,770,056
North Western ...	1,399,994
South Western ...	1,035,927
Welsh and Border ...	685,029
Total England and Wales	9,454,703
Scotland	1,125,645
Northern Ireland ...	214,570
Grand Total	10,794,918

Tests in Surrey

AT Kingswood Warren, a large country house in Surrey, some 20 miles from London, 200 BBC engineers and research men are carrying out tests and experiments in an effort to improve radio and television reception. Their work includes aerial study, using kite balloons to which new transmitting aerials are attached, eliminating the expense of erecting giant masts.

Third Programme

DURING the week May 31st to June 6th, every programme to be broadcast in the Third Programme has been chosen to reflect some aspect of the Coronation. In the weeks before and after the event, also, the Coronation will provide the theme for many programmes.

The broadcast of Her Majesty the Queen, to be given simultaneously in all BBC internal services at 9 p.m. on June 2nd, will in the Third Programme be set in concert of Handel's music.

H.P. Abuses

IT is reported from the Midlands that many dealers in radio receivers and radiograms are finding that customers buying sets on the hire-purchase system are defaulting in their payments.

This has resulted in many dealers having to apply for court orders to regain their property from people who fall behind in their payments.

The Ampere Medal

THE Ampere Medal presented by the Société Française des Electriciens of France has been awarded this year to Monsieur H. Andre.

This medal, of which one only is presented annually, is awarded in consideration of a life's work in some branch of the electrical field.

Monsieur H. Andre is the inventor of the modern form of silver-zinc accumulator, the Commonwealth rights of which are held by Venner Limited.

V.H.F. Radio Link

THE sound broadcast of the boat race by the BBC from the launch *Enchantress* was transmitted via a high-quality radio link provided by GME.550 Mobile Frequency-modulated V.H.F. Communications Equipment, developed and manufactured by Mullard Ltd. This extremely compact equipment has been specially designed to give broadcast quality transmissions, and is used in over 90 per cent. of all outside BBC broadcasts involving radio links. It is operated from 12-volt batteries.

Wireless for Patients

INSTALLATION of new radio equipment in Boundary Park General Hospital, Oldham, to provide a wireless service for the patients will cost the Oldham Hospital Management Committee £2,200.

The suggestion that television should be installed was turned down, radio being considered of greater priority. Most of the patients can now hear programmes by earphone or pillowphone.

Licence Drive

AN intensive search for licence dodgers was carried out in the county of Northampton during April, mainly in the county town itself.

The detector van was used in the drive which was the first since October, 1950, when many listeners were caught without licences but none prosecuted. This time, according to Mr. T. A. Benger, Head Postmaster of Northampton, the "pirates" will not find it so easy.

"Great Pianists"

EDWARD SACKVILLE WEST, who has previously broadcast in the Third Programme series of talks with musical illustrations on questions of interpretation, is broadcasting a new series of talks in May and June under the title of "Great Pianists."

Radio Controlled Models

THE International Radio Controlled Models Society, announces that its Annual International Contests for Radio Controlled Models, will be held at Southend-on-Sea, on July 25th and 26th.

A contest for radio controlled model boats will be held on Saturday, July 25th and contests for radio controlled model aircraft on Sunday, July 26th. The aircraft sections of these contests, comprising a contest for power-driven aircraft and a contest for gliders, are held in accordance with the F.A.I. regulations for international contests.

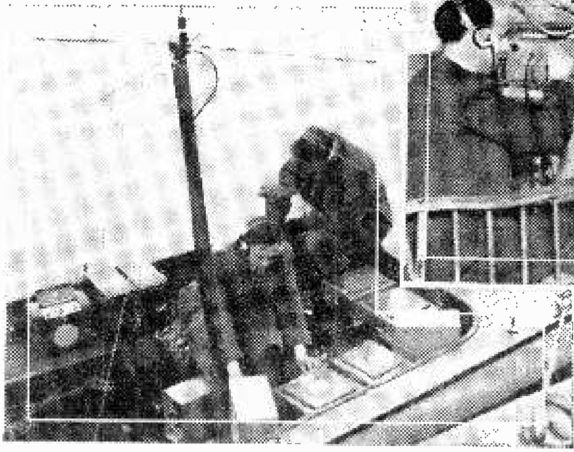
Apparatus for Use in Schools

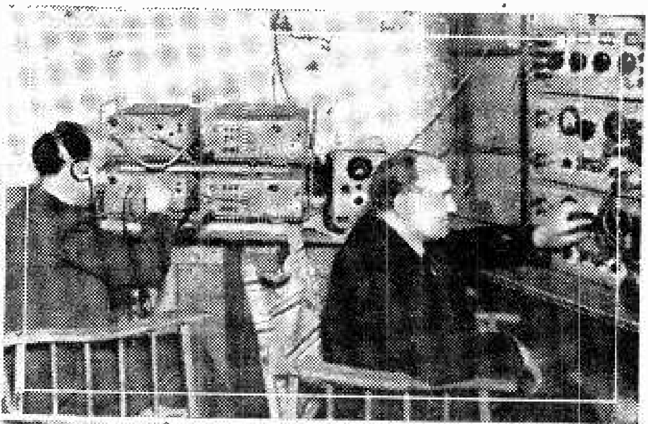
THE School Broadcasting Council has issued a fourth list of Broadcast Receiving Apparatus, approved as suitable for use in schools. Copies of the list (free) and further information may be obtained from the Secretary, School Broadcasting Council for the United Kingdom, 55, Portland Place, London, W.1.

G.E.C. Sound Equipment

THE installation of a complete public address equipment in a 5,000-ton liner in four days has been achieved by the staff of the Singapore Branch of the G.E.C., Ltd.

The work had to be carried out during the brief periods for which the S.S. *Jalagopal*, 5,321 tons, plying between Bombay, Madras, Penang and Singapore, could dock in the Crown Colony. Thus the four days installation period was not a continuous one, a point that will be fully appreciated by engineers who have tackled similar problems.





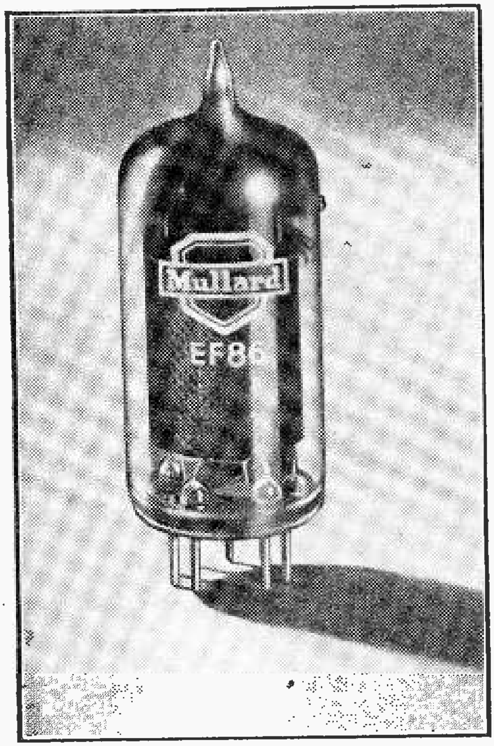
For the commentary on the Boat Race this year, two Mullard F.M., V.H.F. transmitters and a receiver were installed in the launch Enchantress. *(Left) BBC engineers at the controls in the launch. (Right) An engineer at the reception point, the roof of Harrods Depository situated on the south bank of the Thames.*

The Radio Components Show

A REVIEW OF SOME OF THE EXHIBITS AT THIS YEAR'S R.E.C.M.F. EXHIBITION

THIS year's exhibition was the largest which has yet been held, the number of exhibitors being 120. The attendance, too, broke previous records, 30,000 tickets being issued for the three days on which it was opened.

The increasing use of electronic arrangements in industry has resulted in the development of special items, and in many changes in the design and appearance of well-known devices. For instance, the fixed condenser is a simple component which is readily identified by every amateur, but in its many new forms it would undoubtedly be unrecognised by many constructors. Six of these components are illustrated at the foot of the opposite page, and although these particular models bear some



The Mullard EF86 low-noise A.F. pentode with B9A base.

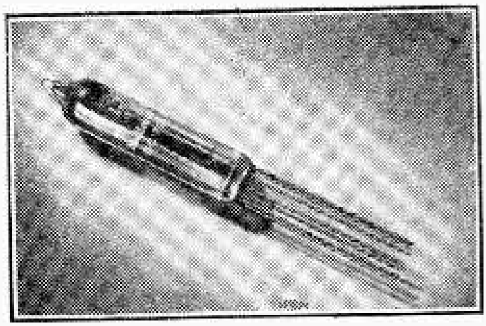
resemblance to the popular condenser, the multiplicity of leads would undoubtedly lead to some confusion to anyone not acquainted with them. In the circular forms and other models the same remarks apply. New techniques have been introduced in the making of these components, and much higher degrees of accuracy are now attained. Polystyrene is being used as the dielectric and this may be made to much more accurate thicknesses than paper, etc., and the exact sizes of required capacities may, therefore, be more easily calculated. A further advantage is that the capacities will not vary so much under wider temperature changes, and the overall size is also reduced.

Miniaturisation

The resulting compactness of these components is also reflected in the overall dimensions of other items right up to the actual valves, a midget version of which is seen below. This is approximately of the same pictorial proportions as the small B9A based EF86 shown by its side, and as most constructors know these are already much smaller than the standard type of valve which has for so long been in general use. The latter illustration is, in fact, slightly larger than full-size. Egen Electric showed some miniature volume controls which, with the small valves and condensers mentioned, are employed in deaf-aids, the modern version of which is more compact but gives greater amplification than models seen last year. The introduction of Ferroxcube and similar materials has also enabled transformers and other items to be cut down in size and in many cases this has been accomplished with an increase in efficiency, so that the general impression one gained of the exhibits was that the back-room boys had been very busy during the past 12 months.

In addition to such items as wire, cables, mouldings, valveholders, test equipment, etc., there were many new products such as the magnetic materials produced from iron dust seen on the G.E.C. stand. Although this material has been used for some time in coils and other materials, it was not possible to use it for the production of a permanent magnet. The powder was too coarse, and in the new magnets the particles of iron which are used are only 100 times the diameter of an atom of iron, and one-thousandth the diameter of the finest radio iron powder hitherto manufactured.

To produce this fine powder presents many difficulties, one of which is that when fine metallic powders are loose they are liable to ignite on coming into contact with the air. This has

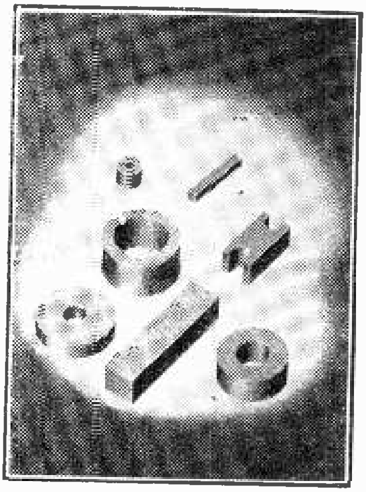


This is the Mullard sub-miniature indirectly-heated triode, type DC70.

been satisfactorily overcome, and some small sample magnets were available showing that they weigh about half as much as a conventional steel magnet of the equivalent power. The applications of such material to such branches as airborne equipment need no emphasis.

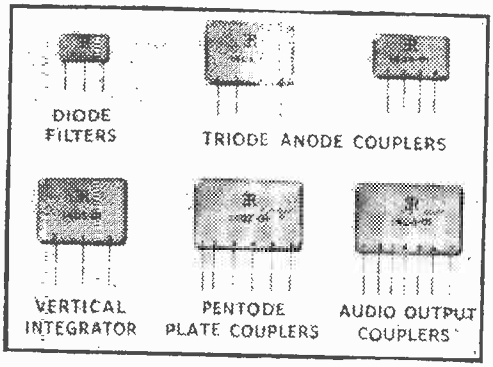
Constructional Accessories

An interesting line which was attracting considerable attention during our visit was the new Multicore Tape Solder which can be melted by the heat of a match. This is the standard resin-cored material which has for so long been popular with the set builder, but constructed in the form of a thin tape. It is intended to be wrapped round the required joint, and then if a lighted match is held under it it will run and make a sound joint, thus removing the need for an iron which may be desirable in some types of delicate equipment. If it is required to use the material for a large joint a number of layers may be used and a candle or spirit lamp used. This particular material is available on a card for 1s. To assist in the construction of miniature receivers or small instruments Multicore were also showing a solder in miniature form—a 3-core solder in 34 s.w.g.



A selection of Ticonal permanent magnets.

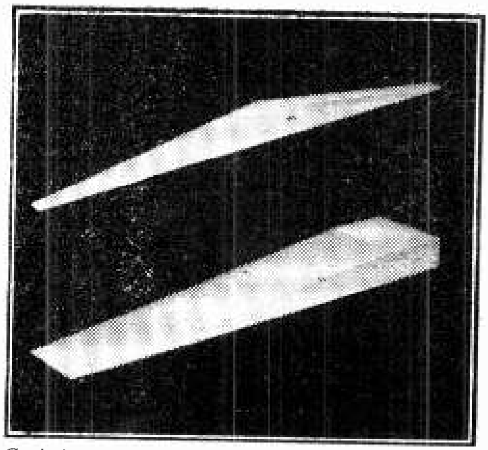
For the reproduction side of home-built receivers, in addition to the popular W/B range of speakers, elliptical loudspeakers are now available, and these enable overall cabinet size to be reduced as well as giving improved reproduction. Various claims are made for this shape of speaker, and in many of the models shown the magnets are of special material and design to reduce the external field and thus permit of their use in compact and television receivers.



A group of the new T.C.C. capacitors.

Recording

A large range of record and tape equipment was on view, the Collaro and Garrard ranges being very extensive and including a number of already familiar models. The increasing popularity of Long Playing Records has resulted in a wide range of pick-ups and turntables, motors, etc., and some new complete models were to be seen. Tape Equipment has also increased in variety and efficiency, and some new complete desks were on show. The popular Wearite Tape-Deck was seen in several types—one of which has dual-track facilites. This has a single synchronous capstan motor, whilst others, such as the Truvox, have 3-motor drives. We could only find one instrument which had a playing-time indicator, but the fast rewind feature now appears to be a standard in all models. A novel feature seen in the Ferrograph instrument is a "voice-signal" switch which sets the recorder in operation only when a signal is present in the recording head. Thus, should the recorder be used with some signal which is intermittent (for instance, recording a telephone conversation or radio signal) it will avoid considerable waste of tape and time by stopping when the signal ceases.



"Caslode"—a homogeneous ceramic semi-conductor for use as absorbers and attenuators for micro-wave radiation.

Among the many small items the Belling Lee stand was probably the most comprehensive. Fuses, fuse-holders, interference suppressing devices, terminals, aerial equipment and a multiplicity of plugs and sockets were shown, many already well tried and tested over the years, but a few newer models to cope with new practices. For the manufacturers, Simmonds Aerocessories had a wide range of fixing devices on view, all intended to simplify the construction of receivers by avoiding the use of nuts and bolts. A few of these items are available to the home-constructor, but it is to be hoped that many more will be available in the near future.

A BALANCE METER

AN ACCESSORY FOR THE QUALITY ENTHUSIAST

By Robert D. Paterson

No audio amplifier containing one push-pull stage or more will give of its best unless each stage is balanced, that is, unless each valve of the pair passes substantially the same current as its push-pull counterpart. This cannot be ensured simply by using the same type of valve and the same nominal values of components on each side of the stage. Variations in valve characteristics and component values even within manufacturers' tolerances may well add up to a state of distinct unbalance. Nor, even supposing a stage is balanced when the amplifier is built, can it be depended on to maintain itself in that condition indefinitely. Changes in valve characteristics, etc., due to ageing may cause unbalance in a relatively short time. Means must be provided to restore balance by altering the grid bias or the load resistors. In the typical push-pull amplifier shown in simplified form in Fig. 1 this could be done by substituting the networks shown in dotted lines for the resistances R1, R2, R3 and R4. But however the balancing is accomplished some form of metering must be incorporated to check the state of balance from time to time. The most obvious method, that of inserting a meter of appropriate range in each anode circuit, is unlikely to appeal to the constructor as it would permanently tie up in the amplifier four valuable meters. It would be possible to use one meter only switching it into the correct positions in turn but this method also has its drawbacks. For one thing, the same meter would not suit equally well the output stage with, say, 50 mA per valve and the preceding stage with perhaps only five. Also, unless the meter was of low resistance, its withdrawal from the circuit might readily upset the balance obtained with it in circuit. Lastly, the switching required would be complicated and likely to introduce feedback in the wrong sense and therefore instability.

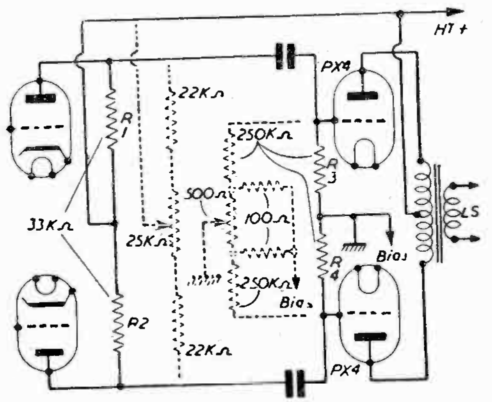


Fig. 1 (a).—Networks to be substituted for R1-R4 are shown in broken lines.

It is possible, however, to avoid these troubles by employing an ex-R.A.F. unit currently obtainable from surplus stores. Each unit contains two microammeter movements, identical but independent, and so capable of being applied simultaneously to the two anode circuits of a push-pull stage. Each movement requires 120μA for full-scale deflection and the pointers cross for most of their travel. Between the crossed pointers is a vertical line whose top is crossed by the pointers at 100μA while the bottom of the line represents approximately 20μA and its midpoint 60μA. The movements are well damped and are not appreciably affected by surges of current although responding clearly to enduring changes. This "balance meter" can be made to show simultaneously :

1. The current taken by each valve of the pair ;
2. Whether these currents are, as they should be, equal

and enables immediate equalisation of the currents to be effected if either has drifted from the point of balance. The meters are not used to measure current directly as that would involve complex switching to get them in and out of circuit. They are used to measure the voltage across and, therefore, indirectly, the current through identical test resistors inserted in the anode circuits of each stage. These resistors also act as anode stoppers. The resistance of the meters when used as voltmeters is so high as to have

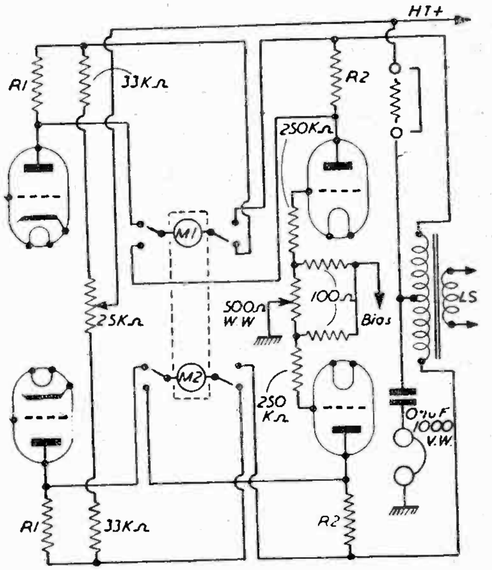


Fig. 3.—Test voltages are developed across R1-R4, whose values are calculated as described in the text.

negligible effect upon the current passed and, of course, none upon the balance.

Suppose that the unit is to be applied to the amplifier of Fig. 1, consisting of two PX4's in push-pull, preceded by push-pull drivers and that the currents passed are, respectively, 50 mA and 5 mA per valve. The circuit is to be arranged so that when the valves are passing their correct current the pointers of the meter unit will cross at a point on the vertical line on the dial chosen so that the meters can register excess current as well as deficiency. Assume, too, that the meters are to be converted to voltmeters by making up their internal resistance to 20 K with series resistors. It follows that the voltage required to be developed across the test resistors to register, say, 60μA on the meters will be:

$E \doteq I.R = 60 \times 2 \times 10^4/10^6 = 1.2$ volts.

Since each output valve should pass 50 mA the resistance which will develop 1.2 volts when 50 mA are passing is:

$R = E/I = 1.2 \times 1000/50 = 24$ ohms.

Similarly, each driver stage will require an inserted resistor of 240 ohms. See the adjoining table for values corresponding to other total meter resistances.

Since 24 and 240 ohm resistors are not standard an alternative approach is to choose standard resistors of the same order and find out if the zero they produce on the meter lies on the vertical line.

For instance, what will be the result if we choose resistors of 47 ohms and 470 ohms? Five milliamps passing through 470 ohms and 50 mA passing through 47 ohms will develop the same voltage:

$E = I.R = 50 \times 47/1000 = 2.35$ volts

and this voltage applied to a voltmeter with a total resistance of 25 KΩ will produce a current:

$I = E/R = 2.35 \times 1{,}000 \times 1{,}000/25{,}000 = 94$ μA

which is a suitable point within the range of a 120μA meter and not off the vertical line.

The Practical Side

Before anything else is done the meter should be checked and, if desired, calibrated. Set up the circuit shown in Fig. 2A, wiring the two movements in parallel so that the pointers move in opposite directions when current passes. R1 may be composed of two resistors, 10K and 6.8K in series. Its purpose is to limit the current passing to a maximum of 120μA even when the variable resistor is at its minimum. The maximum value of the variable resistor will reduce the current to less than 20μA. If a battery of higher voltage is used a correspondingly higher value of series resistor will be required.

Carry out the following checks :—

a. Check that when no current is passing the pointers lie over the two sloping lines on the dial which make convenient reference points. If necessary use the mechanical zero adjustments to set the pointers over the lines.

b. Set the variable resistor to its maximum and close the switch. Adjust the resistance slowly and check that the intersection of the pointers as they move always lies over the vertical line. This it should do unless the meter is faulty.

Choosing the Series and Test Resistors

The circuit shown in Fig. 2B is used to choose two identical resistors for the meters. Pairs of resistors of the same nominal value are inserted at r_a and r_b until two are found such that the pointers intersect on the vertical line. Alternatively, two variable resistors can be similarly treated or one variable matched to a fixed resistor preferably of the precision type and of 20K Ω. In the same circuit and in the same manner can be selected the pairs of identical resistors across which the voltages to be measured are to be developed. Although the resistors should be of the order stated in the table it is much more important that each pair should be exactly equal than that they should be of precisely the value indicated. Unless it is proposed to calibrate the meter in mA for which purpose the test resistors will be required, as described under "Calibration" these can now be inserted in the amplifier, the pair of higher value in the driver stage and the other pair in the anode circuits of the putput valves. Since they are also intended to act as anode stoppers they should be wired in as closely as possible to the anode pins of the valveholders. The switching involved is shown in Fig. 3, the amended version of Fig. 1. A 4-pole, 2-way switch is required. If the constructor expects to have other uses for the meter unit a 3-way switch should be used and the extra contacts brought out to four terminals so that either or both parts of the unit can be used independently.

Calibration

If the test resistors and the total meter resistances are of precisely the values calculated both pointers will lie over the chosen point of reference when the valves are passing 50 mA and 5 mA respectively. The vertical line then can be readily calibrated in the circuit of Fig. 2C, using a microammeter of 100 or 200μA as the standard. Remove the case from the

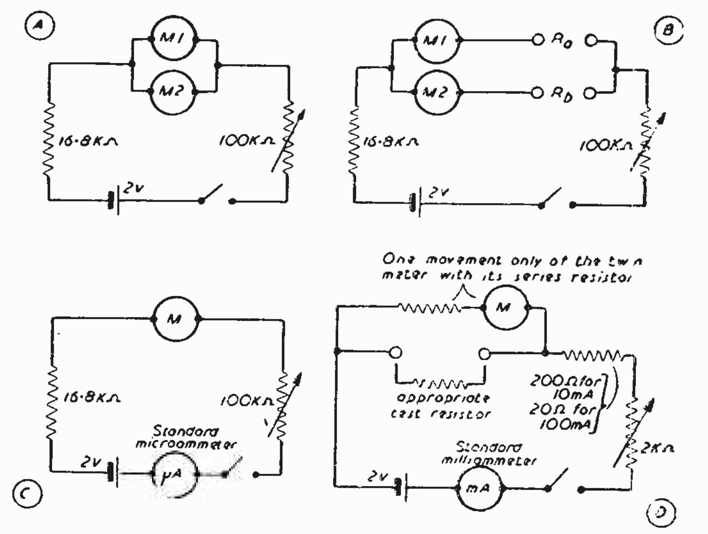


Fig. 2.—Circuits used in checking meters and test resistors.

meter taking every precaution to prevent dirt from entering the delicate movements. Adjust the variable 100K Ω resistor until the standard microammeter reads 60μA, put a mark on the vertical line where the pointer (only one movement need be used) crosses it and label that point 5 mA on one side and 50 mA on the other. If desired, micro-amp. readings can also be inserted. Similarly 1, 2, 3,........9 mA are represented by 12, 24, 36,........108μA on the standard meter. If, as is more likely, the matched pairs of resistors depart from the theoretical values, the milliamp. scales can be independently calibrated in the circuit of Fig. 2D. This must be done, as stated above, before the test resistors are incorporated in the amplifier and milliammeters of suitable range must be used, 0-10 mA with the 240 ohm resistors and 0-100 mA with the 24 ohm. The calibration is simple. The variable resistor is adjusted until the milliammeter reads 1 mA, 2 mA, etc., in succession and the corresponding points on the microammeter suitably marked.

TABLE OF RESISTORS

Microammeter f.s.d.	Total Resistance of Meter and Series Resistor	Volts to give half f.s.d.	Resistance in ohms to give required voltage when passing : 5 mA	50 mA
120	20 KΩ	1.2	240	24
	10 KΩ	0.6	120	12
500	20 KΩ	5.0	1,000	100
	10 KΩ	2.5	500	50
1 mA	10 KΩ*	10.0	2,000	200

* Note that if a meter of 1 mA or more is used the test resistors required rise in value so that the effect of the parallel resistance inserted by the meter ceases to be negligible. A low value of series resistor should therefore be used. Unit used was Visual Indicator Ref. 100/2.

Using other Movements

As some twin 500μA meters are available (and there may be some of other values) the following notes should enable anyone to make the calculations necessary to use them.

Take as the point of reference a reading about half to two thirds the full scale deflection, *expressed in amperes.*

Let the total resistance of each meter plus the series resistor required to convert it into a voltmeter $= r_m$.

Then the voltage required to produce whatever proportion of f.s.d. (full scale deflection) is decided upon is :—

$e =$ f.s.d. in amperes $\times$ proportion decided upon $\times\ r_m$.

and the resistor which will develop "e" volts when a valve is passing "m" milliamps. is :—

$$r \text{ ohms} = \frac{e \times 1{,}000}{m}$$

Another usable unit contains one 500μA movement and one of 120μA shunted to 2 mA f.s.d. with pointers on two separate arbitrary scales, one vertical, the other horizontal. Each can be set to a central point as a zero. The 120μA movement can be used with or without the shunt but see the footnote to the table of resistors.

A Final Refinement

Once each stage has been balanced an overall check upon balance can be made by inserting a pair of high-resistance headphones either between the mid-point of the primary of the output transformer and the earth line with a reliable condenser in series to block d.c. or across a 100K resistor—with a suitable shorting bar, as suggested recently in PRACTICAL WIRELESS—in the portion of the H.T. lead common to both output valves. Both methods are shown in Fig. 3 though of course, only one need be adopted. Final adjustments should then be made to R5 and R6 for *minimum* signal in the headphones.

Death of a Pioneer

IT is with regret that we announce the death at Brentford (Middx.) Hospital recently of Mr. Andrew Gray, one of the earliest of the wireless pioneers and a personal friend and assistant of the late Marchese Guglielmo Marconi.

He was 80, and since his retirement 21 years ago had lived in West London, first in Acton and later at Brentford.

Mr. Gray was born at Glasgow and was a graduate of Glasgow University. He subsequently took a diploma in electrical engineering at the Glasgow and West of Scotland Technical College, later to become assistant to the late Professor Andrew Jamieson.

In 1895 he joined the staff of the West India and Panama Telegraph Co., Ltd., first as assistant electrician, then as chief electrician and later as telegraph engineer. He was responsible for the efficiency of 7,000 miles of cable.

It was in 1899—two years after the formation of Marconi's—that Mr. Gray first joined it and started immediately as personal assistant to Marconi ; he was particularly active in tests between the Isle of Wight and the mainland in the tuning of wireless circuits whereby multiplex and duplex working were made possible.

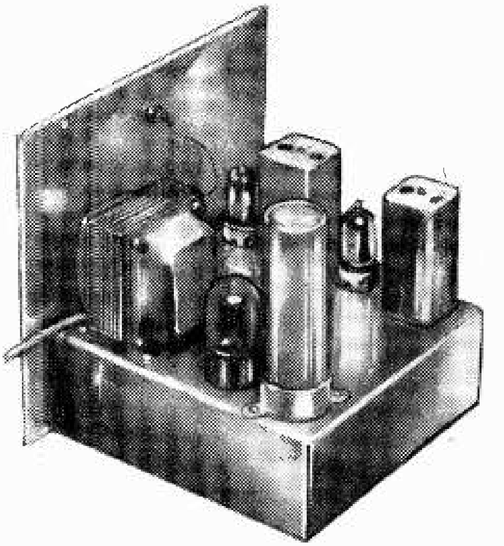
At the turn of the century Mr. Gray introduced the Marconi system of wireless inter-communication in the Hawaiian group of islands, organising and training local operators. It was from this system that the first regulations regarding marine wireless operation were eventually born.

The Marine company took over their own telegraph operating in 1906, but until 1919 Mr. Gray continued to supervise the testing and installation of wireless on ships. At the same time, as Chief of Staff, Mr. Gray was also responsible for design, testing, installation and working of all the Wireless company's stations and also development of patents for the parent and associated companies.

Mr. Gray was appointed chief engineer to the Company in 1910, joint general manager in 1923, and technical general manager in 1928.

On his retirement in 1932, Marconi said of him at a ceremony : "Ever since he joined me Mr. Gray has contributed to, and kept pace with, the vast expansion of wireless communications throughout the world. He has assisted me not only in my experiments for the development of radio communication, but also in obtaining and tracing valuable data and publications necessary for the carrying out of my work.

"In him I can truly say I have always had a most able and trusted collaborator, and a most loyal and trusted friend."



Radio Feeder UNIT

A High Quality Radio Unit for the Single-ended Hi-fi Amplifier

THE need for a high quality feeder unit of a reliable nature, that is capable of reproducing the full range that the BBC broadcast, has been felt in the amateur constructor field for a long time. In this unit the number of valves has been kept to a minimum and the power unit can be modified to a very large extent to use the components that the constructor has on hand. The two main valves are those of the latest design and combine both reliability and sensitivity whilst the improved heater construction reduces the hum modulation introduced by the valves themselves. The case and chassis used is the Kendall and Mousley type "9," as it is a smaller version of the case used for the single-ended hi-fi, and matches it perfectly. Thus with an amplifier and a feeder unit the versatility of the unit is more than doubled. As a tribute to the design and the musical reproduction of the units the original of the feeder unit and the hi-fi amplifier are now being used by an education authority for the instruction of pupils in music. This choice was made against several manufacturers, on the ground that the fidelity of the reproduction was the best.

It was decided that it was not necessary to have continuous tuning on the feeder unit as only two or at the most three stations are used by the connoisseur. The station selection is carried out by means of a three-position four-pole wafer switch, a separate pair of coils being used for each station. On the original model developed in our laboratory only two stations were used with the position in the centre of the switch being used for an "OFF," so that the unit could be cut out without touching the control setting of the main amplifier. The four tags, instead of being connected to the coils, are joined together and joined to chassis.

The smoothing unit of the feeder is one that has to be well smoothed, but the output current does not have to be high. There are many suitable smoothing chokes on the market and the inductance must be as high as possible. As the current is only quite low a good choke can be made by the use of an output transformer with the secondary wires cut off. The smoothing condensers chosen are the twin unit 32-32 made by Hunts. It is the type K41; the ripple permissible with this condenser is exceptionally high, and consequently it is of very low resistance. It is not generally realised that the electrolytic condenser has an amount of resistance as well as capacitance, and on the high ripple types this is very much lower. These condensers are made by all the leading condenser manufacturers, such as Dubilier, Hunts and T.C.C. Can-type condensers are far more reliable than the carton types as the metal is far less likely to get damaged and the electrolyte dry up. The ripple must be kept at an absolute minimum or, if the unit is used with an amplifier with a bass lift, the hum level will prevent the use of bass restoration. Also it is most distracting to an audience if there is an amount of background noise.

It is not advised that resistance capacity smoothing be used, as the resistance required to give the same amount of smoothing as the choke will give a drop so large that the amplification of the feeder unit will be greatly reduced. One other point in the reduction of hum is the wiring of the heaters on the

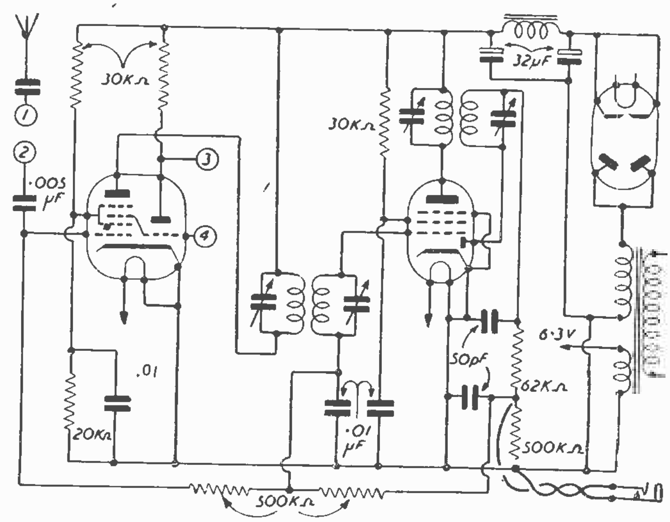


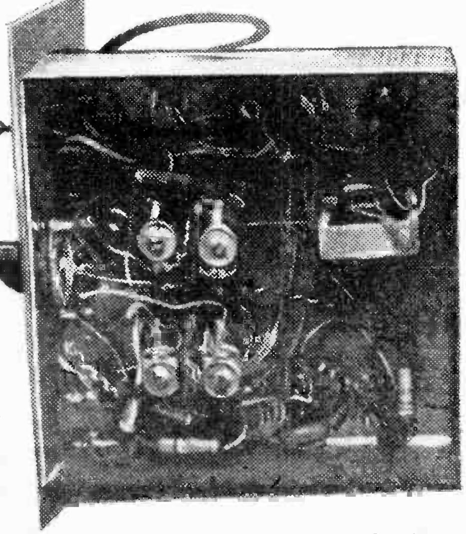
Fig. 1.—Theoretical circuit of the feeder unit.

valves. It seems easier to earth at each valve as it is simple and saves wire. This method has the disadvantage that there is hum radiated from the single wire, whereas if closely twisted twin wire is used the two equal and opposite hum fields due to the currents in the two wires will be zero as they cancel out. It is best to make the earth as close to the frequency changer valve as possible so that instability due to feedback via the heater wiring is eliminated.

The Circuit

The circuit is a conventional frequency changer using the Mullard ECH42, with a switched coil unit constructed out of Wearite type "P" coils. These coils are not one of the modern midget types and are about 1in. in diameter, consequently they naturally have a high "Q" but require a trimmer to be mounted across two of the tags. This the writer prefers to the use of slug tuning, but is a matter of opinion. Other makes of coils can be used if preferred by the constructors. The IF valve is a diode-pentode of the EAF42 type, another modern type made by Mullard Ltd. It combines the action of a diode for the detector and A.V.C. and the action of a variable-mu H.F. pentode. The A.V.C. is used for both this valve and the frequency changer. There is no bias on either valve as it is developed by the A.V.C. line. This has the effect of improving the action of the A.V.C. as the non-use of a bias resistor ensures that the full use of the A.V.C. voltage is made. If a bias resistor was used it would mean that as the current through the valve was reduced the bias voltage would also be reduced, so that the full effect of the A.V.C. voltage would not be obtained.

The IF coils used were made by Lee Products, Ltd., but several types were experimented with, and it was found that whilst the gain varied with different makes, this was counteracted by the A.V.C. so that only very little difference was made. Those made by the Amateur Division of the E.M.I. are very good, as are those made by Wearite.



A view of the underside of the chassis.

The other valve, the rectifier, is not in the least critical; it can be almost any type. As a Forest's pre-amp. transformer was available this was used; it gives an output of 30 ma at 250 volts and 6.3 at 2 amps. Almost any type of pre-amp. transformer can be used, providing that it will give sufficient L.T. for the valves. If it does not give sufficient a

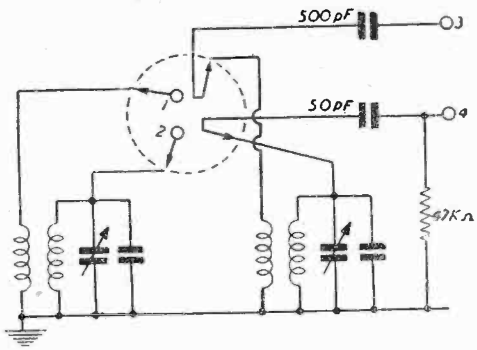


Fig. 2.—Wiring to the wavechange switch.

metal rectifier can be used. The range of 6.3 valves is very large and includes such types as 6X5GT, EZ35, EZ40 and the EZ41.

Construction

To start the actual construction of the unit, obtain a suitable chassis. The one for the type "9" instrument case made by Kendall and Mousley of Tipton was used in the prototype. This is 7in. square and 2½in. deep, and the suggested layout is given in Fig. 3. The actual drillings will depend on the type of transformer used, the size of the choke (this is mounted under the chassis), and the types of IF transformer used. It is just as well to lay out the components on the chassis and mark out the drilling from the position of the components. This way is very good for the constructor as errors due to measurements are very greatly reduced. The valve holes can best be made with the aid of a Q-Max or Osmor cutter as this tool makes a hole that is just as neat as one cut out by a press. Having marked out and made the holes, make provision for the tag strips. The latter are used for the mounting of resistors and condensers that cannot be made off to valve tags. Next mount all the components in their places. Don't forget that the coils should be about 1in. from the sides of the chassis and the switch and then at least ½in. should be allowed between coils, with 2in. between aerial and oscillator coils. The trimmers can be mounted direct on the top of the coil tags—that is, on the long tags on the "P" coils. After the heaters have been wired it is recommended that the coil unit be wired as is shown in Fig. 4. Looking at the coil from the top and starting at the long tag with the red mark and calling this 1, and proceeding in a clockwise direction, the tags will be numbered one, two, three and four.

Tags number two and three on all the coils are joined together and earthed. Tags one and four are taken to the appropriate tags of the wavechange switch, as is shown in Fig. 2. The fixed condensers shown have to be calculated, and depend on the station required. The variable condensers shown are small 40 pF trimmers mounted direct on the tags of the coils. After the coils have been wired the remaining wiring can be done.

Full use should be made of suitable tag strips. There are many of these on the market and those made by Ediswan-Clix were used in the original. It is essential that a separate earth be used for each stage, especially the smoothing. If there is only one common earth the very slight resistance of the earth can be sufficient to introduce all kinds of noise and instability

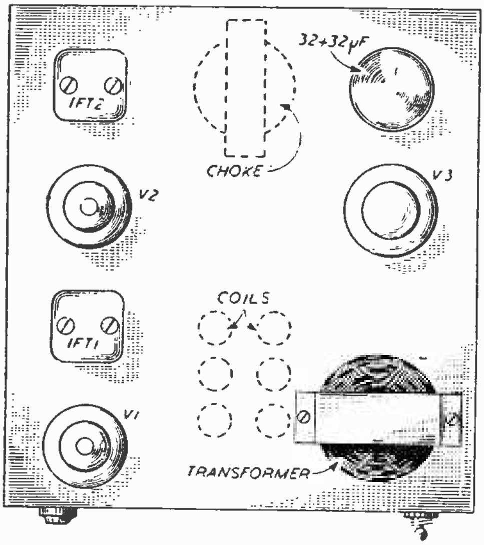


Fig. 3.—Suggested layout.

faults that are very hard to trace. This is not the case in all cases, but as the tags oxidise with time the resistance rises and it is then, after the unit has been working satisfactorily for some time that the trouble starts.

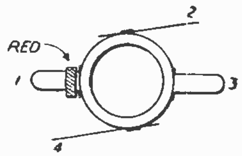
Having completed the wiring and then gone over it and checked it very carefully, switch on. Leave for a few minutes to warm up, then with the aid of a signal generator set the alignment of the unit. This cannot, in the writer's opinion, be done satisfactorily without the use of this instrument. There have in the past been several inexpensive circuits in the pages of PRACTICAL WIRELESS. Again, a qualified radio engineer will do the alignment for a matter of shillings. The word qualified is emphasised here, as there are many so-called engineers who do not know the correct way of using the instrument. For the benefit of the readers we will go through the process.

Lining Up

First connect the signal generator to the grid of the first valve by means of the direct outlet. This renders the A.V.C. inoperative on the first valve. Set the generator to 465 Kc/s and adjust the trimmer on the last section of the second IF coil for a maximum volume. A suitable indicator can be a pair of high impedance 'phones plugged into the output jack. Then adjust the other trimmer for maximum volume; repeat this on these two trimmers several times, with the output from the generator only just high enough to be audible; this ensures that there is a minimum A.V.C. voltage to mask the peaking.

Reset the generator to say 460 Kc/s and peak the second trimmer of the first IF coil (the circuit in the grid of the IF amplifier valve) then reset the generator to, say, 470 Kc/s, and do the same to the first section of the coil. Repeat several times on both sections until no further adjustments have to be made. The writer prefers to set his IFs to plus and minus 10 Kc/s, that is give a 20 Kc/s bandwidth. If the setting of the width is too great there will be an amount of "monkey chatter" from other transmitters on adjacent wavebands. This setting the IFs for bandwidth has a very great effect on the tone of the receiver, as if all peaks are put in line as it were,

Fig. 4.—Details of the coil connections.

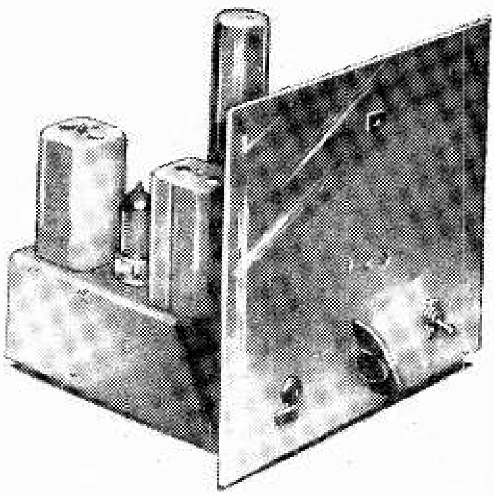


all on 465 Kc/s the top notes are cut and the bass accentuated. There is, however, nothing to stop the fidelity enthusiast lining the unit up to suit his conception of fidelity.

At a demonstration of the correct method of alignment given at an exhibition in 1952 there were several people present who could not hear any difference in, in line, plus and minus 5 Kc/s and plus and minus 10 Kc/s. Further demonstrations with a test tone record (Decca EXP55) showed that they were incapable of hearing above 3 Kc/s! This latter case is exceptional.

The setting of the bandwidth of the IF has been done now for many years. The first firm to do it as far as the writer has been able to find out is E.M.I. who have been doing it for about 20 years. There are on the market several receivers that have a variable IF bandwidth that can be set by the use of a switch, and the tone controlling of the set is done to a very large extent by the use of this switch.

(*Concluded on page* 362)



Three-quarter rear view of the unit.

DESIGNING METERS—2

(Continued from page 278, May issue)

Specially written for the Beginner, this and the previous article deal with the use of various types of moving-coil meter. This month we deal with the Ohm-meter, its use, construction and calibration.

NEXT to the measurement of voltage comes that of resistance, there are many ways of measuring this, and by far the most convenient is the ohm-meter. This instrument consists essentially of a standard resistance, a current meter and a battery. The simplest circuit is shown in Fig. 4, In this, for the scale to be calibrated it is essential that the battery voltage is not altered. Alternatively, a set of calibration charts can be made for different battery voltages. This system is used by the Post Office Engineering Dept. for making simple measurements on lines. An improved circuit is shown in Fig. 5 and this can be simply constructed using an ex-W.D. 0-1 milliammeter. The resistors should be of as high quality as possible, and for rough checking 10 per cent. tolerance will do, but remember that the accuracy will always be lower than the resistors used as standards. In choosing resistors it must be remembered that the meter has resistance ! A simple point which is often forgotten. If the meter is, say, 100 ohms, then the 1,500 ohm resistor will have to be reduced to 1,400. With the high range the resistance of the meter can be ignored as it will only make 1 part in 150 difference. The firm of Dubilier will supply resistors of very close tolerance, even to a tolerance of 0.1 per cent., but they are expensive in such a close tolerance range. The writer normally uses their 1 per cent. range for this type of job. Erie, Ltd., also produce high tolerance resistors, but only to an accuracy of 2 per cent.

Calibration

The calibration can be done either by calculation or by comparison. The latter is perhaps the most accurate, and it is here that keeping a set of close tolerance resistors in the laboratory comes to its own. The writer has a set of Dubilier in the 1 per cent. range consisting of one each 100, 1,000, 10,000, 100,000 and 1,000,000 ohms. These are kept carefully, care being taken to see that they do not get damp, and that they are not overloaded in use. The calculation calibration can be carried out from the formula R equals Rm (V1/V2—1). With this formula it is taken that V1 is the battery voltage and V2 the voltage reading with the unknown resistance in circuit ; Rm is the resistance of the meter including the series resistor. With this formula it is as well to make a set of charts covering several voltage readings, i.e., full battery voltage to, say, 20 per cent. lower. If the meter is calibrated in, say, 0-1 mA, divided into 10 micro ampere divisions, a full-scale deflection can be called 100.

Example. If Rm equals 1,500, V1 100 and V2 equals 10, then by the formula R is equal to 1,500 (100/10 − 1) = 1,500 × (10 − 1) = 13,500. Again, at the other end of the scale, where V1 is 100 and V2 is 95, then R equals 1,500 (100/95 − 1) = 1,500 (1 1/19 − 1) = 1,500/19 = 70.89 ohms. These calculations are easy, but as was mentioned earlier, the resulting measurements are always to a lower tolerance than the standard resistor. In these two calculations the writer has carried the calculations too far, with the result that the calibration appears to be to a very high order. If the resistors used were 5 per cent., then an accuracy to 10 per cent. can be expected so that example one would be between 12,000 and 15,000 ohms, whilst the second would be between 63 and 77 ohms ; but these calculated resistances could be used.

A much improved circuit is given in Fig. 6, but like most improved circuits it has added disadvantages of increased cost and reduced accuracy, but once calibrated the meter can be adjusted to allow for variations in battery voltage. This is done by altering the value of the shunt current. The values of R1, R2 and the meter should all be the same resistance or nearly so, i.e., if the meter is 100 ohms, then all three should be 100 ohms. This system introduces errors on the low-resistance ranges. If the test voltage is 1.5 volts, the current could be adjusted so that only 1/3 passes through the meter, but when the battery voltage falls to 1 volt then 2/3 of the current passes through the meter. A series resistor of 425 ohms will be required, and this will make the total resistance of the meter 500 ohms when the variable resistor is set to the mid-position, but when this resistor is set at either end there will be a total resistance of only 490 ohms. This amounts to an error of 2 per cent. over the error of the tolerance of the resistors used. As the average radio enthusiast only works to an accuracy of 10 per cent. this circuit is very useful. The accuracy of the higher ranges is greater.

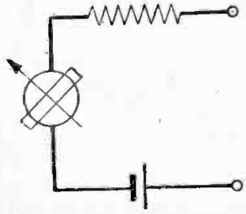


Fig. 4.—Basis of the ohm-meter.

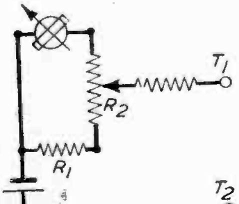


Fig. 5—An improved circuit.

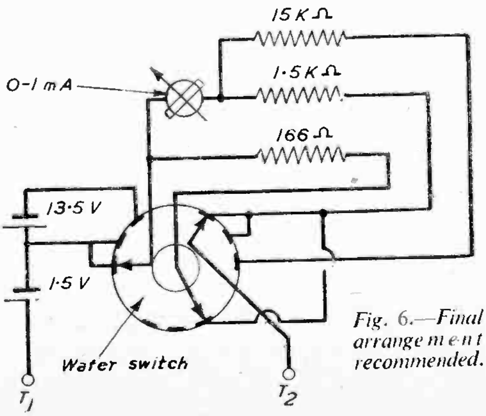
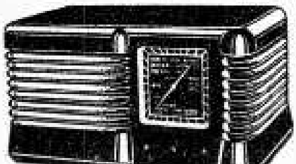


Fig. 6.—Final arrangement recommended.



CABINET as illustrated in walnut or cream, complete with T.R.F. chassis, 2 waveband scale, station names, new waveband, back-plate, drum, pointer, spring, drive spindle, 3 knobs and back, 22/6. P. & P. 2/6.

Circuit and point to point wiring diagram for 3 valve plus rectifier T.R.F. 2 waveband A.C. mains receiver which could be built for approximately £4. (Using the above cabinet 1/6.)

Gang with trimmers to suit, 7/6. **Medium and long T.R.F. coils,** 5/6 per pair.

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Twin-gang and Pair of L. and M. T.R.F. Coils with circuit to suit above, 8/6.

Standard Wave-change Switches, 6-pole 3-way, 2/-; 4-pole 3-way, 1/9; 5-pole 3-way, 1/9. Miniature 3-pole 4-way, 2-pole 5-way, 4-pole 3-way, 2/6.

Valveholders. Paxolin octal, 4d. Moulded octal, 7d. EF50 ceramic, 7d. Moulded B7G slightly soiled, 6d. Loctal amphenol, 7d. Loctal pax., 4d. Mazda Amph., 7d. Mazda pax., 4d. B8A, B9A amphenol, 7d. B7G with screening can, 1/6.

Trimmers, 5-40 pf., 5d.; 10-110, 10-250, 10-450 pf., 10d.

Twin-gang .0005 Tuning Condensers, 5/-. With trimmers, 7/6.

Midget .00037 dust cover and trimmers, 8/6.

P.M. SPEAKERS	with trans.	less trans.
2½in.		15/6
3½in.		13/6
5in.	16/6	12/6
6½in.	16/6	12/6
8in.	18/6	15/-
10in.		25/-

Post and packing on each of the above, 1/- extra.

Crystal pick-up with Sapphire Trailer Needle, 21/- each; with volume control, 23/-; post and packing on each, 1/-.

Constructor's Parcel, comprising chassis 8in. x 4in. x 1½in., with speaker and valveholder cut-outs, 5in. P.M. speaker with transformer, twin gang with trimmers, pair T.R.F. coils long and medium, iron cored, four valveholders, 20 K. volume control and wave-change switch, 23/-, post and packing, 1/6.

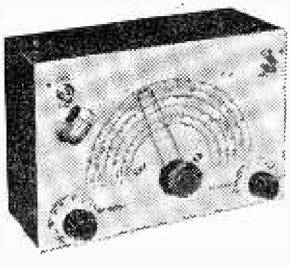
Output Transformers. Standard type 5,000 ohms imp., 2-ohms speech coil, 4/9; Miniature type 42-1, 3/3. Multiratio 3,500, 7,000 and 14,000 2 ohms speech coil, price 5/6. 10-watt push-pull 6v6 matching 2 ohms speech coil, 7/-.

Mains Transformers, primary 200-250 v. 280-0-280, 250 mA., 6 v. 6 amp., 5 v. 3 amp., drop-through, 29/6. P. & P., 3/-.

Mains Trans. Pri., 200-250 v. Sec., 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 and 30 volt at 2 amps., 13/-. P. & P., 1/6.
300-0-300 100 mA., 6 v. 3 amp., 5 v. 2 amp., 25/-.

Germanium crystal diode, 2/3 post paid.

Heater Transformer, Pri. 230-250 v. 6 v. 1½ amp., 6/-; 2 v. 2½ amp., 5/-. P. & P. each 1/-. 2, 4, or 6 volt 2 amp., 7/6.



Kit of parts for Signal generator. Coverage 110 Kcs.-320 Kcs., 320 Kcs.-900 Kcs., 900 Kcs.-2.7 Mcs., 2.75 Mcs.-8.5 Mcs., 8.5 Mcs.-20 Mcs. Metal case 10in. x 6½in. x 4½in., size of scale 6½in. x 3½in., 2 valves and 1 rectifier valve. A.C. mains 230-250. Internal modulation 400 cps. to a depth of 30 per cent. Frequency calibration accuracy plus or minus 1 per cent. Modulated or unmodulated R.F. output continuously variable 100 millivolts, £3/10/0. P. & P. 4/-. Circuit diagram and point-to-point, 3/6. This includes the return to us for checking and calibration. We will build for 15/- extra.

Terms of business—Cash with order. Dispatch of goods within three days from receipt of order. Where post and packing charge is not stated, please add 6d. up to 10/-, 1/- up to £1 and 1/6 up to £2. All enquiries and Lists, stamped addressed envelope.

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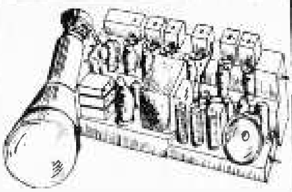

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TRANSMITTING TOPICS

IN DEFENCE OF SUPER-MODULATION

(*See* PRACTICAL WIRELESS *dated September* 1952)

By Wm. A. Hope

IN many leading radio journals, the technical aspects of super-modulation have been discussed with a view to their application to amateur radio. Unfortunately, the results obtained in practice have been "few and far between"; and, in many cases, we have heard the old and now familiar story—"It won't work; you can't get something for nothing." Quite true! But have you ever considered just why the results claimed are not being obtained? The pitfalls of this system will be discussed later.

Carrier Requirements

There is, normally, a bandwidth of 2-3 Kc/s. on either side of the carrier frequency, while the power in the sidebands is greatly emphasised by suppression of the carrier power. The resulting carrier bandwidth decrease and the increase in sideband power gives rise to an increase in the carrier signal/noise ratio at the receiving end and also a reduction in heterodyne interference. This increased signal/noise ratio results in a gain of about 6 db. or so (over the conventional A.M. systems) due to the resulting increase in output voltage from the detector, operating under linear conditions. This 6 db. gain can, by use of Formula 1, be converted to a voltage ratio.

$$x=20\log_{10}\frac{E_2}{E_1}\text{ db.}\quad(E_2>E_1)$$

Since 8.686 db. equal 1.0 Neper,

$$x=\log_{\epsilon}\frac{E_2}{E_1}\text{ Nepers, where } \epsilon \text{ is } 2.71828 \text{ approx.}$$

From the tables, we find that a voltage ratio of 1.9953 : 1 is numerically equal to 6 when expressed in db. If we were to correct the voltage ratio to two places of decimals, we would have a ratio of 2 : 1 increase. Alternatively, if we consider a signal/noise ratio of 1 : 1, this is numerically equal to zero db. Hence a 6 db. increase is equal to a 2 : 1 increase in signal/noise ratio. It is easily seen that if we are doubling the received signal/noise ratio by using S.M., we are halving the generated carrier noise level. It will be found that this type of carrier is extremely "sharp" to tune due to the reduction in bandwidth. From basic theory of A.M. carriers we learn that the power in the actual carrier is exactly two-thirds of the total radiated power: the remaining one-third being shared between the sidebands. Since the sidebands convey the information we are wasting good power in the actual carrier itself. Using S.M., the sideband power is approximately three times that of the carrier. The basic Taylor circuit for super-modulation is given on page 326. This system, however, was due to the developments of Doherty and later perfected by R. E. Taylor for telecommunications purposes during the 1939-45 war.

Stability

We have discussed the carrier requirements, and now we must consider the factors of stability. Instability in the V.F.O., buffer or multiplier stages is one of the pitfalls encountered with this system. It is advisable to stabilise all critical voltages to the valves in the above stages. In the speech amplifier section, which need only supply in the region of 5 watts audio to fully modulate a 130-150 watt carrier, instability can be cured by the introduction of a little negative feedback.

Circuit Components

When designing the transmitter, great care must be taken to ensure that none of the valves are going to be operated at voltages other than those specified by the makers. Complete control of R.F. drive, audio and grid bias to the PA./PM. stages is desirable, as variations in the above constitute the initial transmitter setting-up procedure. It should be stressed here that the Audio volts and the R.F. Drive to the Positive Modulator is exactly twice that to the Power Amplifier. The P.A. valve operates under normal Class "C" conditions, while the P.M. valve is biased to twice its "cut-off" value.

Difficulties Experienced

One serious fault was spreading of the carrier. This was due to an impedance mismatch between the PA./P.M. stage and the radiating system. In order to cure this, slacken off the coupling to the aerial system or tuner. The coupling, on the other hand, must not be too loose if maximum P.M. efficiency is to be obtained. The P.A./P.M. stage is a little "frequency conscious," i.e., a small change in V.F.O. frequency will cause the tank circuit to be retuned. The tank circuit should be tuned up as follows. With loose coupling on the output stage tune the P.A. for minimum "dip" as usual; then increase the aerial loading until the P.A. draws max. anode current. Assuming Class "C" conditions for the P.A., the R.F. Drive and the audio volts are increased until the P.A. anode current falls by about 25 per cent., i.e., to three-quarters its C.W. rating. Under no circumstances should the aerial loading be altered—unless changing bands. Now adjust the audio gain control until the P.M. valve just draws anode current. As the P.M. Ia. rises the P.A. Ia falls but should never reach a value less than 75 per cent. of its C.W. rating. If this does happen, however, the R.F. Drive should be increased very slightly until the P.A./P.M. stage is operating satisfactorily.

Another curious fault was the appearance of a serious mismatch on the transmission line to the transmitter. Theoretically, there appeared to be an impedance reflection to the tank circuit. Investigation showed that this was mostly in the cases where direct connection to the radiating system was effected by twin-wire transmission lines of the open-wire and Telcon varieties. Assuming that the transmitter coupling hadn't been altered, the prevailing weather conditions were blamed. In the case of the twin wire transmission line where each wire is of radius "r" cms. and the distance between their geometrical centres is "D" cms., the characteristic impedance of the line is given by

$$Zo \doteq \sqrt{K^{-1}}\, 276 \log. \frac{D}{10r} \text{ ohms.,}$$

where K is the dielectric constant; in this case, for air, unity. It should be appreciated that K only has the value unity under normal atmospheric pressure and temperature conditions. (A.P. equals 76 cms. of mercury at 0 degrees C. Temp. equals 0 degrees C.).

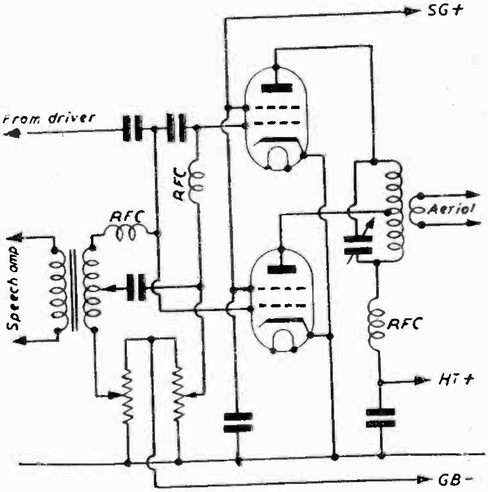
The impedance formula now reduces to:

$$Zo = 276 \log \frac{D}{10r} \text{ ohms.}$$

This explains the variations in Zo. Thus if we vary K, the Velocity Ratio of the transmission line will also be varied according to:

$$V.R. = K^{-\frac{1}{2}} \text{ or } \sqrt{K^{-1}}$$

Upon inspection of the S.W.R., it may be apparent that there is also a mismatch between the transmission line and the actual radiator. This must be remedied as no transmitter will function on A.M. let alone S.M. with a high degree of mismatch.



The basic Taylor circuit.

When reports on speech quality are required, always ask "DX" operators since there appears to be overmodulation on "local" receivers due to the delay constant between the A.V.C. stages and the detector. Switching off A.V.C. will remedy this. One undeceiving test can be effected at the Rx end by using an oscilloscope to check modulation and that the carrier is not "broken up" during modulation. At the Tx end, modulation can be checked by applying a true sine wave of about 20-50 micro-volts to the speech amplifier input, while the depth of modulation is checked by the oscilloscope.

In conclusion, the author would like to add that this system definitely has possibilities when used in a sensible manner. When constructing and operating, always remember that there is enough QRM on the bands without the introduction of any more.

THE BUDGET

(See also Leader page)

AS we close for Press, details of the Budget concessions have been announced. With the reduction in Purchase Tax the industry should obtain a much-needed fillip, and the home constructor will find a considerable saving in many component parts, in addition to complete receivers. The all-round cut of one-quarter in purchase tax will mean that complete radio receivers will cost from a few shillings to three or four pounds less, whilst battery users will find quite a large reduction in the price of batteries. Although there has not been time for the Trade to supply detailed information of the reductions, it may be assumed that batteries, for instance, which previously cost 17s. 1d. will now be 13s. 9d., whilst the popular 9s. 8d. models will be only 7s. 9d.

On complete receivers the now-popular battery-mains portables which were priced at £19 19s. should cost a little over £18, whilst the more expensive luxury radio-grams and combined radio and television sets will show a saving of up to £20. In addition to these direct costs, there is, of course, the question of replacement valves and picture tubes. Tax of up to 10s. 10d. was originally payable on some classes of valve and this will show a considerable saving on the purchase of a complete set of valves such as may be needed by the constructor building a new receiver. Loudspeakers are also subject to tax and should therefore be cheaper.

In the case of kits of complete parts, some particular sets come within the tax category, whilst others are exempt. But, the reduction should certainly result in an increased demand for all types of radio and television apparatus, and over a period the cost of maintenance will also be lower.

A Valveless Radio Control Receiver

A RELAY-OPERATED UNIT FOR USE ON THE 27 Mc/s BAND

By F. G. Rayer

MODEL-CONTROL receivers which use one or more valves naturally have a greater range than other types of receiver. However, they must be left switched on during the whole of the time control may be required, and accordingly consume current during this period. This is not a very severe disadvantage with some models, which are used for limited periods, but can be a serious drawback with other types of equipment.

This disadvantage can be overcome by using a valveless receiver circuit. This does not require to be left switched on, and draws no current when not in actual operation. Such a receiver may be left tuned in and coupled to the controlled mechanisms, yet full control may immediately be had from the transmitter alone. Because of this, such a receiver may be used in circumstances where it is impossible to use a valve receiver. If the latter is switched off, control may not be had from the transmitter, while if it is left switched on for long periods, frequent battery replacements are necessary.

To overcome this, experiments were made with sensitive relay circuits which could be operated directly from the signal received, and useful results were achieved. The circuit is shown in Fig. 1, and it is left tuned permanently to the transmitter frequency. Both relays are open, and no current flows. The apparatus may be left indefinitely in this state. When a carrier is radiated from the transmitter, the first relay is closed by the rectified current. As the contacts of this relay can handle only a very small current, at low voltage, they are used to complete the circuit to a secondary relay. The second relay then operates, closing a further circuit. When this final circuit is completed, the controlled units function. The latter may consist of lamps, motors, an electro-magnet assembly, or any similar mechanism. The transmitter is then keyed in the usual way, to bring about the desired movement in the controlled mechanism. (In this respect, the method of controlling the mechanisms is exactly the same as that adopted with any carrier-wave transmitter and valve receiver.)

The maximum range over which control may be had naturally depends upon the power of the transmitter, and the size of the aerials. Using a small two-valve transmitter powered from 90 v. H.T. battery and two-volt accumulator, with an 8ft. aerial on the transmitter, and 3ft. aerial on the receiver, no particular difficulty was experienced in obtaining control over 20 to 25yds. range. This is sufficient for mechanisms used indoors, and for boats on small stretches of water.

The Receiver Section

This is very simple, both in design and initial setting-up, as tuning is quite flat and there is no regenerative or similar controls to adjust. Layout and wiring are shown in Fig. 2.

The components are assembled upon a small piece of paxolin or other insulating material, exact dimensions being unimportant. If the aerial is not of the rigid, self-supporting type, a bracket to hold this will not be necessary.

The coil is self-supporting, consisting of 12 turns, 1in. in diameter. The whole coil is 1¼in. long, and wound from 20 s.w.g. tinned-copper wire. A length of the wire should be drawn out straight, and the turns wound upon some object of suitable diameter. The coil is then slipped off, and the ends bent to shape. Actually, the exact diameter of the coil is not important, but it will be necessary to increase the number of turns, if the diameter is reduced. Similarly, coils of larger diameter will require fewer turns. A coil wound as directed will enable the 27 Mc/s model-control band to be tuned, and this is, of course, essential for whatever coil is used. If the coil is wound upon a former range will be somewhat reduced.

The crystal diode is of the usual type, and may be wire-ended or intended to fit in clips. With the latter type, leads should *not* be soldered to the diode, since the heating will be detrimental. Ex-service and second-hand diodes are not recommended, since they may have received misuse that has reduced their sensitivity. Polarity of connection is not important.

The 50 pF trimmer is for tuning, and can be secured to the paxolin by one tag. Two short flexible leads are taken from the terminals shown to the microamp relay.

The Microamp Relay

Since this is required to operate on currents of about 10 microamps upwards, the ordinary type of magnetic relay is not suitable. Sensitive microamp relays may be purchased, but are somewhat expensive, and that used was made up as shown in Fig. 3. The basis of the relay is a 50 microamp moving-coil meter unit. Movement of the pointer closes small

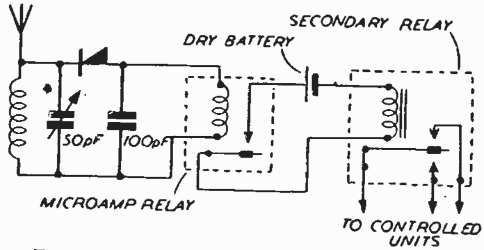


Fig. 1.—Complete circuit of the apparatus.

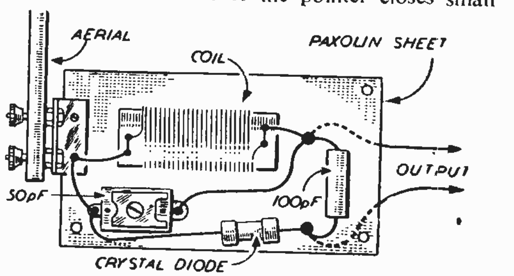


Fig. 2.—Wiring diagram of the receiver.

contacts. Meters of this and similar type are available from various ex-service stockists. If the meter actually used has a full-scale deflection of more than 50 microamps, then the equipment will be proportionally less sensitive. If a ready-made moving-coil relay is purchased, it should be assured that it is of a sufficiently sensitive type.

The method of arranging the contacts is clear

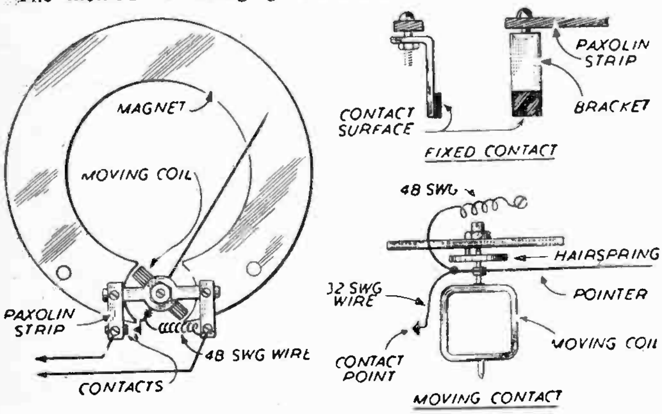


Fig. 3.—Details of the microamp relay.

from Fig. 3. Two small strips of paxolin were secured under the screws holding the meter assembly to the magnet. One strip holds the fixed contact, which is soldered to a small bracket. The other strip serves to provide an anchoring point for a pigtail made from thin enamelled wire. This pigtail takes current to the moving contact, and was made by coiling about 9in. of 48 s.w.g. wire round a small metal rod. It should be so arranged that it does not unnecessarily impede the movement of the pointer. The wire holding the moving contact is secured to the back projection of the pointer. Since this additional weight slightly upsets the balance of the movement, the latter is used flat. (E.g., with the pointer moving in a horizontal plane.)

Various materials were tried for the contacts, the aim being to provide a low contact resistance with light pressure, and without sticking. Copper and similar materials tend to oxidize, so that appreciable resistance is set up. Accordingly, two tiny pieces of silver were eventually used. These are soldered to the 32 s.w.g. wire and bracket. The wire may be bent to bring the contacts into suitable relative positions.

Leads from the receiver go to the moving-coil terminals of the meter. The contact terminals are wired to the secondary relay and battery used to energise it.

Relay and Control Circuit

If any attempt to pass a high current through the contacts of the microamp relay is made, the contacts will tend to stick together. The secondary relay was accordingly of the model-control type, and adjusted to close with a current of .1 mA. This current is provided by a small dry battery. The use of a high-resistance, sensitive relay of this type has the added advantage that operation will not be prevented by even appreciable resistance at the microamp relay contacts. When the signal is weak, pressure between the contacts is very slight, and so a secondary relay of sensitive type is essential for proper results.

A typical controlling mechanism is shown in Fig. 4. The motor is run for the desired period, until the mechanism operated by the link takes up the required position. The carrier is then switched off. The microamp relay contacts open; the secondary relay contacts follow, and the motor ceases to run. If further movement of the controlled object is desired, the carrier is switched on. Both relays then close, and the motor commences to run.

A typical controlled object would be the rudder of a model boat. Other mechanisms will suggest themselves, in accordance with the usual procedure adopted with model-control equipment.

Adjustment Notes

The receiver should first be tuned exactly on frequency. The aerial may be self-supporting, or consist of a short length of wire. Tuning should be undertaken with the usual receiver aerial, since stray capacitances will modify the tuning point, if the aerial is modified.

The microamp movement may conveniently be connected so that the pointer can move fully across the scale, and tends to do so, when a signal is received. The receiver trimmer should then be adjusted for maximum deflection.

When the maximum possible deflection has been obtained, the leads to the movement may be reversed. The transmitter is switched off, and the hairspring control of the meter adjusted until the contacts are slightly apart. When the transmitter is switched on,

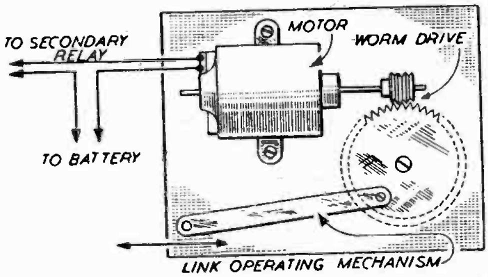


Fig. 4.—A typical controlling mechanism.

the contacts will close. They will open when the transmitter is switched off.

It was found that the apparatus could be used up to a range where a normal meter deflection of about 10 microamps was obtained. On smaller currents, opening and closing of the contacts was sluggish.

If desired, the meter may be set with the contacts normally touching. The circuit will then be broken when the transmitter is switched on.

If it is desired to switch on and off equipment driven from the mains, this may be done by using a suitable relay, and controlling this relay from the secondary relay shown in Fig. 1.

The receiver may be used in conjunction with any ready-made or home-constructed 27 Mc/s model-control transmitter.

On your Wavelength

by THERMION

Radio and Art

IN our May issue, in dealing with radio classes at schools, I said that in one school the radio course finished the art class "and a good thing, too." Mr. T. W. Adams, who is an art teacher of many years experience, said my paragraph was in bad taste and showed a narrow-minded attitude towards the aesthetic side of life. He asks the Editor to ensure that I do not make such derogatory remarks in future. What I had in mind in that passing comment was that there is to-day too much concentration on art. One has only to visit Chelsea to see the large numbers of corduroy-trousered, unkempt individuals training to be artists, but really leading a lazy life. They have no doubt been taught that there is a future in art, when the fact is that there is only room to-day for a very small proportion of genuine art; the world to-day requires commercial artists. I am not opposed to art being taught as a hobby, but it should not be made a profession.

Our 21st Birthday

I SHOULD be very glad to hear from any reader who has continuously taken this journal from the first issue. In a contribution which I shall make to our birthday number I shall, naturally, refer to some of the receivers of the period, so if any "reader from No. 1" would care to write me an anecdotal letter it might refresh my memory on some points which I might otherwise overlook. Any photographs which are apropos would be additionally welcome.

The New D.G.

I WAS very pleased to meet Major-General Sir Ian Jacobs at a recent conference with technical press representatives at the BBC. I rapidly formed the impression, from the manner in which he dealt with quick-fire questions from the journalists present, that he has a quick mind and an intimate grasp of all the problems involved in his important task. Sir Ian is 54 years of age and was educated at Wellington College, the Royal Military Academy at Woolwich and King's College, Cambridge, where he took his B.A. He became a Second Lt. R.E. in 1918, a Captain in the R.E. in 1929, and was at the Staff College in 1931-1932. He has had a very distinguished career in the Army since, and in 1939-46 was Assistant Military War Secretary to the Cabinet and travelled all over the world with Mr. Churchill and other political and Army chiefs, attending conferences in America, Cairo, Teheran and Casablanca. In 1946 he was appointed Controller of the BBC European Service and in 1947 became Director of Overseas Services on establishment of the Board of Management. He became President of the European Broadcasting Union in 1950, and a few months later Vice-chairman of Chatham House. In April last year his title was changed to Director of External Broadcasting (D.X.B.). He is the son of Field Marshal Sir Claud Jacob.

Major-General Sir Ian Jacob's wartime career was one which brought him in contact with the most interesting and important people at the crucial moments of the war. He is one of the few people who were present at the meetings between the heads of states at No. 10 Downing Street, in the Kremlin and at the White House. He was at the conferences at Yalta, Potsdam, San Francisco, Casablanca, Quebec and Washington. He went to Moscow twice with Mr. Churchill and once with Mr. Bevin. He went to America with Mr. Attlee to make Britain's declaration on atomic energy. So he has the fullest knowledge of the problems besetting Europe and of the methods by which they are tackled by the governing powers.

Since the war he has visited many European countries to make personal contact. His hobbies are cricket, golf, tennis and sailing. He stresses the fact that he is not a politician and has never been identified with any political party.

He is the right man in the right job.

V.H.F. Report

THE Assistant Postmaster-General, in a Parliamentary reply, said that he hoped the Television Advisory Committee would soon report on the matter of V.H.F. sound broadcasting. Before V.H.F. broadcasting can commence, the form of modulation to be used and the best way of developing the service has to be decided.

When these questions have been settled the rate of progress will depend on the amount of national capital resources which can be allotted to this and other BBC developments.

The Trade and the Constructor

DURING discussions with leading trade representatives at the recent R.E.C.M.F. components exhibition, I was asked whether the home-constructor market was as lively as it was before the war. I was able to inform them that it was livelier, for the simple reason that the war was responsible for training many in one or other of the branches of radio and that since leaving the services they have taken it up as a hobby. I know that the circulation of this journal is even greater than it was before the war, and the demand for blueprints is greater than ever. I gather that the object of this question was to ascertain whether the time was ripe for some of the old firms to return to the constructor market. It would be a good thing for them, as well as for constructors, if they did. Taking the long view, the sales of sound receivers must eventually reach absorption point and the trade must depend upon replacement sales only. The ready-made receiver will never eradicate the home-constructor market. The building of receivers is well established as a national hobby, and all firms which have remained faithful to it are doing increased business.

The television home-constructor market is also developing rapidly; over 300,000 receivers now in operation are home built.

THE LATE C. E. M. JOAD

PHILOSOPHER OR SHOWMAN? AN APPRAISAL

By F. J. Camm

IN the interests of accuracy it is proper, when a public man dies, that an obituary notice should tell the truth about him so that biographers, if any, may present a future generation with an accurate picture of him. The tendency until recently has been to sing his virtues and to ignore his failings. That is why so many men of the past appear to the present generation as saints instead of reprobates. In general, the obituary notices of the late Cyril Edwin Mitchinson Joad have presented a true picture of this fantastic character, whose main claim to fame was the part he played as a showman in that equally fantastic series of broadcasts "The Brains Trust"—surely the most inept description of any BBC feature programme. First, let it be known that Dr. Joad was not a professor in the accepted sense, for he had never held a professorial chair in a university, and it is doubtful whether he was qualified to do so.

The late Doctor (not "Professor") Cyril Edwin Mitchinson Joad.

After complaints from real professors he had to acknowledge that he was not one in one of the Brains Trust broadcasts. In that he laid claim to knowledge and ability which he did not possess he was, of course, a "professor" in the sense in which conjurers and quacks use the term. He was a doctor of literature only—one of the easier of the doctorships and one which does not deal with the exact sciences such as mathematics, physics and chemistry. His knowledge of those subjects was less than that of the average elementary schoolboy, but that did not prevent him from answering questions on them with a didactic air intended to act as a veneer to a mind which was almost vacuous on the subject.

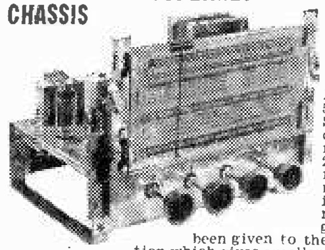
As one who knew him well, I frequently, in this journal, drew attention to the inaccuracy of his answers on Brains Trust questions and the dangerous doctrines he promoted through those answers. Like Shaw, he was a showman and knew that by expressing views contrary to what was generally accepted he would gain publicity. His views on any subject were seldom sincere. One could always tell the book he had read the previous week by his column in a Sunday newspaper which purported to answer a question, which he had really posed himself. The answer was often a mere regurgitation of the book. When it suited him he changed his views almost overnight. For example, he was a well-known pacifist until, in the early days of the war, he saw the possibility of being taken into protective custody like so many others, under 18B, for "giving comfort to our enemies." Then he announced that he was in favour of the war; that was only because of the fear of losing his freedom. His logic was often inverted, like that of Shaw, who was a vegetarian not because he liked live animals but because he hated dead meat. Nor was he ever really original.

He was an untidy, unprepossessing looking man with a squeaky, irritating voice, and he endeavoured to monopolise the Brains Trust by frequent interjections when others were speaking. Of course, it was a mistake on the part of the BBC to presume that a small panel, such as the Brains Trust, could answer questions on almost every subject. That is why, presumably, questions were selected which merely invited an expression of opinion or an answer which could never be right or wrong. "What is love?" "Is a man justified in committing suicide?" are typical examples of the questions which were asked. Now and again, however, a question arose which demanded some scientific knowledge in its answer, and when Huxley gave that answer it was nearly always accurate. On one occasion, however, a question was asked as to why it was that a cat could see better than human beings in the dark. Joad burst into a lengthy and quite irresponsible disquisition on why it could do so, thus disclosing that he did not understand the very first principle of optics: as everything we see is by the light reflected from the object, a cat cannot see any better than a human being in absolute darkness, and that is the answer which should have been given, with the rider that in a partially-darkened room its keener sense of hearing might aid its sight.

I corrected Joad, in this journal, on a number of these points over a long period, and finally he invited me to lunch with a mutual friend, W. J. Bassett-Lowke (both Fabians, by the way) to discuss my criticisms. I went through every one of them, point by point, and although he tried the usual trick of blustering wriggles, which he had found effective in disarming too shrewd a criticism in the Brains Trust, I forced him to admit that in every case he was wrong. He then said that I should bear in mind that he had no prior knowledge of the questions before he went on the air. That is precisely the point I was waiting for him to make, and I administered the *congé* by asking him if any of his students had prior knowledge of their examination questions, to which he was forced

(*Continued on page* 338)

A COMPLETELY ASSEMBLED "ALL-WAVE" SUPERHET CHASSIS



MODEL B.3.—A 5-valve 3 waveband Superhet Receiver, for operation on A.C. mains 100-120 volts and 200-250 volts, employing the very latest miniature valves. It is designed to the most modern specification, great attention having been given to the quality of reproduction which gives excellent clarity of speech and music on both Gram and Radio, making it the ideal replacement Chassis for that "old Radiogram," etc.

Brief specifications :—Model B.3.—Valve line up, 6BE6, 6BA6, 6AT6, 6BW6, 6X4. Waveband coverage, Short 16-50. Medium 187-550, Long 900-2,000 metres. Controls (1) Volume with on off ; (2) Tuning (flywheel type) ; (3) Wave change and Gram ; (4) Tone (3 position switch operative on Gram and Radio). Negative Feedback is employed over the entire audio stages. Chassis size, 11in. x 7½in. x 8½in. high. Dial size, 9¼in. x 4¼in. Price, complete and READY FOR USE, excluding speaker, £12/12/0. (Carr. and Pkg. 7/6 extra.)

NEWS! WE NOW INTRODUCE THE "TELE-VIEWER"

5 CHANNEL TELEVISOR—A design of a complete SUPERHET T/V RECEIVER FOR THE HOME CONSTRUCTOR

This receiver has been developed after most careful research to provide a Televisor employing SUPERHET circuit for 12in. or 9in. tubes, which can be readily assembled by the home constructor. In designing it we had three objectives :—(a) OUTSTANDING QUALITY AND DEFINITION ; (b) EASE OF ASSEMBLY ; (c) ECONOMY IN COSTS. We confidently believe that not only have we achieved a T V receiver that surpasses in efficiency any other designed for the home constructor, but also the stage by stage diagrams permit the inexperienced to successfully assemble it at about half the total cost of a similar type of commercial receiver.

SOME OUTSTANDING FEATURES

- A SUPERHET CIRCUIT suitable for reception of all present transmissions, i.e., LONDON, SUTTON COLDFIELD, HOLME MOSS, WENVOE and KIRK-O'-SHOTTS.
- A BRILLIANT and SHARP PICTURE afforded by provision of high E.H.T. (approx. 10 K.V.).
- Outstanding QUALITY and DEFINITION for daylight viewing.
- NEGATIVE FEEDBACK in the Audio Frequency Stages.
- Simple control. Only two controls on the front of receiver.
- Simple and compact design with rigid C.R.T. mounting.
- The complete Televisor, including all Valves can be built for only **£28** (plus cost of C.R.T.).
- As no hire purchase terms are available the receiver can be bought in five separate stages (practical diagrams and circuits are provided for each stage), thus enabling Hire Purchase interests rates to be avoided.

The complete set of ASSEMBLY INSTRUCTIONS will be available about 23rd May, price 5/- (refunded against first order). The instructions include really detailed PRACTICAL LAYOUTS, WIRING DATA AND COMPONENTS PRICE LIST.

ALL COMPONENTS ARE AVAILABLE FOR INDIVIDUAL PURCHASE.

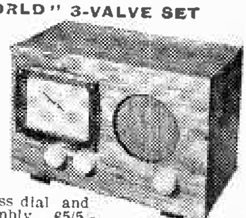
A CABINET WILL ALSO BE AVAILABLE.

A DUAL CHANNEL PRE-AMPLIFIER and TONE CONTROL UNIT

This comprehensive PRE-AMPLIFIER and TONE CONTROL UNIT provides full control of Bass and Treble in conjunction with a main Volume/Mixer Control. Can be used with any Amplifier and any Pick-up, the range of frequency control provided by the unit affording ample compensation for all types of Pick-up and all natures of recordings, i.e., English, American and Long-Playing, without recourse to Pick-up correction. The extreme flexibility of the Bass and Treble Controls is such that the level of Bass and Treble can be set to suit any conditions irrespective of the volume output of the Amplifier.

The Unit measures only 7in. x 4in. x 2in., including self-contained Power Supply, and can be accommodated either on or away from the main Amplifier, i.e., in the front panel of a Cabinet or any other position. Price including drilled chassis, valves (6SN7 and 6J5), £3 16/9. Complete assembly data is available separately for 1/3. Completely assembled and ready for use, £5/5/-.

THE "WIRELESS WORLD" 3-VALVE SET



A Midget 3-valve T.R.F. Receiver for operation on A.C. mains, covering long and medium wavebands. We are able to supply all of the components to build this set, as designed and specified in the Feb. 1950 issue including the drilled chassis, valves and moving coil speaker, etc., at the following prices :—To construct complete chassis, less dial and drive assembly, £5/5/-. Ditto, including dial and drive assembly, £6. To construct the complete Set, including dial and drive assembly and cabinet, £7 3 6. Overall size of cabinet is 7½in. x 5¼in. x 11½in. A reprint of the designer's article, giving Circuit and Assembly Instructions (this is available separately for 9d.), together with a Practical Component Layout is included with each of above assemblies.

A MAINS OR BATTERY PORTABLE KIT

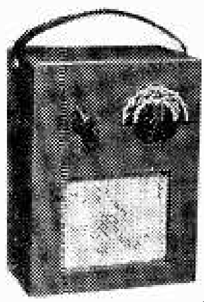
A midget 4-valve Superhet Portable Set covering medium and long wavebands.

Designed to operate on A.C. mains 200-240 volts or by an "All-dry" battery. The set is so designed that the mains section is supplied as a separate unit which may be added at any time. The Kit therefore can be supplied (a) as an "All-dry" Battery Superhet Personal Set which can be accommodated in the Attache Case as illustrated (size 9½in. x 4½in. x 7in.). This is attractively finished in lizard, maroon, dark green, or blue rexine, (b) or as a Combined Mains/Battery Superhet Portable Receiver, for which a polished Wood Cabinet is available to accommodate both Mains Unit and Batteries together.

Circuit incorporates delayed A.V.C. and Pre-selective Audio Feedback. Kit is complete in every detail and includes ready-wound Frame Aerials, fully aligned I.F. Transf. and drilled chassis, etc. Overall size of assembled chassis 8in. x 4in. x 2½in. This receiver as illustrated can be completely built for approx. £10 (plus Mains Unit if required). Send 1/9 for the fully descriptive Assembly Book which includes Practical Layouts and complete price list of Components.

"Personal Set" Battery Eliminator

A complete kit of parts to build a Midget "All-dry" Battery Eliminator, giving approx. 69 volts and 1.4 volts. This Eliminator is for use on A.C. mains and is suitable for any 4-valve Superhet Receiver requiring H.T. and L.T. voltage as above or approx. to 69 volts. The kit is quite easily and quickly assembled and is housed in a light aluminium case, size 4½in. x 1½in. x 3½in. Price of complete kit with easy-to-follow assembly instructions, 42/6. In addition we can offer a similar COMPLETE KIT to provide approx. 90 volts and 1.4 volts. Size of assembled Unit 7in. x 2½in. x 1½in. Price 47/6.

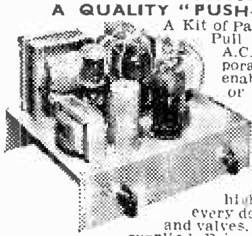


THE "MINI FOUR."—A 4-valve Battery Superhet Receiver, designed by "Practical Wireless" to receive 4 Pre-set Stations, no tuning being necessary. The complete Receiver can be built for £9 10/- (plus case 15/6). Send 1/6 for Assembly Instructions, Layouts and Component Price List.

THE "MINI TWO-THREE."—Complete diagrams and layouts from which either a T.R.F. 3-valve set or a 2-valve set (afterwards easily converted to the 3-valve) can be made for £5/3/- or £4/3/6 respectively (plus case, 15/6). Full Instructions, Layouts and Components Price List, 2/-.

THE "MINI TWIN."—The ideal set for the beginner ! A simple 1-valve 2-stage Battery Set covering Long and Medium Wavebands. Can be built for 37/6, plus 9/6 for attractive Plastic Case and 14/9 for suitable headphones. Complete instructions, layouts and price list 1/3.

A QUALITY "PUSH-PULL" AMPLIFIER



A Kit of Parts to build a 6-8 watt Push-Pull Amplifier for operation on A.C. mains 200-250 volts. Incorporates a simple arrangement to enable either a magnetic, crystal or light-weight pick-up to be used. A 10-watt Output Transformer is designed to match from 2 to 15 ohm speakers. Tone control is incorporated. The overall size of the assembled chassis is 10in. x 8in. x 7½in. high. Price of kit complete in every detail, including drilled chassis and valves, £6 17 6. Component layout is supplied. Price of assembled chassis, supplied ready for use, £8 12 6. Instructions, layouts and price list 1/-.

★ Send 9d. P.O. for our STOCK LIST, showing many KITS OF PARTS for Sets and Battery Chargers and "hundreds" of Radio Components. When ordering please include 1/6 to cover cost of postage and packing.

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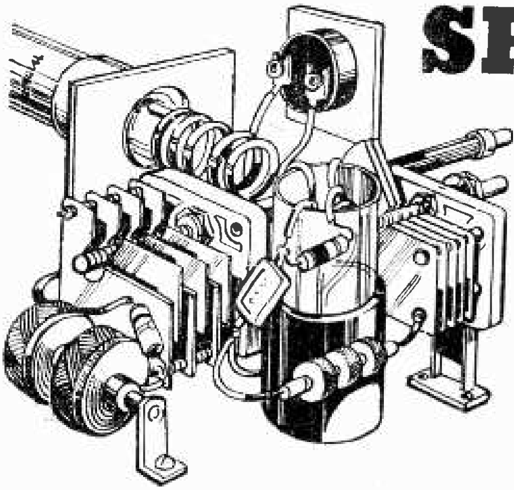


SHORT-WAVE SECTION

H.T. BATTERY ELIMINATORS FOR USE WITH SHORT-WAVE RECEIVERS

By A. W. Mann

CORRESPONDENCE arising from my recent article dealing with a selection of pre-war components suitable for inclusion in home-constructed short-wave receivers reveals a rather surprising interest in that respect. The reasons being, of course, that many readers have a number of components to hand which are what might be termed standard lines as, for example, L.F. coupling units, short-wave plug-in coils, and dual and triple range tuners, etc., or know just where there are some for sale.

The active experimenter with a varied stock of old and new components to hand finds that as his stock increases so does the scope for experiment.

The standard materials can be worked in with the new, and multi-valve receivers of various types can be built and tried out. If one prefers A.C. mains receivers, a separate power pack designed to supply sufficient voltage and current to meet the requirements of the biggest receiver one proposes to build can be assembled, or alternatively bought, as a complete unit.

At the present time, however, a really good short-wave T.R.F. or superhet, if built with first-class materials, requires a comparatively high outlay.

A versatile power pack with good regulation and the necessary smoothing and suitable for short-wave work can alone run away with a fair amount of spare cash, as the writer knows from experience.

On the other hand, the experimenter who prefers battery-operated equipment is apt to find as he progresses that, when multi-stage receivers are contemplated, the demands to be made on the H.T. battery loom large. This in many instances determines the valve line-up of the next model to be put in hand.

H.T. Eliminators

H.T. eliminators having given place to all A.C.-operated receivers, thousands of the former have been discarded while still capable of giving reliable service. Various types and makes are to be seen in amateur radio supply stores and other places, and no doubt some are forgotten by their owners and likely to remain so.

As one seldom sees ex-Government types advertised, the prospective buyer must perforce depend on the second-hand market in order to obtain what he requires. The point is—does he in most instances know, in the technical sense, the most suitable types to seek ; if not, this article should help.

H.T. eliminators in good electrical and mechanical condition can sometimes be purchased at very reasonable prices, but it is as well to know exactly what to seek, select, and avoid.

What To Avoid

In the heyday of the H.T. eliminator one had the products of at least 20 reliable firms from which to choose. Unfortunately, there were also on the market a few eliminators of doubtful origin, housed in flimsy metal cases. Such apparatus in some instances were unreliable and inefficient, and altogether a risky proposition.

The author suggests, therefore, that only the products of the better-known firms should be considered. " Avoid the no-name variety " should be the rule.

Suitable Apparatus

The prospective purchaser should make quite sure that the H.T. eliminator input is suitable for coupling up to the local A.C. power supply ; 230 volts 50 cycles supplies are the rule in many areas, for example, while in others 250 volts 50 cycles is the rule.

Secondly, the output voltage and current ratings should be ascertained in your presence. The average amateur supply stores will usually oblige in this respect. In case of a take-it-or-leave-it attitude, leave it.

If the eliminator happens to be offered for sale in other than a radio shop, a request to be allowed to try it on the receiver with which it is to be used may be granted. Some difficulty may, however, be experienced in this respect, unless the prospective purchaser is known to the seller.

Better far to limit the purchase of eliminators, therefore, to radio stores where test equipment is available. The off-load voltage on test will be higher than the rated on-load voltage when tested if the apparatus is as it should be. Old valve rectifier type models may require a new rectifier valve which will put matters right.

Where metal rectifiers are concerned, it is rather difficult to advise, as it may be that the rectifier has been overrun. If the rectifier is suspect the correct procedure is to inquire the cost of a new one before taking matters further, as it may not be worth while.

Metal rectifiers will, as I know from experience, give efficient service for many, many years, but they will not stand abuse.

Short-wave Requirements

Standard H.T. eliminators, while designed for use with broadcast receivers, are in many instances suitable for short-wave use as they stand. Others may require additional smoothing. A separate choke and condenser type unit should be sufficient to meet requirements.

Makes and Types

One H.T. eliminator worthy of note is the G.E.C. Gecophone H.T. power unit for 200-260 A.C. 50-100 cycle mains. This is of the 20 mA valve rectifier type, using a U5 rectifier valve, and has three fixed tappings as follows—60-SG-140 volts. This model was designed and produced for short-wave purposes, as well as for use with broadcast receivers.

Philips

Amongst the various models produced by Philips is the 3002 230 volts A.C. input, 50 cycles, 150 volts 30 mA, which has been used by the writer for many years. There is also the model 3009 with 150 volts 22 mA D.C. output, and 20 volts grid bias. Both models are of the valve rectifier type.

Atlas

Messrs. Clarkes produced a considerable number of types, housed in the well-known green metal cases. Model CA25 is of special interest to those who use receivers of the class B and QPP types. This is suitable for A.C. inputs of of 200-250 volts at 40 to 120 cycles. The D.C. output tappings are as follows: First, 60 to 80 volts with two intermediate tappings. Second, 50 to 90 volts with three intermediate tappings. The third and fourth are power tappings providing 120 volts and 150 volts respectively. Model T 25 is a trickle charger variant of the above model.

The A.C. 300

This is what might be termed a universal model taking into account its suitability for use with three-valve receivers, and Class B and QPP types. There are three tappings, two of which are variable—0/100 volts and 1/120 volts with one fixed 150 volts fixed tapping.

It is interesting to note that by means of a tapping panel the following outputs are available: 12, 18 and 25 mA at 150 volts, independent of the H.T side. A trickle charger, charging at either 2 volts, 4 volts or 6 volts all at .5 amps is incorporated and metal rectifiers are used throughout, in the three models described.

Ecko

There are a variety of models in this range. Model K25 is housed in a strong and well-finished metal case. This, like others, is of the metal rectifier type. Input voltages are suitable for the usual A.C. mains requirements. D.C. outputs are 120 to 150 volts, at 25 mA. Two tappings 50/80 volts are also available and, in addition, a trickle charger of the 2, 4 and 6 volts .5 amps type is incorporated.

Telsen No. W 346

This model is for 200, 250 volts A.C. mains at 40 to 100 cycles D.C. output 150 volts at 28 mA with separate S.G. and detector tappings, metal rectifiers and trickle charger of the 2, 4 and 6 volt .5 amps type.

Regentone

Here we have a really handy unit in the ACW5A model. This provides 120-150 volts D.C. output at 25 mA. Metal rectifiers are used and a trickle charger is included. The following tapping points are available: S.G., detector and power. S.G. 85, 65 and 50 volts. Detector, 95, 75 and 50 volts. The output tapping is 150 volts. This unit, it is interesting to note, is fitted with a voltage regulator to compensate for mains fluctuations, and this can be used to reduce by 25 per cent. the maximum overall voltage if desired.

Additional Notes

The Philips models quoted in this article have seven tappings, and were supplied complete with wander plugs. If these are not available ordinary banana types, although somewhat shorter overall, can be used.

It may be that some reader will come across a G.E.C. BC 1530 model eliminator which, by the way, is suitable for 200-260 volts A.C. 50 cycle mains, and has a D.C. output of 180 volts at 30 mA.

The models dealt with in this article are but a small percentage of those available before the war. Those mentioned should, if in sound condition, prove satisfactory in use. Personal choice would, however, centre on types capable of supplying at least 25 mA current at 120 to 150 or more volts.

In addition to solving the H.T. problem of the battery-type short-wave receiver, the scope of the experimenter is widened to a useful degree, and thus somewhat more ambitious receivers can be built and used. Do not, however, use a cheap meter to test eliminator output voltages, as the high current drain will result in a false reading. A good 1,000 ohms per volt type is recommended.

3-D SOUND

AN international group of businessmen listened to a table-tennis game from a binaural tape recorder recently in Chicago and ended up by moving their heads back and forth, "watching" the imaginary ball bounce from end to end of the table that wasn't there.

This feat of realism was carried out by Magnecord, Inc., on their binaural system of recording sound. This registers the "third dimension," or directional location of sound, along with pitch and volume, just as the ears are able to discern it naturally. Music recorded and replayed by the Magnecord binaural system is extremely life-like.

The occasion was the two-day visit of the "Observatour" group of overseas businessmen to the Magnecord plant for the purpose of observing the latest developments in recorders, and receive training on demonstrating, selling and servicing these technical instruments. Magnecord, Inc., is the world's largest manufacturer of professional magnetic tape recording equipment.

The "Observatour," sponsored by Ad. Auriema, Inc., export representatives of Magnecord, Inc., was a five-week, 4,000-mile tour of 20 U.S. industries in 18 cities from Massachusetts to Iowa, by businessmen from Argentina, Belgium, Brazil, Cuba, Mexico, Spain and Uruguay.

The Beginner's Guide to RADIO

The Second of Our New Series of Articles for Those New to Radio. This Article Concludes Instructions on the One-valver and Explains How to Convert it into a Two-valver

By F. J. CAMM

YOU will by now have completed the wiring up of the simple one-valver described last month and probably have conducted some tests. There were two vital parts of the receiver not mentioned, namely the low-tension and the high-tension batteries. In larger receivers these are sometimes separate units consisting of a high-tension battery of anything from 60 to 120 volts, and a two-volt wet accumulator, which can be re-charged when it runs down. This little receiver makes use of a combined L.T. and H.T. battery. The theoretical sign is shown in Fig. 11 below. It is important to remember that the thin line always represents the positive terminal of the battery and the thick line the negative. This applies to both H.T. and L.T. batteries. It is necessary to bear this in mind because most circuit diagrams do not include the positive and negative signs. It is a detail one is expected to remember.

Examination of the circuit will show that the L.T. negative and H.T. negative are joined together and this is standard practice.

I ought, here, to say in connection with a circuit diagram, that where two wires are shown connected by a black dot, the dot represents a soldered joint, and where two wires cross one another by means of a loop they are not connected. Although this is clearly stated in the caption to the circuit, one or two readers missed the explanation.

Now for a test run. Having connected the aerial, the earth, the battery and the earphones turn the aerial tuning condenser, that is, the left-hand knob on the panel, and listen for signals. When one is heard, turn the reaction condenser by means of its knob to build up the strength of its signal. It may be that the reaction condenser fails to do this, or that it acts in reverse, that is to say, when the plates are all out. In this case it is only necessary to reverse the connections from the reaction coil to this condenser. Make sure, of course, that the switch is in the "on" position. If you still do not obtain signals, check the wiring very carefully by the wiring diagram (Fig. 12). Ordinary cotton-covered wire of about 22 gauge may be used for wiring. If signals happen to be weak, try the effect of connecting the aerial lead direct on to the tuning condenser, that is cutting out the .0001 μF fixed series aerial condenser. This may be necessary if a short inside aerial is used in preference to an outdoor one. Also try varying the position of the reaction coil—sliding it slightly to one side of the other coil. A smooth control of reaction should be aimed at. Avoid tuning in with the set oscillating as this will cause interference with your neighbours' reception. If the set oscillates reduce reaction immediately.

Tracing Faults

Assume that the receiver gives no signals at all. Disconnect the wire which is connected to the anode or plate socket of the valve-holder (in the theoretical diagram, Fig. 1, given last month, this is represented by the black line at the top inside the circle), and connect one lead of a pair of headphones to the terminal and take the other lead to H.T. positive. Switch on the set and ascertain whether signals come through. If you hear nothing at all tap the valve. If no noise is heard, the valve is defective, or the L.T. circuit is not complete.

Converting to a Two-valver

In Fig. 13 the circuit shown last month has been altered to include a second valve. The old circuit is shown by dotted lines and the new component (the *low-frequency transformer*) and the additional wiring are shown by solid lines. The theoretical sign for a low-frequency transformer is shown in Fig. 14, which also includes a perspective sketch, showing what the transformer looks like. Now a low-frequency transformer is a device for coupling valves together so that both the volume and the quality of the signals is improved. A low-frequency transformer consists

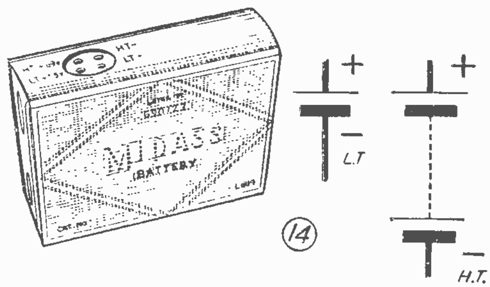


Fig. 11.—The theoretical signs for low tension (L.T.) and high tension (H.T.) batteries. Note that the thin line always represents the positive terminal, and the thick line the negative terminal. On the left is a pictorial view of an all-dry combined L.T. and H.T. battery, but in most cases the accumulator is of the wet type: that is to say it contains dilute sulphuric acid and can be recharged.

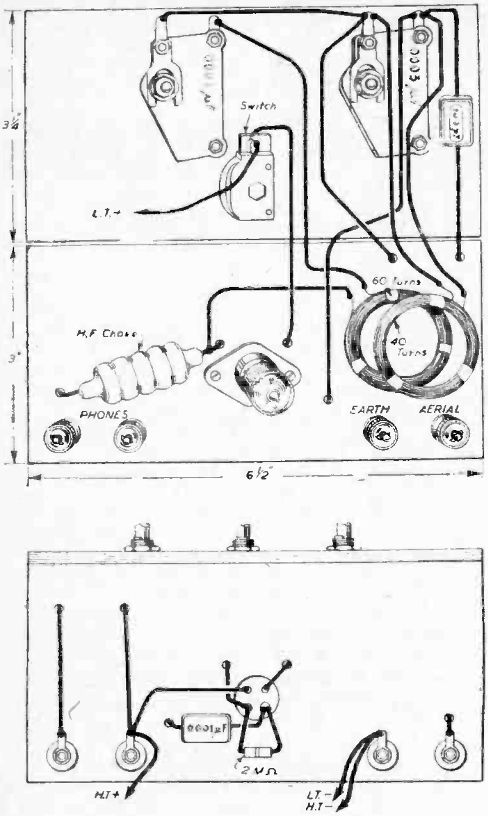


Fig. 12.—Wiring diagram for the simple one-valver, circuit diagram of which was given last month. A circuit diagram showing how to convert it into a two-valver is shown in Fig. 13.

LIST OF COMPONENTS

One .0003 µF variable condenser.
One .0001 µF variable condenser.
Two .0001 µF fixed condensers (T.C.C.).
One H.F. choke.
One 2 megohm grid leak.
One coil (see text).
One XD 1.5 v. valve (Hivac).
One valveholder.
One On/Off switch.
Four terminals.
One pair H.R. headphones.
One type L5504 battery (Vidor).
Two knobs.
Connecting wire, wood for baseboard and panel.

of a core of soft-iron stampings, around which are wound two separate coils of wire—either side by side or one upon the other. The ratio of these windings determines the amplification given by the transformer, and thus a three to one transformer means that the primary has (roughly) one-third the turns of the secondary. The primary winding is connected in the anode circuit of the valve, that is, one end of the primary is joined to the anode and the other end to the H.T. supply. The oscillations in this winding are transferred by induction to the secondary winding, which is connected to the grid circuit of the following valve, and therefore, this valve receives similar impulses to this with the exception that they are strengthened by the step-up due to the ratio of the windings. The advantage of this type of coupling lies in this step-up of strength or *stage gain*, but there are a number of disadvantages.

In other words a transformer is a combination of two inductances (coils) so arranged that alternating current in one will induce current in the other winding. There are three principal types of transformer employed in wireless receivers ; high-frequency transformers, low-frequency transformers and mains transformers. High-frequency transformers consist simply of coils of wire, of which either the primary or the secondary may be tuned. The coupling is so tight that the effect of tuning one circuit is the same as tuning both. The relation between the windings, or, in other words, the ratio, is governed by the type of valve with which it is used. The low-frequency transformer consists of a similar arrangement, with the inclusion of a core of iron to increase the inductance.

The mains transformer consists of a similar arrangement, except that the primary is wound for inclusion in the A.C. mains circuit, and in place of one secondary, several secondaries are employed, to give voltage supplies for heating the heaters of valves and also for H.T. supply. One secondary winding is provided for the purpose of giving the H.T. supply.

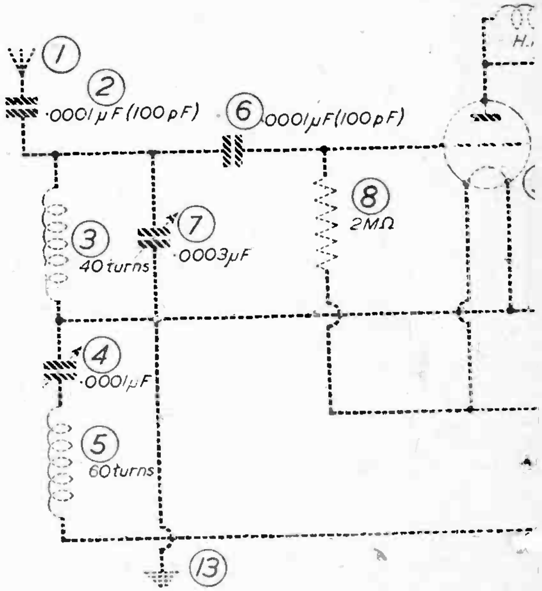


Fig. 13.—Theoretical circuit of a two-valve receiver, w... last month. The one valve circuit is shown by means of d... are shown by solid lines. The only additional parts a... holder (part...

L.F. transformers generally have a step-up ratio of from 1 to 1 to 1 to 8; the most usual ratio is 1 to 3.

The usual ratio of primary turns to secondary turns is spoken of as the *transformation ratio*; thus a transformer with 100 primary turns and 1,000 secondary turns would have a transformation ratio of 100 to 1,000 or 1 to 10.

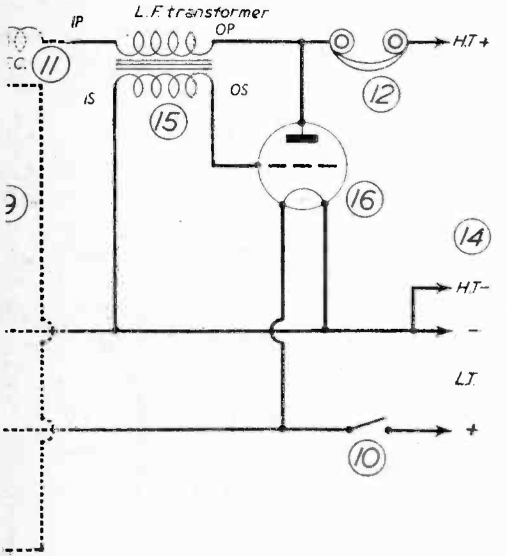
$$\frac{\text{Primary turns}}{\text{Secondary turns}} = \frac{\text{Primary E.M.F.}}{\text{Secondary E.M.F.}} = \frac{\text{Transformation}}{\text{Ratio}}$$

When connecting a low-frequency transformer it is important to note which is the *in-primary* (I.P.), the *out-primary* (O.P.), the *in-secondary* (I.S.) and *out-secondary* (O.S.) otherwise it may be necessary after testing to change over the connections.

Some transformers are marked I.P., O.P., I.S., and O.S. although most to-day are marked, P. (or A), H.T., G. and G.B. corresponding to plate (or anode), high tension, grid and grid-bias. These, of course, correspond to I.P., O.P., I.S. and O.S.

In some designs it is necessary to avoid the direct current flowing through the primary of the transformer and it is, therefore, *parallel fed*. This means that the terminal marked H.T. should be joined to earth, the terminal marked P should be fed through a fixed condenser of about .01 to 1 μF capacity to the plate of the valve, and the high tension applied to the plate through an *anode* resistance. The anode, is, of course, another name for the plate of the valve although the term has other meanings.

The anode resistance should have a value about four times the *impedance* of the valve. Later on,



hich is modified from the one valve circuit given *tted lines. The new wires and additional components* *e a low-frequency transformer, a valve and a valve* *15 and* 16).

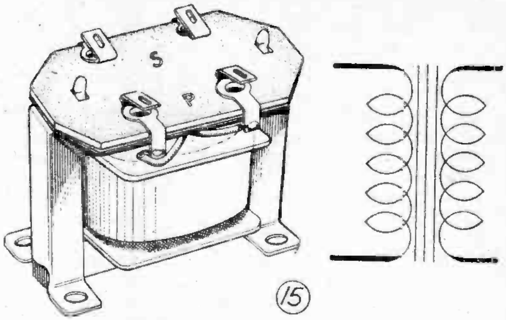


Fig. 14.—Theoretical sign for a low-frequency transformer and (left) pictorial view of an actual L.F. transformer.

when we deal with valves separately, we shall learn what the impedance of a valve means, but briefly it means the resistance to flow of current offered by a circuit.

The ratio of the transformer must be chosen according to the position it occupies in the circuit. If, as in this case, only one stage of low-frequency amplification is employed, a high ratio transformer can be used, say 7 to 1, although this to some extent will depend upon the valve. If a *pentode* valve is used a ratio of about 5 to 1 would be suitable.

The valves used in these two circuits are triodes, that is to say they have three *electrodes*, an electrode being either of the two poles or terminals of a valve, battery, dynamo, etc. A pentode, as its name implies, thus has five electrodes. In the case of a triode the electrodes are respectively, the plate, the grid and the filament. The filament is surrounded by the grid and this in turn is surrounded by the anode or plate. Some valves, of course, employ more than one grid.

The functioning of a valve commences when a *low tension* (low voltage) current is passed through the filament. This has the effect of heating it and when it has reached the correct temperature it throws off minute electrical negative charges known as *electrons*. The electrons are attracted to the grid and from there to the plate and from thence they flow back to the high-tension battery. To attract these negative electrons to the anode from the filament the anode is kept positively charged, for it is a well-known fact that a positive charge attracts a negative charge. To charge the plate or anode positively it is connected to the positive side of the high-tension battery, the negative side of the battery being connected to low tension negative as explained earlier. In this way the voltage applied to the filament remains unchanged, but the voltage of the anode in relation to the filament is greatly increased and with it the electron flow. The grid is a spirally wound length of special wire and to this the incoming wireless signals are applied. These signals are alternatively negative and positive and this changing of *polarity* tends to control the electron flow from the filament to the anode; for when the grid is positive it acts like a small anode and because it is nearer to the filament its attraction for the electron is much greater. But this also means an increase in anode current.

The grid, however, is just as often negative and has the effect of repelling electrons leaving the filament, for like repels like and unlikes attract. A negative grid will therefore mean a decrease in anode current. It will be seen then, that if the grid is biased negatively with a grid-bias battery it will tend to prevent any positive signal voltages from making the grid positive and the flow of grid current is thus prevented, although the controlling action of the grid is maintained. It is important, therefore, to use the correct value of grid bias, otherwise the grid will not be able to deal properly with the signal voltages applied to it.

A valve acts as an amplifier owing to the fact that the anode current produced by the application of a *potential* or *voltage*, or *pressure* to the *cathode* (the filament) and anode is much greater than that which is passed to the grid. The signal oscillations on the grid vary the anode current as explained above and as this is of greater magnitude than the signal amplification takes place.

In the one-valver the valve, of course, acts as a *rectifier* as well as an amplifier, as already explained. A negative potential is applied to the grid so that when the signal oscillations are passed to the valve a uni-directional current is produced in the anode circuit.

This is not the only method of rectification, of course, for it may be carried out by including in the grid circuit a fixed condenser with a high resistance joined to the cathode. The inclusion of this condenser and resistance has the same effect, namely the production of a uni-directional current in the anode circuit.

We have not yet dealt with the grid leak, which is called upon in a detector circuit to discharge the electrons accumulated on the grid during alternate half-cycles. In the resistance-capacity-coupled stage, which we shall deal with next month, it has to complete the grid circuit of the valve and discharge it continuously and rapidly so that the voltage at the grid at any instant accurately follows the signal voltage fluctuations. For the average leaky grid detector a condenser of .0003 mfd. capacity and a grid leak of about 2 megohms resistance are usually recommended while for the low-frequency resistance-capacity-coupled stage the condenser may be as great as .05 mfd. and the grid leak of about 250,000 ohms resistance. The function of the coupling condenser is principally to control the alternating signal applied to the grid of the valve, and the grid leak acts as a discharge resistance.

The *reactance*, or opposition, offered by the condenser to the passage of an alternating current is high at low frequencies and lower at high frequencies.

Errata

On page 252 of the May issue (first instalment of this series) .000001 mfd. read 0.000001 F., and the reference to picafarads should be 0.000000000001 F. A microfarad is usually written as 1 mfd., or 1 μF, and the picafarad as 1 pF, or 1 $\mu\mu$F.

(*To be continued.*)

THE LATE C. E. M. JOAD

(*Continued from page* 330)

to reply in the negative, of course. My next question was: What happened to the students if they failed to answer the questions correctly? To which came the obvious answer that they were failed. That, I said, was precisely what I had done to him! He rather enjoyed that sockdolager. As a result of further conversation I forced him to admit that he was a mere showman and poseur. His reply was pitiful. "What does it matter? I make a lot of money out of it!"

During the 1914-18 war he discovered that he had a conscience—in other words he was a conscientious objector, or, to put it more bluntly, he wanted to dodge joining the Army. In 1933, in an Oxford Union debate, he spoke in favour of the resolution "That this House will in no circumstances fight for its King and country." His advocacy of that resolution was responsible for it being passed.

Every reader was aware of his famous trick, when asked a question in the Brains Trust, of prefacing his "reply" with the words, "It all depends what you mean by . . ." That was only another way of admitting that he did not know the answer, a dialectal trick of gaining time to think out some sort of an answer, or completely altering the question so that he could provide an answer for the question in its new form. No man who had suffered the soul-destroying atmosphere of the Civil Service for 16 years, as he did, could possibly be the scintillating wit and philosopher which was his particular pose. For Joad was undoubtedly a *poseur*.

His main claim was that he was a philosopher. He worshipped at the shrine of Socrates in the belief that by so doing people would endow him with the wisdom of Socrates. It was his form of reflected glory. Joad was not a philosopher; he changed his mind too many times for that and, indeed, his code of living was certainly not philosophical, for he was neither epicurian nor stoic. The very first tenet of philosophical teaching is that honesty is the best policy. Everyone knows of the railway incident (which resulted in his exit from the Brains Trust) in which he was charged with travelling on the railway without a ticket and with intent to defraud. In his apologia relating to that case he admitted that he had "lied like a trooper." The opinions of a man who so frequently changed his mind (he was an agnostic at one time, but later returned to the fold) could not be relied on, for what he stated one day he was likely to disavow the next. We must not forget the many thousands whom he converted to beliefs which he later disowned. He wrote many books, but none of them could be classed as literature. Some, indeed, were pot boilers.

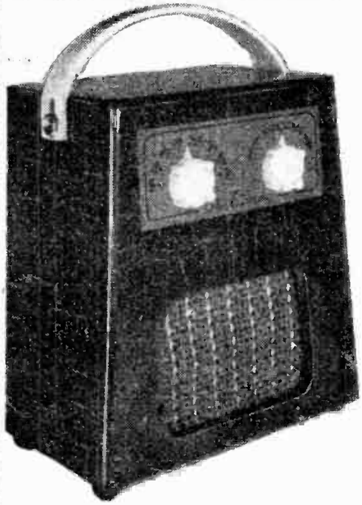
He was educated at Blundells School, Tiverton, and gained a scholarship to Balliol College, Oxford. Latterly, he was head of the Department of Philosophy at one of the less well-known colleges attached to London University—the Birkbeck. He was a socialist "not because I like the working classes, but because I hate the sight of them and want to make them different." Even his socialist views changed. "Socialism, which when I was young was an affair of long hair and red ties, is now an affair of red tape and safety razors."

Withal he was an entertaining chatterbox, and the fact that his verbal froth was pleasant to large numbers of people is perhaps justification for the respect many, who did not know him, felt for him.

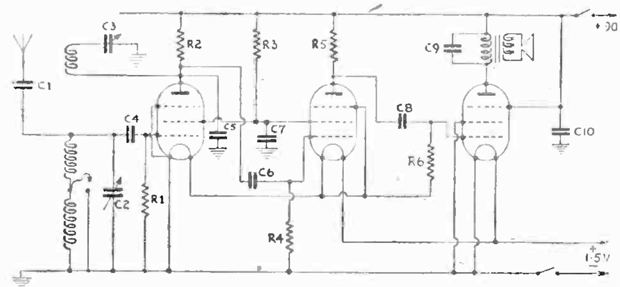
Was Joad, therefore, a philosopher? A *poseur*? a humbug? Your appraisal of him is as good as mine!

De mortuis nil nisi *bonum*? *Bunkum*!

Whilst a man is protected by the law of libel from the truth being told about him while he is alive, no one should object if it is told about him when he is dead.

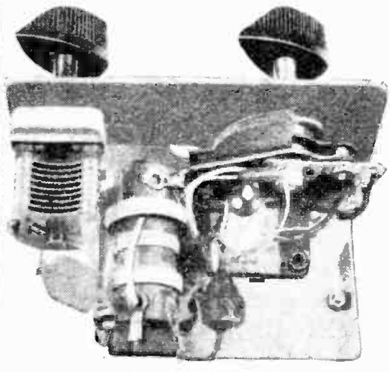


THE *Elpreq* "HANDY THREE"

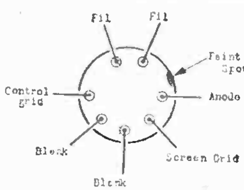


Theoretical Diagram

A small, self-contained set which can be carried about from place to place must be a valuable addition to your personal belongings. When the family want Television, for instance, you may wish to hear a special Radio item, if you have a long job to do in your shed or greenhouse or even whilst having a bath, an important programme need not be missed. Cycling, too, can be made more enjoyable if you can listen to music and singing (of course under these conditions a loudspeaker would not be too successful but an earphone of the deaf-aid type is ideal).



Above Chassis



Valve Connections

The little set described here uses sub-miniature valves and can be built for only 80/-. It will receive long and medium waves at good strength with only a short throw out aerial. The circuit used, i.e., single-coil tuning with reaction is one which was very popular in the early kit set days. We have chosen this type of circuit because it works well with the miniature valves and does save the heavy cost of the midget 2-gang I.F. transformers, etc., which are necessary with a superhet. Also this set is much cheaper to run having only three valves and needing only 45 volts H.T. in most areas and 1½ volts L.T.

We give enough details on this page for most readers but a blueprint showing point to point wiring is available, price 1/6.

Notes

1. For L.T. use 1.5 v. battery type U2.
2. For H.T. use 45 v. Ever Ready battery B106.
3. In most areas a 15ft. aerial slung around the picture rail is plenty.
4. To receive the station adjust tuning and reaction controls together.
5. In weak reception areas try a longer aerial, an earth, and/or increase the H.T. to 90 v., i.e., Ever Ready battery B126.

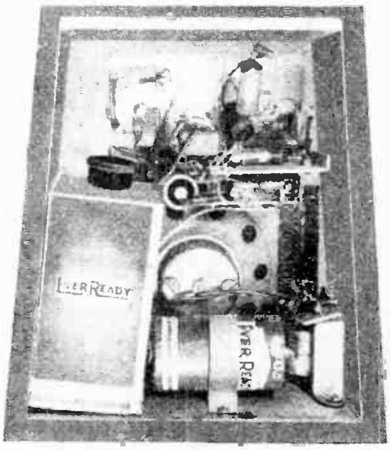
Components, valves and prices

Resistors
R1, R3, R4—2.2 megohms.
R2, R5—560 k ohms.
R6—1 Megohm.
Total 6 available for 2/-.

Fixed condensers
C1, C4, C6, C8—1,000 pF.
C5—100 pfd.
C7—.1 mfd.
C9—.01 mfd.
C10—2 mfd.
Total 8 available for 4/-.

Variable Condensers
C2—.0005 mfd.
C3—100 pfd.
Both available for 7/-.

Valves
V1, V2—CV443 5/9 each.
V3—CV385 6/9 each.



Assembled Receiver

Other components

Metal chassis	4/6
Miniature output transformer	4/6
Dual wave coil	3/6
3½ in. loudspeaker	14/6
On/off switch	2/6
Knobs (2)	1/-
Cabinet	15/9
Sundries, nuts, bolts, battery, plugs, wire etc.	3/6
Blueprint	1/6

Special Offer

All above parts bought separately come to £4/2/6, but if you buy them all from us within 30 days we will supply the cabinet at 13/3 thereby reducing total cost of set to £4. Non-callers add 2/- for postage.

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TUNING PACKS

PRINCIPLES OF DESIGN AND DETAILS OF SOME MODERN PRODUCTS

By W. J. Delaney (G2FMY)

IN the early days of home-construction, the amateur wound his own coils which were later superseded by commercial products usually ganged in sets of two or three. The type of circuit used in these receivers was of the simplest, and to construct a superhet was considered extremely difficult—if not impossible. The design of coils has gone a long way since then, and to-day the coils have been reduced to extremely small dimensions, but are, in general, more efficient than their larger earlier counterparts. It is to-day possible to purchase individual coils with iron-cores for inductance adjustment in practically every type needed in a modern receiver. In a T.R.F. circuit all coils work at the same frequency, whilst in a superhet one or two coils are at signal frequency, and one is used in the oscillator stage, with all remaining tuned circuits operating at a fixed frequency. This permits of screening and maximum gain, whilst the soils for these circuits may be screened and once installed may more or less be forgotten. They are, of course, the IF transformers. Therefore, in a modern circuit there need only be three coils for a really efficient superhet circuit, and for a T.R.F. the same number of coils will permit of a two H.F. design.

The main difficulties encountered in using two or more coils are the disposal of connecting leads and the prevention of interaction. The former may be taken care of in the mounting process, but screening must be introduced where the coils operate at the same frequency, and difficulty is usually encountered in arranging the leads. This difficulty is increased when it is desired to make a circuit to operate on two or more wavebands.

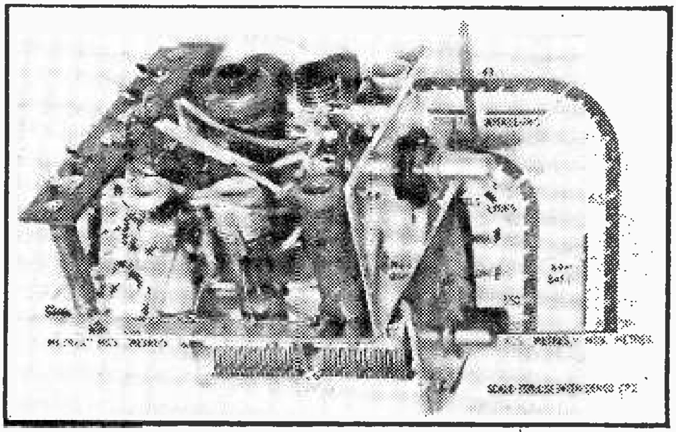
Frequency Coverage

For a medium-wave-only circuit, little trouble should be experienced, a simple strip of metal being used on which the coils may be mounted on either side, in the case of a T.R.F. circuit. With a superhet the two coils may be placed side-by-side with about one inch separating them, providing that no R.F. stage is employed. In the latter case, the tuning circuits of the R.F. stage and the input of the frequency changer will be identical and these should therefore be screened in the same manner as the T.R.F. coils. If a two wave-band circuit is required, two identical sets of coils will be needed, and a wave-change switch will be needed to select the desired coils. The type of switch will depend upon the types of coil and the particular circuit which is used, and in the case of the superhet additional padding and trimming condensers are needed to enable a standard type of tuning condenser to be employed.

From these details it will be seen that whilst the construction is not really difficult there are a number of incidental items which will call for care, and the accessibility of the trimming devices and the arrangement of the switch generally call for rather more work and skill than the average amateur can cope with.

Fortunately, there are now available on the market various commercial packs in which all the intricate work is already done, and the packs are generally built round the multi-contact switch in such a manner that the switch mounting nut—usually of the one-hole fixing type—is used to mount the complete unit.

In some of these packs the trimming or initial adjustment may be carried out from the rear of the chassis, whilst in others it may be necessary to drill holes in the chassis to enable a trimming tool or screwdriver to be inserted to make the adjustments. The packs should be selected by the constructor with care, bearing in mind the wave-bands he desires to cover, the type of circuit he wishes to use, and whether or not he has access to a signal generator. In many cases the packs are supplied pre-tuned, which means that they have been factory-tested on an actual receiver and have been accurately aligned. This does not necessarily mean, however, that such pre-alignment will hold good in another receiver, as the way in which the leads from the pack are run to the valveholders, etc., may introduce stray capacities exceeding those which existed in the test receiver, and therefore a slight adjustment may be called for in order to obtain maximum performance. Such adjustments should, however, be very carefully carried out, the trimmers or cores only being moved a very slight amount. If they are turned too quickly or too much and have to be re-set, it may be found that the optimum setting is not easily found and they



A typical modern coil pack mounted on the tuning condenser. This is a Denco product.

may have to be sent for re-alignment or a signal generator obtained to trim them.

Tuning Dials

A further advantage in using these commercial coil or tuning packs is that the makers usually supply for use with them a calibrated tuning scale which, provided the right type of tuning condenser is employed, will ensure that an accurate dial is available and the location of stations may be read off as in a commercial receiver. This is, of course, one of the main difficulties of the home-made receiver. A simple dial marked only in degrees, or a home-made dial calibrated on actual stations may be made-up, but the finished product will not have a professional appearance. A selection of dials are available with some makes of pack, and in some cases these will hold good irrespective of the actual receiver circuit which is adopted, that is, whether or not an R.F. stage is employed before the frequency changer. The illustration on p. 341 shows a very small coil pack from the Denco range, which is actually mounted on the tuning condenser, and the dial for this is shown in the background. To simplify still further the work of making a superhet the Roding Laboratories, for instance, supply a coil pack and the required IF transformers, all pre-aligned and sealed, and if desired these may be supplied with the condenser and dial, all matched to reduce construction merely to the wiring-up of the remainder of the parts. The Osmor coil packs are also available with a specially-prepared dial, and readers will remember that this was employed in our Three-speed Autogram. In the Osmor range a separate unit in the form of the necessary parts for an R.F. stage are available, so that if a constructor should build a superhet without an R.F. stage, and later decide to add such an arrangement, he need not replace the entire pack—merely obtaining the R.F. stage and adding the valve and other necessary items.

Tele-type Equipment

INITIATED through the operational research of International Aeradio Ltd. and produced by the Plessey Co., as a result of development in conjunction with I.A.L., this new radio tele-type receiving and transmitting terminal equipment is the first to be designed as a complete unit to meet the exacting requirements of world-wide high-speed telegraphy for teleprinter transcription. Its advent should prove of primary importance to press agencies, transport, meteorological and other authorities of international scope whose operation necessitates a high degree of reliability in teleprinter transcription over long distances.

This Plessey —I.A.L. equipment fulfils the stringent I.C.A.O. requirements for aeronautical fixed telecommunication networks; it is designed for unattended operation, providing four channels for F.S.K. working in the H.F. band 2-20 Mc/s. In these circumstances it makes available extremely stable and completely automatic transmission and reception of radio-telegraph signals to give the maximum realisable service throughout the year, mitigating, to the greatest possible extent, diurnal and seasonal changes in propagation conditions.

The complete installation may be remotely controlled over two telephone lines at distances up to 10 miles, using a control panel fitted with a standard telephone dial and an indication that channel selection has been achieved. Alternatively, local control can be extended up to 50ft. on a multi-wire system.

Six foot cabinets with standard International 19in. rack and panel assemblies house both the receiving and transmitting terminals (double bay for receiving and single bay for transmitting). Cooling of the cabinet interiors is accomplished by forced air draught, the small pressure built up internally virtually excluding dust and dirt. The entire equipment is fully tropicalised, and all transformers and chokes are totally enclosed.

The installation described represents the most comprehensive equipment at present offered by the company for this service, but, for more modest operational requirements, a reduced scale of equipment can be offered at a corresponding reduction in cost.

For example, equipments can be offered varying from 3, 2 or 1 channel (diversity) with *or without* remote control down to a single channel non-diversity installation consisting of: 1 Receiver, 1 H.F. Oscillator, 1 Beat Frequency Oscillator, 1 Converter Unit, 1 Keyer Amplifier, 1 Stabilised Power Unit. Mounted in a small single-bay cabinet.

A wide range of special installations using the same basic units can be supplied to meet any operational requirement.

Coronation Commentators

THREE more names have been chosen for the team of commentators to describe the Coronation events on June 2nd. Bernard Braden and Michael Henderson will join the television team and Willy Richardson, who hails from Trinidad, will join the sound team.

Braden had much experience as a sporting and ceremonial commentator for radio networks in Canada before coming to this country in 1949; Henderson, one-time newsreader/announcer in the European Service, has done many commentaries on television in recent months, and Willy Richardson, West Indies producer in the BBC's Overseas Service, has been heard in many feature programmes in the external services. The selection of these three commentators completes the final team for the domestic programmes on June 2nd. Positions at Westminster and along the route are as follows:—

Michael Henderson Richard Dimbleby

Venue	*Sound Commentators*	*Television Commentators*
Buckingham Palace ...	Jean Metcalfe	—
Victoria Memorial ...	Wynford Vaughan Thomas Talbot Duckmanton Willy Richardson	Chester Wilmot Berkeley Smith
Embankment	Rex Alston	Max Robertson
Outside Westminster Abbey	Frank Gillard Tom Fleming	Mary Hill Michael Henderson
Annexe	Audrey Russell Capt. W. E. S. Briggs	—
Inside Abbey	Howard Marshall John Snagge	Richard Dimbleby
Trafalgar Square ...	Raymond Baxter	—
Marble Arch	David Lloyd James	—
Piccadilly Circus ...	John Arlott	—
Stanhope Gate... ...	Alun Williams	—
St. James's	Henry Riddell	—
Near Grosvenor Gate	—	Brian Johnston Bernard Braden

A Built-in Pre-amplifier

AN ACCESSORY FOR THE RECORD ENTHUSIAST

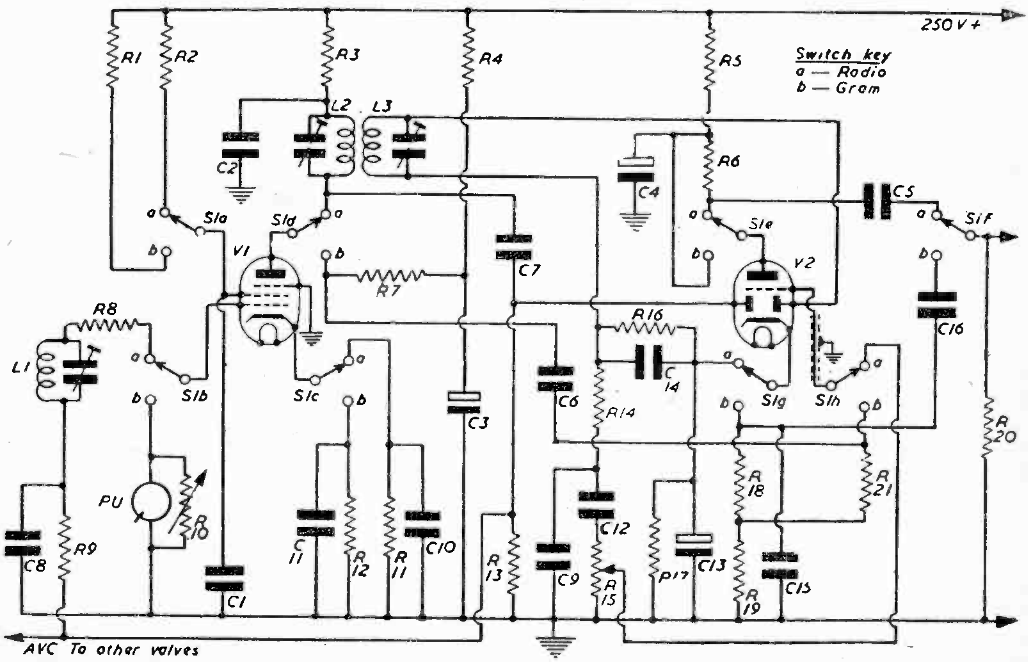
By N. T. Cook

THE advent of microgroove recordings will expose the weaknesses of many conventional gram. stages. It is not unusual to find that even standard records do not load normal A.F. arrangements due to many and varied causes, including lower pick-up and/or valve/s sensitivity. Also, how often is satisfactory output only achieved by keeping variable controls at maximum? Pre-amplifier circuits are published as an answer to the insufficient A.F. gain problem, but H.T. and L.T. supply are often either separate, with their greater expense, or obtained from the existing source which the pre-amp. "adds to" as a signal booster. It is not ideal policy to drain the last drop from power units, especially where the unit is not fully protected by appropriate fuses. The idea here given involves more care than expense, for it will be seen that all vital components are either already in an existing circuit or due to be built in as shown (radio side particularly). The proposition is that by skilful addition of a few components we can acquire a high level of audio gain potential, well above normally provided levels and sufficient to eliminate all need of ponderous pre-amps. and trailing wires.

The Circuit

The diagram shows a section of a superheterodyne, actually the final (usually the first in most sets) I.F. amplifier and a double-diode-triode providing detection (diode) A.V.C. (diode) and A.F. amplification (triode). All these functions are retained on radio, but with the system suggested here for more audio gain we put our pentode to work again whereas it usually becomes redundant on gram. The triode is also at work, but at no gain, for it becomes a cathode-follower with all that arrangement's advantages. It is not essential that we should sacrifice the triode's gain, however, it can be retained if desired simply by leaving its normal anode and cathode circuits alone and just switching its grid from the slider of R15 to C6 in the latter case carrying R21 to chassis. It will be seen, as the circuit diagram is largely self-explanatory, what to put in or leave out when considering the question of whether or not to abandon the triode's normal function.

The "stray capacities" school will see that I.F. detuning is unavoidable, the degree of this depending on the care and technique employed. But in most cases it will be unnoticeable and for those about to build and using this idea the question does not arise because building in pre-aligned I.F. transformers invariably "detunes" them; no two layouts are identical. When I.F.T's are factory aligned stray capacities are estimated, not known. In any case,



Theoretical circuit of the pre-amplifier.

the strays are in negligible proportion with elementary caution.

A full analysis and detailed description cannot be given for obvious reasons. Experienced readers will need no help, and beginners can build the section (of a superhet) exactly as shown for which reason all values are given. No great technicality exists here. The radio side is a well-used and popular circuit, and the gram modifications are the whole point of this article. The pentode anode current must be limited for voltage considerations. A glance at its audio anode load will show why. Thus appropriate resistors are switched in for gram work.

Hum

Hum can easily be caused by the increased sensitivity of the arrangement when built as here for audio work. The I.F. valve will normally already be screened for its H.F. tasks, but its input and output points may still give trouble. This is not to say that hum will occur as a matter of course ; quite the contrary, for adoption of this system can easily cure an existing fault of this nature, not to mention the motor-boating risked where decoupling is not in use as shown here !

The new input points can be shunted with a low value resistor (around 20,000 ohms) if hum only occurs when the signal source, say the pick-up, is plugged in. With the low value of R10, as shown, it should hardly be necessary.

Finally, nothing hard-and-fast in the way of ruling can be stated for this circuit. Knowledge, experience, need will all vary from reader to reader, as will existing apparatus and arrangements. As an example, the valves shown (6J7 and 6SQ7) are 6.3 volt types, and the circuit is adjusted to their needs. However, valve manuals will supply any help needed where valves employed differ from those given. For that reason, with an eye on beginners, especially those contemplating stocking-up with microgrooves besides about to build a superhet radio, all values have been given to complete an overall picture of a radio section that becomes a pre-amplifier of reasonably good quality and unusually powerful A.F. performance. Even greater output is optional, as pointed out.

COMPONENTS NEEDED FOR MODIFICATION

Resistors
R1—1.5 M Ω.
R4—4.7 K Ω.
R7—220,000 Ω.
R10—47,000 Ω (variable).
R12—2,200 Ω.
R18—6.8 K Ω.
R19—220,000 Ω.
R21—470,000 Ω.

Condensers
C3—8 μF (500 v. wkg.).
C11—10 μF (10 v. wkg.).
C6—.05, C16—.02, C15—.0001 μF. (mica)

Switch is 8-pole 2-way.

R11—820 Ω.
R13—1 M Ω.
R16—220,000 Ω.
R14—470,000 Ω.
R15—500,000 Ω (variable).
R17—10,000 Ω.
R20—500,000 Ω (adjust value to output) valve.

Condensers
C1, C2, C5, C8, C10, C12 All .05 μF (preferably mica)

For an overall list of Components add these (which will normally be in existing or planned circuits).

Resistors
R2—100,000 Ω.
R3—4.7 K Ω.
R5—4.7 K Ω.
R6—220,000 Ω.
R8—220 Ω.
R9—220,000 Ω.

C14, C9, C7 .0001 μF mica
C4—8 μF (500 v. wkg.).
C13—10 μF (10 v. wkg.).
V1 — 6J7G/GT (or equiv.).
V2—6SQ7 (or equiv.).
L1, L2 and L3 are I.F. transformer coils, L1 being secondary of first I.F. trans. (normally from freq. changer).

Cooling of Transistors

METHODS for cooling transistors so that they can be operated at relatively high-power levels were revealed recently by Dr. L. D. Armstrong and Dr. D. A. Jenny, of the David Sarnoff Research Centre of the Radio Corporation of America.

The two R.C.A. scientists, speaking at the annual convention of the Institute of Radio Engineers, pointed out that the electronic performance of the tiny germanium crystal in a transistor deteriorates when its temperature approaches 200 deg. F. In the many low-power applications available for transistors, they explained, the power to be handled is too small to raise the temperature of transistors to the danger level. But in many other applications—higher power equipment such as audio amplifiers or apparatus that must be used in a confined space where ventilation is poor—transistors may become overheated and erratic.

To study ways of overcoming this temperature problem, Drs. Armstrong and Jenny designed transistors with built-in cooling systems. These experimental power transistors, which are about the size of a thimble, have already been made to handle one watt of electrical power as compared to about 5/100 of a watt maximum for uncooled transistors. In further laboratory tests, using an external cooling means, such as air or water circulated around the transistor, the power types were operated at 3 watts.

The two scientists discussed two approaches to built-in transistor cooling that have shown promise in the laboratory : liquid cooling and metallic cooling.

By the first method a junction transistor (without the plastic case that normally surrounds its germanium wafer) is encased in a tiny metal tank which has been filled with a cooling liquid. The liquid transfers the heat generated in the transistor to the metal shell, from which it passes into the surrounding air. The liquid must be a good electrical insulator have a high boiling point, and be thin enough for rapid circulation within the tank.

In metallic cooling, the transistor is encased in a metal cup which offers a relatively wide area for dissipating heat, or special cooling fins are attached to the outer casing. The metal cooling surface is connected by soldering it to the transistor's tiny wafer so that when the electrical power heats the germanium, excess heat is carried off to the outside cooling surface

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BATTERY SET CONVERTER KIT. All parts for converting any type of Battery receiver to All Mains. A.C. 200-250 v 50 c/s. Kit will supply fully smoothed h.t. of 120 v 90 v or 60 v at up to 40 mA, and fully smoothed l.t. of 2 v at up to 1 a. Price complete with circuit, point to point wiring diagrams and instructions, only **48/9.** Or ready to use, **7/9** extra.

PERSONAL SET BATTERY SUPERSEDER KIT. A complete set of parts for construction of a Unit (housed in Metal Case) to replace Batteries where A.C. Mains supply is available. Input 200-250 v 50 c/s. Outputs 90 v 10 mA and 1.4 v 250 ma, fully smoothed. For 4-valve receivers. Price complete with circuit. Only **31/6.** Or ready for use, **7/9** extra.

H.T. ELIMINATOR AND TRICKLE CHARGER KIT. Input 200-250 v A.C. Output 120 v 40 mA, fully smoothed, and rectified supply to charge 2 v acc. Price with steel case and circuit, **29/6.** Or ready for use, **7/9** extra.

BATTERY CHARGER KITS
For Mains 200-250 v 50 c/s.
To charge 6 v acc. at 2 a. **25/6.**
To charge 6 or 12 v acc. at 2 a. **29/6.**
To charge 6 or 12 v acc. at 4 a. **49/9.**
Above consist of transformer, full wave rectifier, fuse, fuseholder and steel case. The kits can be supplied fully assembled at an extra cost of **7/9** each.

EX-GOVT. VALVES (NEW)

	Each		Each		Each
IT4	8/11	6SN7GT	11/9	1625	5/3
IS5	9/6	6SG7	6/9	35Z4GT	10/6
IR5	6/11	6V6G	8/11	35L6GT	9/11
3S4	9/9	6V6GT	10/6	D1	1/3
5Y3G	9/6	6X5GT	8/9	EF36	6/11
5U4G	10/6	7V7	6/9	EF39	7/6
5Z4G	9/6	7C5	6/11	EB91	9/9
6AL5	9/9	8D2	2/11	EF91	11/9
6F6G	8/11	9D2	2/11	KT44	5/3
6AM6	11/9	954	1/11	KT66	11/6
6J5G	5/11	12H6	2/3	MU14	9/6
6J7G	7/6	12K7GT	10/6	MS/Pen	5/9
6K7G	6/11	12K8GT	10/6	RK34	1/11
6K8G	11/9	12Q7GT	10/6	SP4	5/9
6L6G	11/9	12SK7	6/11	SP61	2/11
6Q7G	9/11	12SR7	7/9	U50	9/6
6SL7GT	11/9	15D2	5/9	VU120	2/11

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8µF 450 v	1/11	8µF 500 v	2/11
8µF 500 v	2/11	16µF 450 v	2/9
16µF 350 v	2/3	24µF 350 v	2/11
16µF 450 v	2/9	32µF 350 v	2/11
16µF 500 v	3/11	40µF 450 v	4/11
24µF 350 v	3/6	8-8µF 350 v	3/9
32µF 350 v	3/6	8-8µF 450 v	3/11
32µF 500 v	5/9	8-16µF 450 v	4/6
8-16µF 500 v	4/11	16-16µF 450 v	4/11
25µF 25 v	1/3	16-32µF 350 v	5/3
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350-0-350 v 150 mA, 6.3 v 4 a, 5 v 3 a ... 33/9
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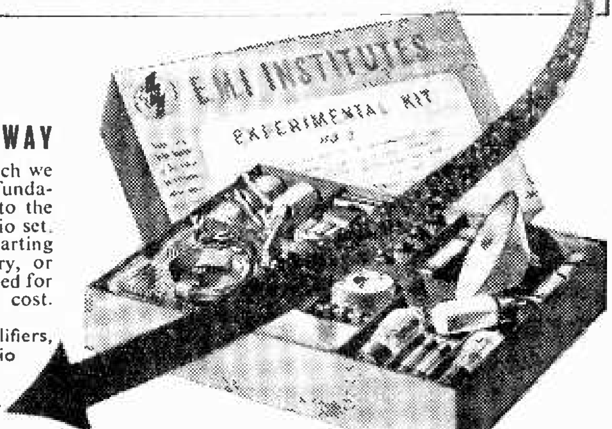

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Long-playing Technique

SOME INTERESTING INFORMATION FOR THE RECORD ENTHUSIAST

By R. L. Jefferson

IN the early 1920s the late Pemberton Billing, M.P., formed a company, produced and marketed a record called "The Marathon." It was the first real attempt at L/P as we know it to-day. Its lack of success was due to several factors, the greatest of which was surface noise, and the acoustic method of recording then in use.

In 1925 Harrison, of the Western Electric Co., U.S.A., introduced electrical recording. At that time speeds had settled down to 78 r.p.m. Electric recording enabled—for the first time—large bodies of choral and orchestral ensembles to be recorded.

The earliest electric recordings made in England were nearly all taken in concert halls. In those days the science of acoustics was not as advanced as it is to-day. Many of the earlier orchestral records had a very blurred and distant tone. The incisiveness of string tone we have come to expect to-day was entirely lacking. Sudden climaxes in the music, with heavy drums, completely obliterated the detail and the already limited treble register simply vanished.

Gradually improvements took place. Microphones became more sensitive, acoustics took on the dignity of an exact science. In the early 1930s the E.M.I. (H.M.V., Columbia, Parlophone) started recording at their Abbey Road studios. These recordings showed a great advance in forwardness and definition but lacked the atmosphere of the concert hall recordings being produced by Polydor of Germany and its French branch. Polydor was eliminated when Hitler came to power. In their place came a new name in the record field—Telefunken.

They soon set a standard for recordings which was not surpassed until 1946, when Decca over here introduced their FFRR technique.

A very large number of these records show an astounding fidelity to the original sounds picked up by the microphone. Record No. K1576, containing the finale to "The Firebird" played on really good equipment, will convince all but the prejudiced just how far we have come toward the ideal of an exact replica of the original sounds. The frequency range of the FFRR records is from 30 to 14,000 c.p.s.

The shape of things to come occurred in 1948 when Goldmark and Bachman launched the long-playing record for the Columbia Phonograph Co. in the U.S.A.

In a gadget-minded country its success was assured at once. Columbia produced a record player at a nominal price which enabled anyone to play the new records through domestic radio receivers. Half a million of these players were sold in the first six months of L/P. I have not the figures of L/P records sold in the U.S.A. since their introduction, but it must be astronomical.

Variety

There are over 130 different L/P record firms alone in the U.S.A. There has never been a period in the gramophone business when so many and varied works have been available to the public. All tastes are catered for, even the collector of antique vocals cannot complain ; the dubbing technique has improved to such an extent that many of the modern plastic-dubbed L/Ps sound better than the originals with their noisy shellac surfaces.

In June, 1950, the Decca Co. took the plunge and launched L/P in this country.

I do not believe it is sufficiently realised even now just what this company took upon themselves. We are by nature a very conservative race and look upon anything new with suspicion. Remember that up to 1950 turntables in this country had been turning at 78 r.p.m. for nearly fifty years. A change to a speed of 33⅓ r.p.m. was indeed a radical departure from tradition and one which needed an entirely new approach on the part of dealers and the public.

It is by now well known that the first Decca L/Ps received adverse criticism from the technical and general press. In certain cases this criticism was justified, in others most definitely not. I number myself as one of those who treated the new discs with reserve. My feeling (a common one) was that it would be impossible to get true bass on a record which had 240 grooves to the inch.

How foolish my suspicions were is proved by some of the L/Ps I now possess and listen to with pleasure, a pleasure which is more complete than it has ever been in over thirty years of listening.

My necessarily brief historical survey has, I hope, served to whet the appetite of the listener as to how best to take advantage of the many wonderful pieces of equipment now on the market for reproducing L/Ps really well.

Equipment

In the first place I would like to say that there is no substitute for unit construction, the player, amplifier and speaker to be three separate units.

The player can be placed beside one's favourite armchair, if possible a two-tier table should be obtained and the amplifier placed on the lower tier. This enables one to operate the controls and the player without rising. The speaker should be placed at the other end of the room, preferably in a corner.

It is important to have the turntable level. A spirit level should be used and packing applied under the cabinet where necessary.

There is an impression, a very erroneous one, that in order to reproduce L/Ps well an enormous sum must be spent on equipment.

Cost

To give just one example of unit construction of first-class quality at a very reasonable price, let us take the following. A Rogers Minor amplifier at £11 10s. 0d. ; a B.S.R. M.U14 3-speed motor at £6 8s. 6d. ; a Decca X.M.S. pick-up with two type D heads, 78 r.p.m. (brown) and 33⅓ (red), at £7. 0s. 0d., and a Golden Wharfedale 10in. speaker at £8 6s. 0d. This equipment costs a total of £33 4s. 6d. and will give first-class results if the speaker is mounted on a 2½ft. baffle of ¾in. timber, rawlplugged and screwed into the angle of the wall so that the speaker "looks into the room" and faces the player. The bottom of the baffle should be just clear of the skirting board if there is one in the room, if not, a clearance of 6in. should be allowed from the floor. The motor, of course, will have to be housed, a simple enough matter. I suggest a cabinet of 16in. square with a lid height of 4ins., this will allow for experimenting with changers or other makes of pick-up if one so desires at a later date.

An important point in reproduction is stylus pressure or weight on the point. This should be 8 grammes in the case of the X.M.S. pick-up for L/P and 24 grammes for S/P. A simple device for measuring these weights can be made from a length of 16 S.W.G. wire bent to the shape shown in the illustration (by courtesy of the Decca Record Co.).

Should the weights be plus or minus the above figures a careful adjustment of the spring in the pick-up arm should be made until the exact weights are obtained. The heads are correctly weighted at the factory so that once the spring is correctly tensioned both heads will be automatically correct.

It should not be forgotten that exact weight has a decided effect on the reproduction. Too great a weight will give a preponderance of bass; too light a weight will give thin and colourless tone with edgy treble. The exact weight should be adhered to: it has been found to be correct after long experiments.

Alignment of the pick-up arm is a vital factor in the reproduction of L/Ps. A template can be obtained and the pick-up should be fixed at the exact point stated. The pick-up arm should be perfectly free and, indeed, should be capable of being blown across the record with the head removed.

Stylus Wear

Some recent research carried out by the Decca Co. on stylus wear should not only be helpful but may remove some misconceptions about sapphire needles. No needle is permanent—not even a diamond. Extravagant claims have been made in advertisements as to the number of sides a sapphire needle will play. In some cases it has been claimed that some thousands of sides can be played with one sapphire point.

Following carefully-conducted tests with sapphires under working conditions, the Decca Co. have issued the following figures: 78 r.p.m., 300 sides, average playing time 20 hours; 33⅓ (microgroove), 100 sides, average playing time 36½ hours.

It should be added that on worn or scratched records the stylus will deteriorate at a much higher rate.

Should the pick-up be accidentally dropped on the record, damage to the stylus is almost sure to occur. Although sapphire is very hard it is also extremely brittle. It is impossible to see, even with a watchmaker's glass, whether the needle has been damaged or not. Only a microscope can show this. A shadowgraph comparison is necessary to ascertain that the shape of the point is satisfactory.

An increase in surface noise and a falling off in aural quality is a sure indication of wear.

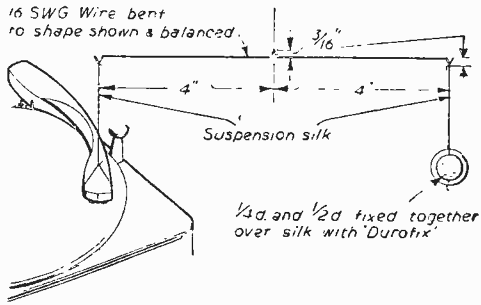
With L/Ps costing up to 39/6 each it is false economy to try to save on needles, always be on the safe side.

Replacing Stylus

Replacing the stylus on the X.M.S. pick-up is a comparatively easy matter. The head is opened by unscrewing two 6 B.A. screws holding the metal base-plate. This will release the base-plate, the latex seal and the top cover of the head.

Hold the head in the left hand and withdraw the armature with a pair of fine pointed tweezers. Insert the new armature, making sure that the shank is central in the hole in the pick-up body. Replace the top cover of the head and hold it tightly in position so that the armature is unable to more out of position. Replace the latex seal so that the stylus passes through the existing hole in the seal. Then replace the metal base-plate and fixing screws.

When it is realised that the groove depth of an L/P record is .0014in., they will be treated with respect.



Adjusting the weight of the pick-up.

An occasional gentle wipe with a barely damp cloth will remove dust. There are also several excellent liquid record dressings on the market at reasonable prices.

There is now quite a lot of competition for the pioneer Decca L/P. In addition to Argo, Nixa, Vox, Allegro, etc., the very powerful E.M.I. group (H.M.V., Columbia, Parlophone) have entered the field and have already made several releases of considerable interest.

Future Tendencies

I believe we are on the threshold of even finer reproduction. Month by month one can hear new advances being made in clearer detail, firmer and fuller bass, and that very desirable feature, a real top without scream.

On shellac 78 r.p.m. discs the dynamic range was roughly from mezzo-forte to forte, anything below mezzo-forte would have been inaudible, due to surface noise.

On L/P it is possible to record a real P P P right up to fortissimo with absolute fidelity. Above all, the most important point is that definition is so much clearer, especially in complicated symphonic music. Anyone seeking advice on how best to take the L/P plunge are advised to write to "The Long Playing Advisory Panel," Decca Record Co., Ltd., 1-3, Brixton Road, S.W.9. They are most helpful, the service is free and has proved of great help to thousands already.

To conclude. The growth of the record business may be gauged from Decca's recent company report. In the 15 months since January 1st, 1952, £750,000 has been collected from the U.S.A. and Canada on record sales alone, a truly remarkable achievement.

ALPHA RADIO SUPPLY CO.

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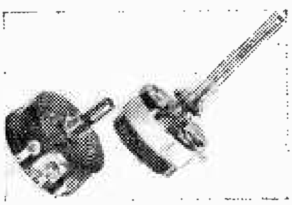

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CENTRALAB S.P.S. ¼ meg. Ω, ½ meg. Ω, 1 meg. Ω, 3/9 ea.
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½in. and ⅜in. complete with iron dust cores. 9d. ea.

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Complete with base and screen, 19/6 ea. Post and packing 1/6.

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This unit consists of a standard power pack. 325-0-325 H.T. transformer, choke and 5Z4G rectifier. Along with 8 EF50 valves, 3 EA50, and dozens of resistors and condensers, 84/- ea. Carriage 7/6.

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Guaranteed new and boxed. Majority in maker's cartons.

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1C5GT	8/6	6K8GT	10/6	Pen25	8/6
1G6GT	7/-	6L7M	7/6	PEN220A	4/9
1H5GT	10/-	6Q7G	10/-	PL82	11/6
1L4	8/-	6Q7GT	10/-	PM202	4/6
1LA4	4/6	6SA7GT	9/-	PY80	11/6
1R5	8/6	6SG7	9/-	R12	14/-
1S4	8/6	6SH7	6/-	UB41	9/-
1S5	8/6	6SJ7	10/-	UF41	12/-
1T4	8/6	6SK7	7/-	UY41	10/-
1U5	10/6	6SL7	9/-	VR21	3/6
215SG	4/-	6SN7GT	10/6	EF39	7/6
2X2	5/6	6SQ7	9/6	EB34	3/6
3A4	9/-	6U5G	9/6	EBC33	8/-
3D6	8/6	6V6G	8/6	EF36	7/6
3S4	10/-	6V6GT	8/6	SP61	4/-
4D1	4/-	6V6M	9/-	SP41	3/6
42	8/6	6X5GT	7/9	EF50	6/6
5U4G	9/-	80	9/-	EF50 Syl	8/-
5Y3G	8/6	220TH	10/-	EA50	2/6
5Y3GT	8/6	807	10/-	ECH35	13/-
5Z4G	9/-	8D2	3/-	VR116 (V872)	4/-
6A8G	11/-	954	2/-	EF8	6/6
6AG5	8/6	955	5/-	VR150/30	10/-
6AL5	8/6	956	3/6	VR137	5/-
6AM6	9/6	9D2	3/-	EL32	8/-
6B4	8/-	DDL4	4/-	KT44	7/6
6B7	8/-	DET19	6/6	VT105	4/-
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6BE6	11/6	EBC41	11/6	VP23	8/-
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6C9	8/-	EF36	7/6	VU120A	3/6
6D3	8/-	EF41	11/6	VU133	3/6
6D6	7/6	H63	7/9	W77 (EF92)	8/6
6F6G	8/-	HL23DD	8/6	X18	9/-
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6H6	4/6	KTZ41	6/9		
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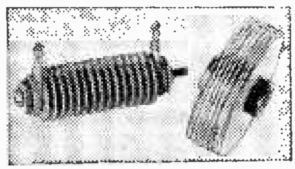
12 v. ½ a., 1/6 each ; 2 to 6 v. 1 a., 3/- each ; 12 v. 1 a., 4/9 each ; 12 v. 5 a., 18/6 ; 250 v. 45 mA., 6/9 each ; 250 v. 75 mA, 9/6. 300 v. 60 m/a, 7/6 ; 12 v. 2 a., 10/6.



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Midget Ediswan type. Long spindles. Guaranteed 1 year.
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W/W POTS.—Min. T/V Type Pre-Set. Fitted knob is knurled and slotted. 25, 50, 100, 200, 500 ohm, 1 K., 2 K., 2.5 K., 5 K., 10 K., 15 K., 20 K., 25 K., 30 K., each **3/-**. 10 K., 25 K., Short sp., **3/6**.
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1S5	9/-	6J7	8/6	12K8	10/6	HVR2a	7/6
1T4	9/-	6K6	7/6	12Q7	10/6	EL41	10/6
1S4	9/-	6K7	6/6	35L6	10/6	PY80	11/6
3S4	9/6	6K8	10/6	35Z4	10/6	PY80	11/6
2X2	5/6	6L5	5/6	50L6	9/6	BL23 DB	
3D6	2/6	6L6	10/6	807	10/6		7/6
5U4	10/6	6N7	8/6	956	5/6	MU12/14	
5V4	9/6	6Q7	10/6	9001	7/6		9/6
5Z4	9/-	6SA7	8/6	9006	7/6	PEN25	8/6
6AG5	7/6	6SH7	6/6	EA50	2/-	TP25	9/6
6AM6	10/6	6SL7	9/-	EB91	8/6	U22	9/6
6B8	7/6	6SN7	11/-	EBC33	9/6	VP23	7/6
6BE6	10/6	6U5		EC91	7/6	6AT6	12/6
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6C4	7/6	6X5	9/-	EF39	9/-	TH41	12/6
6D6	7/6	6J6	10/6	EF50	7/6	EF80	10/6
6F6	9/6	7S7	9/6	EF91	10/6	PY82	10/6
6G6	6/6	12A6	7/6	EF92	9/6	12AT7	10/6

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1R5, 1T4, 1S5 and 3S4 ... ... 32/6
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VIEWMASTER. Set 12 valves, **£6 10/-**. With EY51, **£7**. **TELEKING.**—Set 17 valves, **£9 10s.**
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M/core solder 60/40, 16G., **5/6** ½ lb.; **4d.** yd. T.C., wire 18 to 22 s.w.g., per yd., **2d.**; PVC Connecting wire, 10 colours. Single or Stranded. **2d.** yd. B7G Valveholder and Screening Can, **1/6**. V holders, octal, pax., **4d.**; moulded, **6d.**; EF50, B7G, **9d.**; B8A, B9A, **1/-**; B12A, **1/3**.
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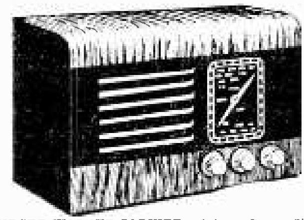

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BRAND NEW RADIOGRAM CHASSIS.—5 v. superhet, L., M. and S. W. and Gram. position. A.C. Mains, 200-250 v. P.U. Sockets. Large, easy-viewing dial, 10in. x 4½in. Latest Mullard valves. Chassis size, 13½in. x 5½in. x 2in. 4 front controls and knobs. Requires only P.M. Speaker. Fully guar. Special offer, **£9 15/-**, carr. and packing, 5/-.
CONDENSERS, new stock, best makes.—.001 mfd. 6 kv. T.C.C., **5/6**. Ditto, 12.5 kv., **9/6**. .002, Muirhead, 8 kv., **2/6**. 2 pf. to 500 pf., **6d.** .001, .005, .01, .02 mfd. 450 v. Tub., and .1 mfd. 350 v. Tub., **9d.** .05, .1 mfd. 500 v. Tub., **1/-**. .25, **1/6**. .5 mfd. 500 v., **1/9**. .01 Sprague, short ends, **5d.**
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LINE CORD. .2 a. 100 ohms per foot, .3 a. 60 ohms per foot, 2-way **1/6** a yard, 3-way **1/8** a yard.
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Valve Retrospect 1932/1953

A REVIEW OF VALVE DEVELOPMENT DURING THE PAST 20 YEARS

By E. G. Bulley

THE publication of the first issue of this journal in 1932 appeared, more or less, at the start of an era where the use of valves was to become widespread. The applications of valves at that period were varied, but limited by the different types of valves available.

Looking back to 1932, valves which were available for ordinary communication did not always suit the requirements of the various branches of the electrical industry. It was, therefore, essential for much research and development to be carried out by both private firms and Government research departments.

For radio reception the triode, screen-grid and pentode valves were available prior to 1932, but in the years 1932-34 further developments of these valves materialised. The hexode, octode and pentagrid (heptode) appeared followed by vast changes in valve engineering technique. The changes were necessary to cater for the rapid advances in circuit design. Such valves as the double diode triodes, double diode pentode, diode pentodes, diode tetrodes, triode pentode, triode heptode and the triode hexode appeared. Furthermore, the rapidity of valve design was not only confined to the receiving types of valves but to the power or what may be termed the industrial types.

The " Ignitron " in 1933 was soon superseded by the all-steel Ignitron, which was revolutionary in design; 1934 gave us the first " shield " grid thyratron and the voltage-doubler valve.

Valve technology was now beginning to make its enormous strides. In the U.H.F. field appeared the acorn valves; these enabled circuit engineers to design equipments capable of operating at very high frequencies, a step that was to open up an entirely new field later on.

The " Kathetron "

As a further point of interest, a valve that appeared in 1934 was the " Kathetron," this being a trade name for a valve with a control grid externally connected to the valve. This valve, although it was not used a great deal in commercial projects, must have furnished research bodies with valuable data which enabled much of to-day's complicated electronic equipments to be developed.

One must not, of course, forget the cathode-ray tube. This was invented in or about 1916, but did not become commercially available until 1932. It was not long, however, before further developments gave us the tube for the production of television pictures. Whilst on the subject of television, it is as well to mention that television camera tubes were being constantly developed around this period. There appeared the " Iconoscope " which was superseded in 1938 by what was termed the " Image Iconoscope." The latter, however, was soon replaced by the " Orthicon " in 1940, followed by the " Image Orthicon " in 1946. Such tubes, however, are always known by their trade names and vary from country to country. The " Image Orthicon " originated as an American trade mark, whereas in Britain similar tubes are known as " Emitrons."

Metal Valve

Reverting back to the conventional valve, the Osram Valve Co. launched upon the world a valve that was once again to revolutionise valve technique. This valve was the " Catkin," the first all-metal receiving valve, and appeared in 1935.

The year 1936 brought further developments that were to improve circuit design. The single-beam power tetrode was soon followed by the double-beam tetrode. Both these types are in great demand to-day and are no doubt well known to many readers.

About this period the electron multiplier became commercially available and is to-day still used. However, from this period and up to the outbreak of World War II all these valves were being continually improved both in design and performance. This applied not only to the receiving types but to industrial, transmitting and special purposes classes.

Applications were being found daily, and Britain then began to become electronically-minded. In fact, one could say it was a start of the electronic age. Nevertheless, the war came and vast strides were then made in what became known as the radio and electronic industry.

Service Requirements

The demand by the research organisations which were mostly Government sponsored was for special-purpose valves needed for use by the Armed Forces.

Such valves as the klystron, multicavity magnetron and the velocity modulated tube appeared. These types gave us centimetric radar, and really opened up the field of microwave research and pulse techniques. These valves were soon followed by trigatrons, grounded grid triodes, concentric valves and the planar or disc sealed valves. One must not forget, however, the travelling wave valve which utilised a new technique of operation. As a point of interest, the " trigatron " is a cold cathode spark gap which operates as a switch for discharging the delay line in pulse modulation, and was found in many of the Services' equipments.

Furthermore, the war years gave us TR valves and the hydrogen thyratron, not forgetting the silicon crystal which was to be superseded by the " germanium diode " and the " transistor."

The " Atomic Age "

One cannot, of course, forget the beginning of the " Atomic Age." This, in effect, can also date back to 1932, when this journal was first published, because it was in that year the " cyclotron " was developed, this being the means by which the atom is smashed. Nevertheless, valves have been and still are being used in atomic research. Such tubes as geiger counters were developed for this field in World War II, another step in the advancement of valve technique.

The post-war period brought many valves and similar devices to the front. The experience gained on wartime projects was now put to use on commercial developments. Such devices as the "memory tube," followed by the "aluminised" and "all metal" cathode-ray tubes for television picture reproduction.

Pressed Glass Bases

In the special purpose field, however, appeared the "decade counter," which will no doubt have many applications in this atomic age. Furthermore, receiving valves went through a complete redesign. This again was no doubt caused by the demand for miniaturisation. The valves based with the familiar B7G, B8A, B8G and B9G pressed glass bases are to-day an accepted fact, but only really became available commercially after the war. Another valve that has come to light is one with seven grids. This valve is designed primarily for F.M. purposes. The origination of this valve is credited to "Philips" of Holland, the trade name being "Enneode."

Before generalising, however, it is as well to include the "Vapotron," this being an industrial valve developed in France which utilises steam cooling. This valve has great opportunities in the industrial field of electronics. Other devices used both in the communication and industrial field, and although not in the correct sense a valve, but are vacuum devices are the vacuum thermal relays and the vacuum condensers. Both these have been developed during the past 21 years.

PRACTICAL WIRELESS has, beyond any doubt, passed through a very interesting era: the electronic age, the jet age and now into the atomic age. So, to look into the future, remembering that the valve is to-day really the heart of all electronic or radio equipment whether it be for industrial, communication or medical purposes. What then of the future? Will it be that in 1982, when this journal celebrates its 50th year of publication, the valve will be an outdated device superseded by a major invention or discovery, and that electrical power from atomic sources will be reality?

Making a Two-note Keyboard

RECENTLY there have been in these pages several circuits and ideas for the designs of electronic organs of the one-note type. Whilst these are very fine instruments, which will give an excellent and wide range of tone colour, one that will play a two-note chord is more desirable. It was with this latter in mind that we worked out a very simple modification.

The tone generators are duplicated, and as in most cases an earth is used, it was a simple matter to arrange a double set of contacts, so that one played the top note of the chord whilst the other played the bottom.

The Contacts

The contacts can be made out of relay contacts from ex-W.D. relay, mounted under the keys, or if the constructor does not wish to risk damaging the keyboard a separate relay can be used for each key. The disadvantage of the latter is that the unit becomes rather heavy and the relays require their own power supply. In most cases 12 volts is enough, and this is best supplied from a rectifier smoothed with a large electrolytic—a 250 μF 50-volt is ideal. A spark quench should be joined across the relay so that a loud click is not heard on releasing the key. This device can best be in the form of a condenser of 0.1 μF to 1 μF, with a resistor of about 200 Ω to 1,000 Ω in series. The action of the resistor is to dissipate the energy stored in the relay. If a condenser only is used there may be some odd "pings" on certain notes. This is due to the relays "ringing," that is, they start to oscillate as soon as the current is stopped. Layout can minimise this, but once again it is better to prevent it than try to cure it.

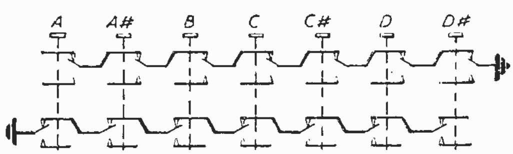

Diagram of the relay idea suggested in the above notes.

Separate Generators

The principle of the connections of the keyboard are shown in the illustration, whereas with the circuits of Messrs. Delaney and King only the top note is selected, with this little circuit the top and the bottom notes are used. It is quite a simple matter to build two complete tone generator units, one for the high notes and one for the low, and when playing use different stop settings. In this way the tone range of the instruments can be increased enormously. There is one snag, however, and that is with the tuning of the two units. Nothing sounds worse than two notes that are supposed to be the same but are slightly different and clash.

One Oscillator per Note

With the idea of the banks of relays it is possible by the use of increasing numbers of contact sets to get more notes to sound at the same time. There is a snag here, and that is that with electronic organs there must be one oscillator for each note.—KENDALL and MOUSLEY.

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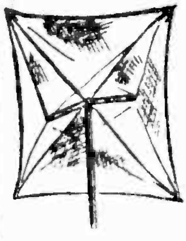

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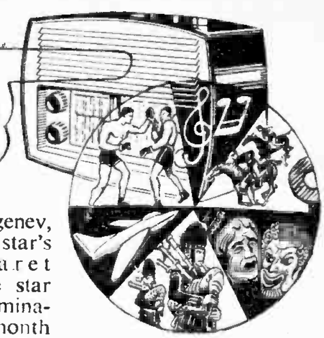

By MAURICE REEVE

Politics

"THE Week in Westminster" has long been a feature, during the sittings of Parliament, at 7.45 each Saturday in the Home Service. In it a Member describes what he heard and saw there, punctuated with visits to "another place"—this last feature rather reminding one of that "popping in for a few minutes" to the picture gallery or the kitchens, or the wood museum and palm house, on our tours of Hampton Court and Kew Gardens respectively. The Member engaged on this somewhat sacrificial task each week is, as near as the balance of parties will allow, alternately of the Government and the Opposition, with a Liberal thrown in for good measure about once every leap year or so. As, for three years, the "two nations" have been almost equally represented, this is automatically a perfect arrangement. What will happen if we ever get a ten-to-one distribution again, as in the 1931 Parliament, is food for thought.

The political label of the Member is never revealed. Short of knowing, this is anybody's guess, as he is only there to "show us around," like the guides at Madame Tussauds, who answer questions but never express opinions. A member of the Opposition can be counted on to say that a Government speaker "made a forceful contribution to the debate" equally to a Government stalwart replying that "such and such of the Opposition made a lively and witty reply." Everyone is as friendly and well-behaved, and as lively, as at a bishop's tea party. Nobody is ever made out to be wrong, or even mistaken, in his views. And about every third or fourth week we are reminded of the "Who goes home?" "echoing round the empty chambers and corridors."

Is this quarter-of-an-hour feature really necessary? Is it not just another of the endless repetitions which so harass the discerning listener? Doesn't "Today in Parliament" at 10.45, being factual, do the thing much better? If necessary, should it not be at a different hour instead of at the height, more or less, of the week-end entertainment period? Would it not be improved if it had a political tang added to it—to the exclusion of propaganda, which is quite another thing? I could answer all these myself, but will leave readers to do so instead.

Plays

Novels and other stories are invariably inferior to plays written originally as plays, when they are "dramatised." A recent striking example was Maugham's "Cakes and Ale." The result must surely always be so, the authors' minds running in entirely different channels. It is as certain to be inferior as the orchestration of a sonata or a string quartet always is. You cannot grill stewing beef, or smoke cigarette tobacco, with satisfactory results.

It has been a good month for plays. The "oscar" I would award to "A Month in the Country," a masterpiece by Turgenev, and a real "star's choice"—Margaret Leighton being the star of taste and discrimination. During a month of summer heat and gentle lassitude, Natalya Petrovna gets caught up in an emotional entanglement with the young tutor to her two children, an affair which cannot and does not materialise. As with all masterpieces it draws character as well as situation. Comedy, drama, pathos, all alternate to a magic formula, the former to a much greater degree than is usual in Russian drama. Miss Leighton, together with Godfrey Kenton, Elsa Palmer, Nigel Stock—the young tutor—Michael Shepley and others, acted beautifully.

"The Ox-bow Incident" was a Wild West thriller and a pleasing change, bringing back to many of us nostalgic memories of bad men and mustangs flashing across the silent screens of our youth and adolescence.

Musical

"South Pacific" was another unusual innovation, a full-sized musical. The "conspicuousness by its absence" of the visual element was perhaps too great to warrant it becoming a precedent. But it was lively, colourful and tuneful for all that.

"The Labyrinth," about Byron, was a terribly powerful play of a tragic story which I thoroughly enjoyed. Did ever a poet so hide his true self as he did in such immortal, chaste lyrics as "We'll go no more a-roaming"? James McKechnie seemed to play the poet on too level a tone, but he worked up some fine climaxes with all the women who were unfortunate enough to get tangled up with him. They were excellently played by Griselda Hervey, Sarah Leigh, Helen Hays and Rachel Gurney.

"The Hasty Heart," by John Patrick, "Sweet Aloes," by Jay Mallory, R. E. Sherwood's "The Road to Rome" and Galsworthy's "The Show" all meriting space I have used.

Cannot the signature tunes in Saturday's Star Show have some variety imparted to them? Almost all of them revolve round the same three or four chords, thus stereotyping an otherwise much improved programme.

"The Sinking of the Scharnhorst" contained some of the most hesitant reading I have ever heard in these documentaries.

The unscripted interview with Sir Thomas Beecham was wholly delightful. It made one want one every day, though Sir Thomas's equals would be very hard to find.

A SCRATCH FILTER

A USEFUL ACCESSORY FOR USE WITH RADIOGRAMS AND RECORD PLAYERS

By J. Macleod Scott, B.Sc.

WITH wide-frequency range recording and the latest in loudspeakers, we can now enjoy nearly perfect reproduction in the home. Although the best recordings give up to 14 kcs, scratch forms a background from about 4 kcs, which cannot be eliminated without affecting the quality of the recording. The average type of tone control reduces output from about 2 kcs increasing the cut with an increase of frequency. Because the greatest rate of cut with a condenser and resistance is about 6 db per octave, the cut must start fairly low and it noticeably affects the quality even with a small reduction of scratch. The older type of magnetic pickup may have had the advantage of a rapid fall in output above 5 kcs, especially when used with fibre needles. Greater rates of cut require special feedback networks with extra amplification or choke-filter circuits which are apt to pick up hum, and which for the amateur are rather hit-and-miss affairs. Too sharp a cut produces an effect called "ringing" which emphasises frequencies immediately below the cut off frequency.

Fig. 1 shows a very simple way of producing what is probably the best rate of cut of 12 db per octave.

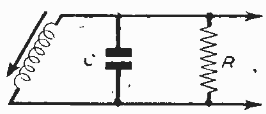

Fig. 1.—A simple scratch filter.

The values must be correct and connections made directly to the pickup head leads. If a matching transformer is used it must have a high primary inductance or the filter will be ineffective. Use is made of the inductance of the head itself to make a constant K low-pass filter. (The circuit cannot be used for crystal-type pickups.)

The Formula

First the inductance of the head must be ascertained and the cut off frequency chosen. About 6 kcs is a useful value. C is obtained from the formula:

$$C = \frac{10^9}{\pi^2 f^2 L}$$

C = μF
f = cut-off freq.
L = millihenries

At this stage it is better to work backwards because it is easier to select the nearest condenser value and adjust the resistance by filing off some of the carbon. Choose double and half values of capacity, etc., to lower and raise the cut-off frequency. Values for R in ohms are given by:

$$R = \sqrt{\frac{1000L}{C}}$$

L = millihenries
C = μF

The amplifier input resistance must, of course, be much higher than R. Cut off frequencies are given by:

$$f = \frac{10,000}{\sqrt{LC}} \text{ (approx.)}$$

The following values were obtained for a coil of 150 millihenries (850 ohms impedance at 1,000 cycles):

C μf	R Ω	f cycles
.1	1223	2600
.05	1730	3700
.025	2450	5200
.01	3880	8200
.007	4630	9800

The results obtained from such a five-step filter will give new enjoyment from old records. For each one a setting will be found where most scratch is eliminated without any apparent deterioration in quality, in fact, quality will have improved due to the removal of upper harmonic distortion at the same time.

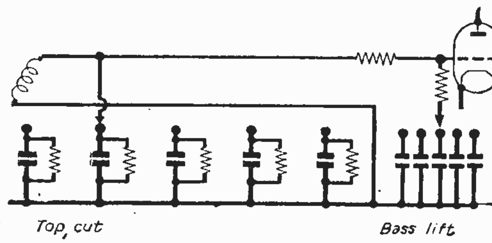

Fig. 2.—A five-step filter.

Dumfries Transmitting Station

IN accordance with the previously announced plan to improve reception of the Home Service programmes in certain areas, the BBC proposes to build a low-power transmitting station at Mousewald, near Dumfries. As the building and installation will take some time to complete, a temporary transmitter will be installed in a caravan on the site so that listeners in the area may have improved service for the present, and much earlier than would otherwise have been possible. It radiates the Scottish Home Service on 371 metres (809 kc/s).

It operates in the evenings only, from 5 p.m. until the Home Service closes down.

The power (500 watts) is less than that planned for the permanent station, but sufficient to provide improved reception for many listeners in Dumfries and the Nith estuary district. When the permanent station is completed the service area will be extended as far as Lochmaben, Lockerbie and Annan.

The temporary transmitter is housed in a standard four-berth caravan which has been modified to BBC design to accommodate the transmitter and its associated apparatus.

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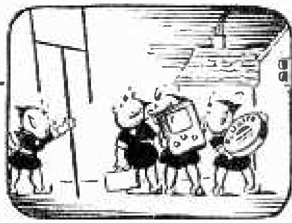

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We'll nip on a bus."
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The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Crystal Results

SIR,—As one of the first of the few to dabble with carborundum, copper pyrites and silicon crystals just after the conclusion of the first World War, I was interested in Mr. Morley's article on germanium diodes in your December issue. Having acquired two of these diodes I retrieved from my loft a crystal set of ancient but not historic vintage, which a previous owner had parked there. My first experiment was merely to substitute a diode for the catswhisker device and to connect up to a small outside aerial and the earth pin of my domestic electrical system. Despite an intermittent shorting of the tuning capacitor the results on 'phone surprised me and a micro-ammeter in circuit showed a reading of nearly 200. Then I replaced the capacitor with one of those "modern" square-law things, replaced the 30 gauge enamel wiring with some stouter stuff and soldered the joints. Result—increased volume and a reading of 300 μA. I found 'phones so loud that I connected up to an 8in. speaker and, in the quietness of my den, I could hear speech clearly at a distance of 6 to 8ft.

Now, thought I, how much better will be the results if I re-make the set, using the specified coil, which I proceeded to make with the utmost care and precision (an art I found I had retained from my early radio days when every coil was home-made !), but I will confess to using 24-gauge wire in place of the specified 26-gauge. The existing coils I should, perhaps, explain comprised a primary and secondary wound in hank form of something like 12 or 14 gauge cotton-covered and held together with plenty of shellac. They were coupled tightly together with adhesive tape and their ends attached direct to their respective tuning capacitors of 300 and 500 pFs. All this surely couldn't be efficient !—but alas, when the new coil was connected up the volume fell and so did the meter to 160 μA. No amount of twiddling would raise it, and worse, the separation of the "Light" and "Home" previously complete was not so now ! So back went the old coil system and back went the meter, champing the bit at 300 μA.

At this point I was about to write to you and say "What shall it profit a man if he gain μA from a super detector to lose them in coil ?" but then I was prompted to see how the germanium diode compared with ancient flints and I must say the results rather upset me. I began the substitution with a semi-permanent detector of the Middle Ages, whose carton described it as the original oscillating crystal and it clocked up a good 200 μA. Then back to one of those super-sensitive silicon crystals that only held their ground if one stopped breathing and, in an optimum setting, which certainly took me a long time to find, the meter rose to the full 300 μA of the germanium diode.

Now I feel I must break into the modern vulgarism and remark "so what ?"

It would, I feel, interest some of us old codgers to see just what could be obtained from a germanium diode under optimum conditions and, unless one is interested in match-box types, there would appear to be no reason why a coil should suffer efficiency for physical dimensions.—A. L. MOSS (Wembley).

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. If a postal reply is required a stamped and addressed envelope must be enclosed with the coupon from page iii of cover.

The Amateur Transmitter

SIR,—I consider that we have drifted into a backwater, especially in our minds, about certain aspects of radio. I refer primarily to morse and transmitting.

Is it not time that the whole subject was brought out and the old, old rules and ideas reviewed. With an open mind (if this is possible with the "man with the red flag walking in front of the motor-car," mentality), let's look over the whole thing.

For instance, can anyone give me a good reason why morse must be mastered if one wished to operate on two metres and 70 cm. ?

Or, for that matter why there is no "citizen" band where anyone could have a go.

I can see the hands going up in horror at such suggestions and voices crying about all the terrible things that would happen.

(I'm not losing sight of the fact that the telephone might lose some business on local calls. However, using the band for commercial and business reasons could be forbidden—they have the use of certain frequencies now.)

To put the point over and as a comparison, let us suppose a national bus corporation had complete authority over the roads. Naturally they would consider their own interests first and motor cyclists and pedal cyclists would be frowned on—probably driven off the roads by restrictions and regulations. As for the man in the street—well! All very safe and cosy—but fantastic. Yet in radio just such a situation occurs.

My hopes lay in the U.S.A. where, in this matter, they have a much more enterprising and idealistic outlook. Where they lead, we may follow. If anyone doubts this compare things now and think back.

But why must we lag—why not lead ?

As the V.H.F.—U.H.F. bands open out let us encourage the novice—give him a band. A few watts, a licence, crystal control and a set of sensible rules should be the only restrictions.

In these times when the international situation gets sticky and almost all war gear has some radio gadget attached to it, one would think the radio hobbyist would be encouraged.

And this question of morse—personally I could never understand this worship of morse which some folks seem to have. Whenever I see anyone using a key I am reminded of a native hitting a tom-tom—jungle radio. All very well for getting intelligence over vast distances—but even a native wouldn't use his drum where he could talk.

I have been told I would get keen on it if only I would spend a few months swotting at it. This would put me in the same class as the chap who wore tight shoes and when asked why he suffered the agony replied—" ah, but you've no idea what a wonderful feeling it is when I take them off."

Surely I am not alone in these opinions and I would like to see the subject discussed.—HECTOR COLE (Workington).

Direct-reading Bridge

SIR,—I would like to thank Mr. Paterson for his excellent article in the September issue of PRACTICAL WIRELESS (A Direct-reading Bridge), and also for his helpful remarks in answer to some questions raised. But I would strongly challenge his advice to use a linear law potentiometer for VR1, as it seems to me that a log-law variable is quite essential in this position in order to get a constant *percentage* accuracy over the whole range.

This point can best be appreciated if one looks at things from the point of view of tolerances. Suppose one has a basic 10 ohm range and wishes to check a 100 ohm resistor of alleged 10 per cent. tolerance. It should come up on the dial between 9 and 11. Only two graduations between the two extremes, please note. Now for a 820 ohm resistor, again of 10 per cent. tolerance. This should come up somewhere between 74 and 90 on the dial and in this case we have no fewer than 16 graduations between the two extremes.

As it is tolerances, expressed as a percentage, that we are interested in, obviously these 16 graduations around the 82 mark should only be allotted the same space as two graduations around the 10 mark, and this calls for a log-law potentiometer.

But if anyone knows where a 10 KΩ, log-law, wirewound variable of good wattage rating is to be obtained (at surplus prices!) I for one would be delighted to hear about it!—JOHN H. REE (Wallasey).

Midget 12-watt Transmitter

SIR,—I have received a letter from a reader whose signature I cannot decipher asking for the value of the oscillator grid leak in my 12-watt station, and although I should like to reply to him personally I cannot do that as the addressed envelope he mentions is not enclosed! However, as other readers may require the information, the following details are given.

The resistor between oscillator grid and cathode is 47,000 ohms, although the value is not critical and anything between 55,000 and 40,000 will serve as well. The gauge of wire used on the receiver coils was 28 s.w.g. enamel.—T. W. DRESSER (Tangier).

Portable Electronic Organ

SIR,—Re my portable electronic organ. I wish to point out, as Mr. Dennis and several readers have noticed, that the rectifier is given as a 35Z4 which has only a .15 amp heater and would not function properly in a .3 amp heater chain. The valve that has been in use since the organ was constructed is the 25Z4, which has a .3 amp heater and a maximum working voltage of 250. I wish to apologise for any trouble caused to readers due to this unfortunate error.

As Mr. Dennis suggests, a 600Ω resistor may be used, but a 800Ω gives more latitude for adjustments should experimental changes be made in the valves. —G. R. KING (Melton Mowbray).

Folded Dipole Aerial

SIR,—Will readers please note that in my article A Folded Dipole Aerial in the May issue, the third paragraph under " Possibilities " should read: " For horizontal erection the unit should be arranged broadside with side E—D uppermost." Horizontal replacing the word vertical. — A. W. MANN (Middlesbro').

RADIO FEEDER UNIT

(*Concluded from page* 321)

Another point about the aligning for bandwidth is that the stability of the receiver is greatly increased and the gain reduced.

It is, of course, possible to make an attempt at the alignment with the aid of a local station, and by the use of the so-called pre-aligned IF transformers, but the latter are upset by the Miller effect in the valves and the stray circuit capacities. The writer has found that in most cases they are close enough to work quite well when the set is assembled, but they are not quite correct. Having tuned for maximum volume from the IF radiation of another receiver, just give the two screws on the first IF can a half turn, one in each direction to give the bandwidth.

Having aligned the IF, the oscillator sections of the coils have then to be set. One of the easiest ways of doing this is on the station. Connect a good aerial to the unit. Then with one of those old-fashioned .0005μF tuning condensers of the half-moon type, tune the grid winding of the oscillator coil until the required station is found (this should be done with the trimmer set at minimum). Calculate the amount of capacity used. This is simple if an old 0-180 degree dial is used with the condenser. Allow 2½ pF for each degree, and obtain a fixed tolerance condenser of the required value. If the value is slightly lower, remember that the capacity of the trimmer will increase it to the required value. For instance, if the value was found to be 250 pF and a 220 pF was obtainable, then the extra 30 pF could be obtained by the adjustment of the trimmer or by adding another small condenser of, say, 10 or 20 pF.

After the oscillator condenser is set then follow by adjusting the grid condenser; this will be found to be a little less critical.

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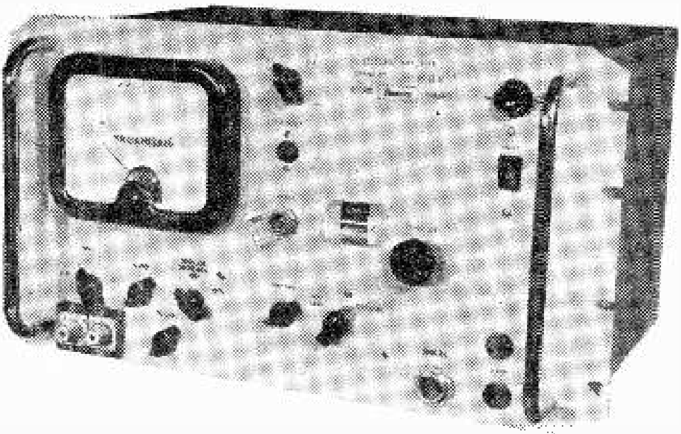
News from the Trade

A Low-hum, Low-microphony A.F. Pentode on the Noval Base

A VALVE that should prove of considerable value for use in high-grade amplifier applications in communications and industrial electronic equipment, has recently been made commercially available by the Communications and Industrial Valve Department of Mullard Ltd. It is the EF86 Low-hum, low-microphony A.F. voltage amplifying pentode on the B9A (Noval) Services Preferred base.

This valve has been designed for use in high-grade resistance-coupled, audio-frequency voltage amplifier circuits. In these circuits it is essential that the hum and microphony introduced by the amplifying valve be kept to an absolute minimum. The hum level in the EF86 has been kept to 5 micro-volts, referred to control grid. This extremely low figure has been achieved by careful internal screening and by the use of a bifilar heater. Moreover, the control grid pin is placed equidistant from the two heater pins, so that, providing the heater winding has a centre-tapped earth, any hum induced from the heater pins is virtually balanced out. The rigidity of the electrode structure contributes, to a large degree, to the extremely low microphony inherent in this valve. Other features of the EF86 are its small size, high gain and single ended construction.



A new selective amplifier for special applications, produced by Plessey.

The main characteristics of the EF86 are:

Heater Voltage	6.3V
Heater Current	0.2A
Anode Voltage	250V
Anode Current	3mA
Hum level	$5\mu V$
Mutual Conductance	1.85mA/V

Further details of the EF86 may be obtained on request to Mullard Communications and Industrial Valve Department, Century House, Shaftesbury Avenue, W.C.2.

Tape Solder

FLEX, wire and small components can now be jointed, models constructed and repairs made on toys and other household articles with a real tin lead solder without the use of a soldering iron. Initial deliveries of Multicore Tape solder which melts with a match will shortly be made by the manufacturers, Multicore Solders Ltd.

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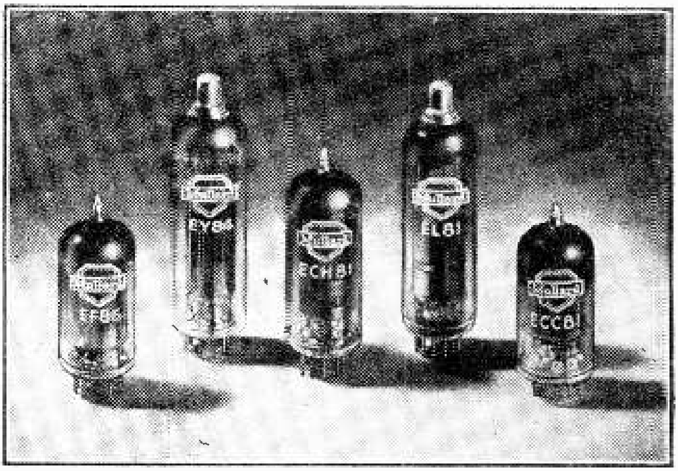

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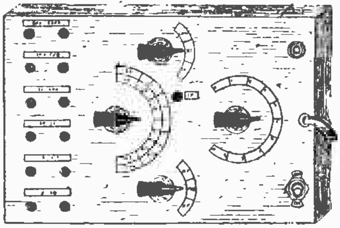

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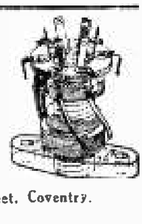

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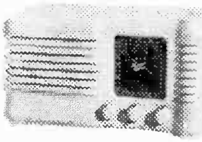

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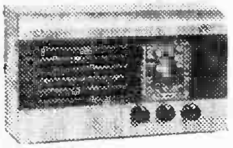

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3 A	... 1½	2¼ round	R.F. Thermo	7/6
3.5 A	... 1½	2¼ x 2¼ ...	R.F. Thermo	7/6
4 A	... 1½	2¼ x 2¼ ...	R.F. Thermo	7/6
20 A	... 1½	2¼ round...	M/C ...	8/6
30 A	... 1½	2¼ x 2¼ ...	M/C ...	8/6
40 A	... 1½	2¼ round...	M/C ...	8/6
1.5 mA.	... 1½	2¼ round..................		12/6
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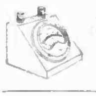

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