

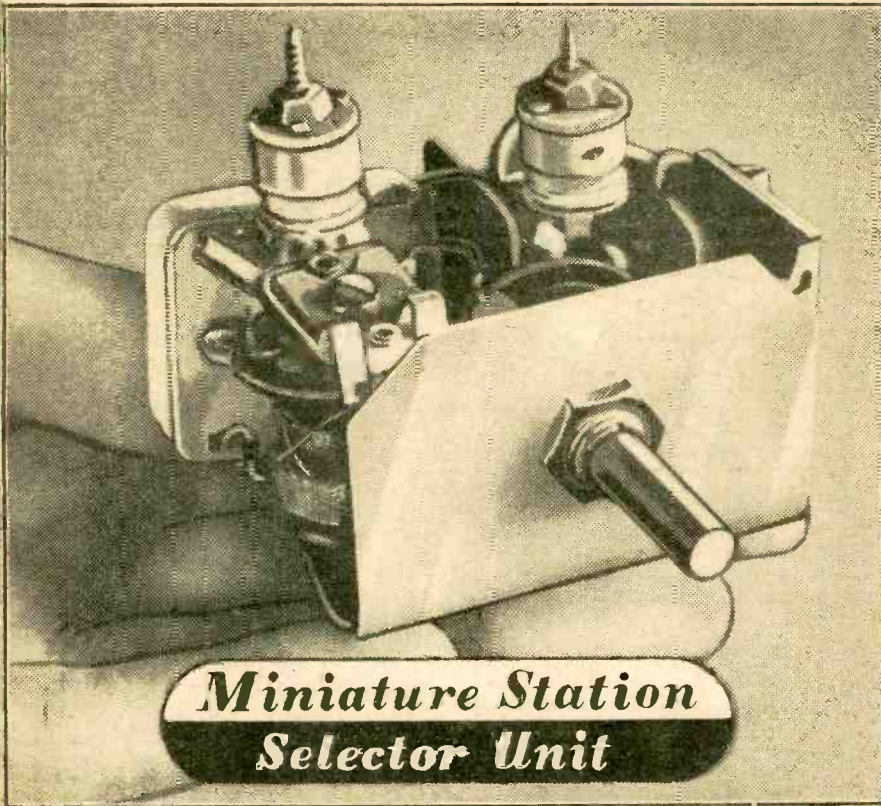
A T.R.F. COMMUNICATIONS RECEIVER

1/-

Vol. 28. No. 547
MAY, 1952

EDITOR:
F.J.CAMM

PRACTICAL WIRELESS



*Miniature Station
Selector Unit*

IN THIS ISSUE :

10 KC/S DOWN
TRANSMITTING TOPICS
REACTIVATING DRY BATTERIES

ALL-WAVE SWITCHING
SHORT-WAVE SECTION
THE EXPERIMENTER'S WORKSHOP



As Specified for Conversion of the 21 Receiver TR196, Type 18, Wartime Utility and other types.

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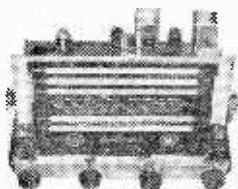


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The prestige of Armstrong chassis is firmly based upon many years of constant endeavour to produce reliable and efficient receivers at an economical price. Our present range of chassis will even further advance the already high reputation enjoyed by our receivers.

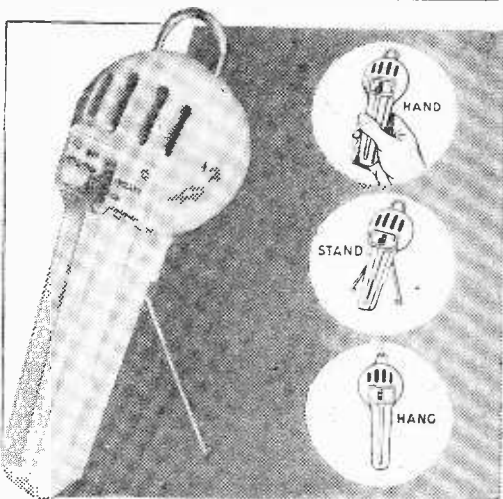
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WALKIE-TALKIE (TRANSMITTER-RECEIVER). Type 38 Mark II. Complete with 5 valves, Throat Microphone, Headphones and Aerial. 7 mcs Amateur Band suitable for field use. Powerful Superhet Receiver. Modulated Transmitter. Guaranteed ready for the Air, less batteries, £4/12/6.

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LOW RESISTANCE PHONES, very sensitive, 5/11.

VIBRATOR PACK 21, delivering approx. 140v. at 40mA., fully smoothed from 6v. input; in NEW condition, 17/6.

ACCUMULATORS, multiplate, 7AH 2v., in celluloid cases, 3½ in. x 1½ in. x 4 in., 6/6.

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TRANSMITTER 21. Sending speech, CW or MCW, complete with valves, control panel and key. PA coils (not formers) and relays, stripped by M.O.S.; may easily be replaced with aid of our circuit and instructions. Tune 4.2-7.5 and 18-31 mc's. In first-class condition, 25/-.

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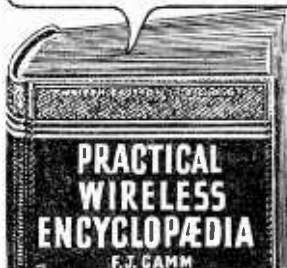
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This world-famous book contains all latest radio and television developments. Earlier copies sold 300,000; this entirely new volume has 400 pages, 1,440 entries, hundreds of illustrations, covers every aspect of radio; new sections include radar, television, remote control, oscillators, Kirchoff's laws, photo-electric cells, new series of modern circuits for receivers and amplifiers, automatic station sel., car radio, electron multipliers, fault finding, building television receiver, new colour codes, etc.—contains all the accumulated knowledge of radio Science! Examine this grand book on our 5 days' Approval Terms—if you do not wish to retain it, return and your purchase money is refunded in full!

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SPECIAL VALVE OFFERS

PEN.A4, 12/10 ;	VP13C,	6C5	7/6	4 VOLT BRITISH
12/10 ;	ID5, 11/- ;	6K7G	7/6	2D4A
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12/10 ;	APV4, 12/11 ;	6Q7	10/6	5D2
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		6SN7	12/6	
		6SL7	10/6	
		6SK7	7/6	
		E1148	2/6	
		6N7	8/6	
		6SS7	8/6	
		DH63	10/6	
		KTW61	7/6	
		KTZ63	7/6	
		KTZ73	7/6	
		KT66	8/6	
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LASKY'S PRICE FOR THE 12 VALVES, £6.10.0
 as specified for the Viewmaster Post free.

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 New and unused. HL2, 4/6 each ; SG (screen grid), 4/6 each ; KT2, 5/6 each.
LASKY'S PRICE FOR THE THREE VALVES, 14/6
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RECTIFIERS
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 3B24 20/-
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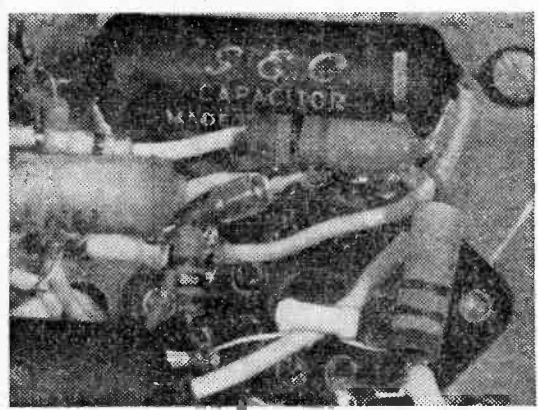
9 PIN LOCTAL
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These are only a few examples from our stock of over 10,000 valves. Space does not permit us to list them all. Send us details of your requirements. Postage and packing 4d. per valve extra.

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 'Phone : Cunningham 1979 and 7214.
 Hours : Mon. to Sat., 9.30 a.m. to 6 p.m. Thurs., half-day.
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G.E.C.
Germanium Diodes

The photograph shows a G.E.C. germanium diode soldered between adjacent tags of an octal socket in a noise-suppression circuit. Standard half-watt and quarter-watt resistors provide an interesting comparison in size.

It is important to note that this photograph is of a G.E.C. production television sub-chassis into which the crystal is soldered without heat shunts and with the leads clipped to the required lengths.

For further information apply to Osram Valve & Electronics Dept.

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2

Practical Wireless

EVERY MONTH
VOL. XXVIII No. 547 MAY, 1952

Editor F. J. CAMM

20th YEAR
OF ISSUE

COMMENTS OF THE MONTH

By THE EDITOR

The 1952 National Radio Exhibition

THE nineteenth National Radio and Television Exhibition will be held at Earls Court, London, from August 26th to September 6th. There will be a number of important changes in the layout and the nature of the exhibits. Earls Court was first used for a radio show in 1951, and the experience gained by staging the exhibition in this roomier building will be applied to this year's show. The plans already disclosed indicate that the show will be even more attractive than the previous one. Every aspect of the radio, television and electronic industry will be covered. As hitherto, the BBC and the Services have promised full co-operation. The BBC is to install a theatre with more action to interest the public. There will be adequate seating for 2,000 people at each of the three daily performances. For two of these the public will be entitled to purchase tickets.

The exhibitors have been invited by the R.I.C. to include as many working exhibits on their stands as is possible, as it has been found that the public prefer movement to an inspection of static exhibits.

Television, as would be expected, will strike a predominant note. Exhibits sequentially arranged will demonstrate the technical events from studio to receiver. There is to be considerable re-arrangement of the exhibition layout. The demonstration rooms, for example, as well as the offices, will be disposed on the outer perimeter of the ground floor. A central gangway running through the show from the Warwick Road entrance will divide the exhibition into two halves. Architecturally designed avenues will run collaterally with these on either side of the show. The main stands are to be in the centre space.

The BBC studio and theatre will be housed on the first floor as well as the studio control room, the R.I.C. exhibition control room and the Government exhibits. The Hall of Television will also be on this floor and it will replace Television Avenue of last year. The Hall of Television will have working TV receivers in booths.

Needless to say, this journal and our companion journal, *Practical Television*, will be represented

on our stand there. On it we propose to demonstrate our radio and television receivers.

THE BUDGET

THE trade in general considers Mr. Butler's Budget a good one. It did not, as was at first feared, add a further increase to purchase tax, but the price of receivers is likely to go up for other reasons. The continuing rise in the cost of raw materials and of labour must eventually be passed on to the consumer. The Excess Profits Levy will affect all businesses where profits are greater than in the years 1947 to 1949. Other businesses will benefit by the reduction in the Profits Tax. The trade will also suffer as a result of the increased Bank Rate.

"TELEVISION PRINCIPLES AND PRACTICE"

WE have just published an important new handbook entitled "Television Principles and Practice." It costs 25s., or 25s. 8d. by post, and contains 215 pages. The chapters are: The BBC Television System; The Television Camera; From Transmitter to Receiver; Projection Receivers; Stereoscopic and Colour Television; Time Bases; D.C. Receivers; Aerials; A London-Birmingham Converter; Servicing; Interference; A Pattern Generator; Choosing a Receiver; The Beveridge Report; Dictionary of Television Terms; Index. The edition is necessarily limited by the paper position, so copies should be ordered without delay.

THE NORTHERN RADIO SHOW

THOSE Northerners who were unable to visit the Radio Show last year are reminded that the Northern Radio Exhibition opens at the City Hall, Manchester, on Wednesday, April 23rd, and will close on Saturday, May 3rd.

Our stand number is 1, and it will feature our technical periodicals and radio and other technical books. A welcome is extended to all our Northern readers to visit us there.

The Radio Component Show will open at Grosvenor House, London, on April 7th, and close on the 9th.—F. J. C.

ROUND the WORLD of WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate numbers of licences issued during the year ended January 31st, 1952.

Region	Number
London Postal	2,381,000
Home Counties	1,665,000
Midland	1,762,000
North-eastern	1,950,000
North-western	1,652,000
South-western	1,082,000
Welsh and Border Counties	737,000
Total England & Wales	11,229,000
Scotland	1,120,000
Northern Ireland	209,000
Grand Total	12,558,000

Radio-controlled Tugs in Sweden

BRITISH-DESIGNED V.H.F. radio equipment is proving a great success in Sweden and details received from Svenska Radioaktiebolaget indicate that the

Marconi equipment, supplied by them, is now used exclusively to control the tugboats of "Goteborgs Barnings- och Bogserings AB"—biggest of Gothenburgh's tug services.

Ten boats are already fully radio-controlled and the amount of work they now handle exceeds by far their capabilities without radio.

At head office a selective calling system is used. This is very much like an ordinary dial telephone; by dialling a number the control calls and contacts the required ship.

Control lines are also to be connected to the homes of officials so that they may keep in touch with any of the tugs day and night. All the tugs are fitted with Marconi Type H.16 transmitter/receivers and a Type H.16A is used at head office.

Car Radio School at Glasgow

A COURSE of instruction on car-radio servicing was held

in Glasgow last month by E. K. Cole, Ltd., for service engineers from fifteen Scottish towns.

The areas represented were: Motherwell, Edinburgh, Falkirk, Dumbarton, Aberdeen, Kircaldy, Paisley, Perth, Glasgow, Dumfries, Stirling, Dundee, Hamilton, Ayr, Airdrie.

The course, attended by representatives of 23 Scottish dealers, was the first to be held outside the E. K. Cole Service School at Southend. Owing to the nature of the class and the facilities required, the instruction was given at the premises of Messrs. George & Jopling of Glasgow.

New Deputy Director General

THE Postmaster General, with the approval of the Prime Minister, has appointed Mr. D. O. Lumley, C.B., O.B.E., to be a Deputy Director General of the Post Office in succession to Sir George Ismay, K.B.E., C.B., who is retiring on June 23rd of this year. Mr. Lumley will lead the Post Office delegation at the Congress of the Universal Postal Union which is being held in Brussels in May.

British Standard No. 1824 : 1952

THIS new British Standard forms part of a series of standards for nickel and nickel alloys in various forms and has been prepared to meet the special requirements of the telecommunication industries, particularly the telephone industry.

The standard lays down chemical compositions, temper grades, mechanical properties and tolerances on dimensions, and specifies the procedure to be adopted in selecting test pieces and carrying out tests. Details are also given in regard to test certificates and independent tests, and an appendix gives a summary of the information to be given by the purchaser in enquiries and/or orders.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 24, Victoria Street, London, S.W.1. Price 2s. post free.



A headquarters operator holding a conversation with one of the tugboat skippers. The selective calling system is seen on the desk.

Sudan Broadcasting Extension

THE broadcasting service in the Anglo-Egyptian Sudan is to be improved by the addition of a latest design British transmitter and radiator mast. The order, for a 50 kW. medium frequency installation, has been received by Marconi's Wireless Telegraph Company, Ltd., and it is hoped that the new transmitter will be in action by the end of 1953.

It will be installed at the Omdurman broadcasting station, three miles north of Khartoum. With its radiation mast the new transmitter will give first-class service to an expected listening public of 1,250,000 people living north of Khartoum and in districts between the White and Blue Niles.

Weighing Electronically

"ELECTRONIC scales" are now used to weigh large objects which are too bulky and heavy to be weighed by normal means.

A resistance wire strain gauge is used which changes its resistance proportionally to its length. The change in resistance is converted into tons, etc., by electronic circuits.

Russian Receivers

RECEIVERS displayed at the International Industries Fair, in Bombay, included radio sets and a television receiver manufactured in Russia.

There were 13- and 15-valve sets and a three-valve two-band receiver.

Tape Recordings in U.S. Hospitals

A TAPE recording network has been set up in America for patients and disabled Servicemen.

Tape records of special programmes are made and circulated among the fifty-odd member hospitals of the network. Programmes by well-known artists are included as well as recordings made by talented Service-patients.

Those confined to their beds hear the programmes by means of receiving units placed next to their pillows.

Delhi's Radio Institute

AN Indian section of the British Institution of Radio Engineers was inaugurated in New Delhi recently by Dr. S. S. Bhatnagar, Secretary to the Ministry of Natural Resources and Scientific Research.

Mr. G. D. Clifford, General

Secretary of the British Institution, was also present.

"Calling All Forces"

SINCE the first edition of "Calling All Forces," the BBC's special programme for forces abroad, over 10,000 requests have been received for favourite songs to be sung by Petula Clark and Carol Carr.

Reports from Korea show that the programme is greatly appreciated by the units there, especially the "You've asked for it" feature, where Servicemen request sounds that remind them of home. These include church bells, factory lathes, fish-frying machines, and trains running into stations. One correspondent asked to hear his mother sharpening her carving knife on the back door step.

These requests have sent BBC engineers all over the British Isles in order to record the sounds.

Emitron Valves

EMITRON valves and cathode-ray tubes manufactured by Electronic Tubes, Ltd., of High Wycombe, can now be supplied to the wholesale and retail trade for maintenance and replacement purposes and arrangements have been made for supplies to be available from: E.M.I. Sales and Service, Ltd., Hayes, Middlesex, to which address orders should be forwarded.

The word "Emitron" has been registered with the British Radio Valve Manufacturers' Association, and Emitron valves and cathode-ray tubes are recognised as officially branded B.V.A. products.

Budget and P.T.

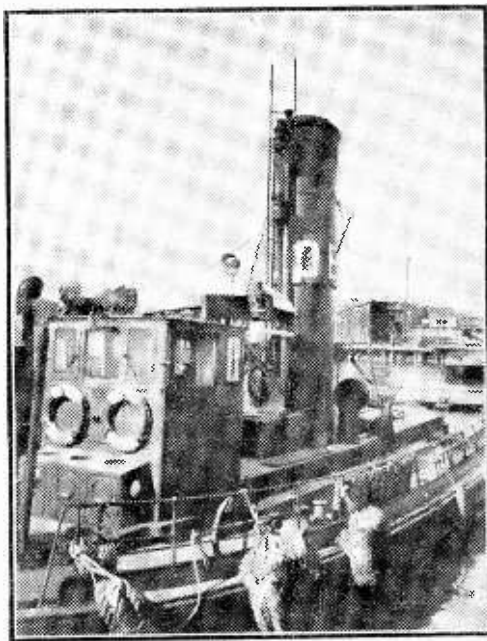
CONSIDERABLE relief was felt in the Trade when the Budget proposals were discovered to include no alteration in the Purchase Tax on Radio and Television equipment—contrary to the beliefs expressed by many before Budget day.

Turkey Visit

MR. P. M. THRELFALL, export director of Pyc, Ltd., left London by air recently on a short visit to Turkey. He was accompanied by the chief engineer and the cabinet designer the object of the visit being to carry out a detailed market survey. Pyc area supervisors have already been appointed to cover both the West and East Mediterranean, the Caribbean and African territories and manufacturing plants in Australia, Canada, Eire and New Zealand have been established. Another of the company's representatives is shortly to leave on a tour of South America.

Worked Cuba Certificate

WE understand that the Association of Radio Amateurs of Las Villas are offering foreign radio amateurs a certificate to show that they have worked at least seven of the eight Radio districts in Cuba. Verification cards should be sent to P.O. Box 136, Santa Clara, Cuba. Remember that CO stations use code and 'phone on all bands, whilst CM's use code on all bands and 'phone on the 7 Mc/s. band.



One of the Swedish tugs which is fitted with the V.H.F. equipment as mentioned on the previous page. The dipole aerials can be seen mounted on the funnel.

Ten Thousand Cycles Down

A TWO-VALVE OSCILLATOR WITH MANY APPLICATIONS FOR THE EXPERIMENTER AND SERVICE ENGINEER

By Robert D. Paterson

FROM the highest audible frequencies to impulses at the rate of one every five seconds seems a lot to ask from one instrument. But this range can be obtained with a simple two-valve oscillator, whose versatility suggests many uses such as (a) generating audio oscillations for testing the audio stages of radio sets or grams (b) energising bridges (c) supplying square waves for oscilloscopy and (d) at the relatively low frequencies, operating relays. The last is a feature of wide application, for instance, in the transmitting field in the automatic keying of a transmitter while its performance is being checked or its output monitored and in the field of mechanics in the control of apparatus involving repetitive actions. It is basically a multivibrator consisting of two triodes, either separate or in one envelope, in the circuit shown in Fig. 1, with another triode acting as a signal-shaper and furnishing the necessary power to operate a relay. A 6SN7 in the first stage and a 6J5 in the second are suitable valves.

Frequency Ranges

The frequency of the oscillation generated is governed by the values assigned to the coupling condensers C_1 and C_2 and the gridleaks R_1 and R_2 and can be calculated as follows:

$$f \text{ (cycles per second)} = \frac{1,000,000}{R_1 C_1 + R_2 C_2}$$

where R_1, R_2 are in ohms and C_1, C_2 are microfarads.

It will be seen that any given frequency can be obtained by an infinite number of combinations of resistance and capacity provided $R_1 C_1 + R_2 C_2$ remains constant. Four independent controls on the panel would lead to confusion. The first simplification to make is to let $R_1 = R_2$ and $C_1 = C_2$, then the expression becomes: $fc/s = 10^6/2RC$. Assume further that for the variable resistances a two-gang potentiometer, $500K\Omega + 500K\Omega$ can be used. With the resistance fully in circuit $2R$ will equal 1 Megohm = 10^6 ohms, and this, in conjunction with $1 \mu F$ condensers will generate oscillations at a frequency equal to $10^6/10^6 \cdot 1 = 1$ c/s. If $0.1 \mu F$ condensers were used the resulting frequency would be 10 c/s. Now what happens as the resistance of R_1 and R_2 decreases? Theoretically, if the capacities remain constant the frequency should increase indefinitely as the re-

sistance decreases to zero, but in practice the minimum usable value of resistance is about $50K\Omega$ in each limb. Below this figure the multivibrator will either cease to function or will produce a bad waveform. When $R = 50K\Omega$, C remaining $1 \mu F$, $f = 10^6/2 \cdot 50K \cdot 1 = 10$ c/s, the same value as is obtained by using R at its maximum value and $C = 0.1 \mu F$. The ranges available may be tabulated then as shown in Table 1.

The Practical Circuit

These conditions can be simply realised by switching the condensers into circuit in equal pairs by means of a two-pole multi-way switch, and using a two-gang potentiometer for the variable resistances.

The minimum resistance, $50K\Omega$, in each grid circuit can be arranged for either by putting a stop on the panel to prevent the potentiometer knob from being turned back too far or, better, by inserting a fixed $50K\Omega$ resistor between each grid and its variable grid leak. The latter method enables the whole sweep of the potentiometer to be utilised; it also makes the maximum resistance in each grid circuit $550K\Omega$ and the minimum $50K\Omega$, so that the ratio of the highest frequency in each range to the lowest becomes 11 to 1 instead of 10 to 1 (as shown in Table 1) providing a suitable but not excessive overlap between the ranges. One minor disadvantage of using equal ganged resistors and paired condensers is that the impulses generated by the two triodes are

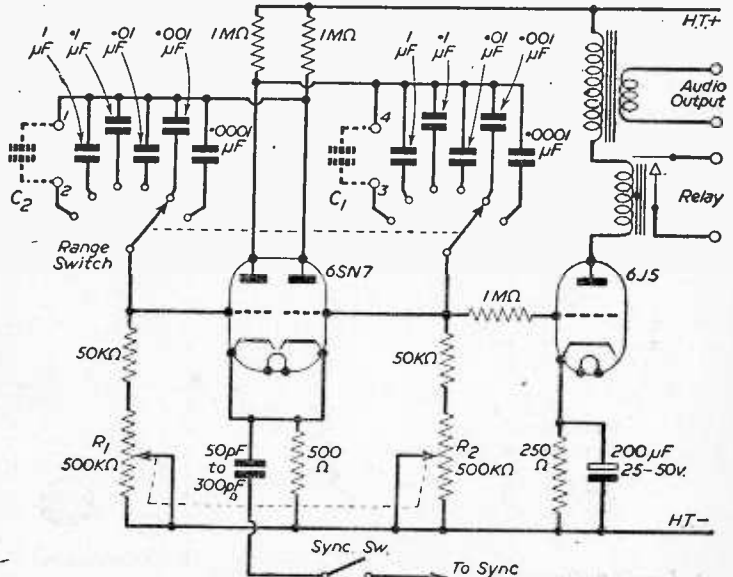


Fig. 1.—Theoretical circuit of the oscillator.

equal in length, so that, for example, in the third use suggested, the automatic keying of a transmitter, mark and space are equal. On occasions it is desirable to have mark and space unequal. To facilitate this, four terminals are provided on the panel, two connected to the anodes of the multivibrator valve and two to spare contacts on the multiway switch. The mark/space ratio can be made unequal by connecting suitably unequal condensers across these as shown in broken lines on Fig. 1.

The resistance in the cathode circuit of the multivibrator valve sets a limit to the anode current passed. It can also be made the means of locking the multivibrator on multiples or sub-multiples of the mains frequency, 50 c/s. To do this a small condenser should be connected between the common cathode pins of the multivibrator valve and the unsmoothed high-tension or to a non-earthed heater pin.

The Signal-shaping Valve

The grid of the signal-shaping valve is connected to one of the multivibrator grids through a 1 megohm resistor. This resistor prevents the signal-shaping valve from drawing excessive grid current and thereby upsetting the operation of the multivibrator. The resistor in the cathode circuit must be adjusted by trial and error to fix the current passed by the valve at a value sufficient to operate the relay, but lower than the permissible maximum current stipulated by the makers. On this account the relay should be as sensitive as possible. The cathode resistor is bypassed by a 200 μ F 25 v. condenser or similar. The audio output can be tapped off between the anode of the signal-shaping valve and earth by means of a 01. μ F condenser connected to the former or, preferably, drawn from the secondary of a low-ratio audio-frequency transformer whose primary is in the anode circuit of the valve. In the latter method the output is not earthed, an advantage when the unit is used to feed a bridge, since in a bridge it is desirable that one "x" terminal should be earthed and consequently the energising voltage cannot be.

The Relay

The relay is in series with the other transformer primary. In the original unit space was saved by utilising a high-speed relay which had two coils on a common iron core, but electrically separate. One became the secondary from which the audio output was drawn, the other acted as the primary and also actuated the armature of the relay. The make and break of the relay was led to two terminals on the panel and was completely insulated, electrically, from the remainder of the circuit.

Power Unit

Very little power is consumed by the unit. A normal H.T. transformer and rectifier arrangement can be used or a midget heater transformer and high tension taken right from the mains through a 230 v. selenium rectifier, the output of about 200 v. being smoothed by a resistance-capacity network consisting of two 8 μ F condensers of appropriate voltage rating and a 1,500 ohm 2 watt resistor. In the latter case the chassis will be live and the unit should be suitably encased so that no live parts can

TABLE 1		Frequency range in cycles/sec.	
$C_1=C_2$	Rmax. 500K Ω	Rmin. 50K Ω	
5.0	"	"	1/5 — 2
2.0	"	"	1/2 — 5
1.0	"	"	1 — 10
0.1	"	"	10 — 100
0.01	"	"	100 — 1,000
0.001	"	"	1,000 — 10,000
0.0001	"	"	10,000 — 100,000 etc.

TABLE 2		Frequency in c/s						
Note	C	D	E	F	G	A	B	C
Frequency in c/s	261	293	329	346	391	439	493	522

be touched inadvertently. Note also the 25 ohm 5 watt resistor on the A.C. side of the rectifier, placed there to safeguard it from excessive current.

Construction and Calibration

The layout is not critical and can be adapted to suit the size of components on hand. A suitable panel is suggested on Fig. 4. The knob should carry a transparent cursor and a cardboard scale should be drawn out and glued below it. The instrument can be calibrated with a fair degree of accuracy by comparing it with a well-tuned piano. Graduate the dial in arbitrary degrees. Set up the multivibrator with a set of earphones or a loudspeaker attached to the output and prepare a graph paper to plot frequency against degrees of the dial. Adjust the range switch and the potentiometer dial until the note emitted beats with middle C on the piano.

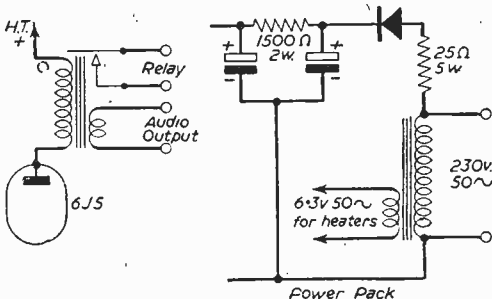


Fig. 2.—An alternative output circuit.

Fig. 3.—Suitable mains unit.

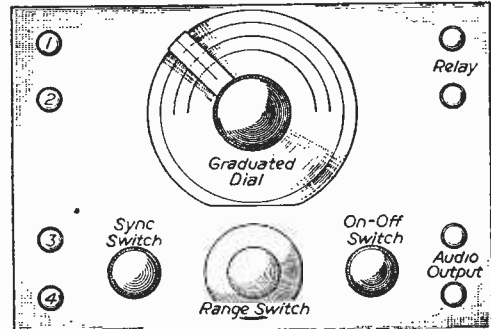


Fig. 4.—Panel layout.

Adjust the potentiometer more critically until the beat note grows lower and finally ceases. This setting corresponds to 261 cycles per second. Plot this on the graph paper. Repeat with the other notes of the piano upwards and downwards. The frequencies corresponding to the first octave upwards are shown on Table 2. The frequency of the other

notes can be calculated from these, bearing in mind that the note an octave above another has twice its frequency, an octave below half. This method is sufficiently accurate for normal purposes. Having obtained a graph of frequency against dial readings for each range, use these to plot chosen frequencies, 50, 100 . . . 1,000 . . . etc., on the dial itself.

Cold Cathode Rectifiers

A DESCRIPTION OF A SPECIAL TYPE OF VALVE

By E. G. Bulley

THESE rectifiers are more or less a development of the two electrode neon lamp or voltage regulator, but they should not be confused with the cold cathode rectifier, although both types are dependent upon the cold cathode.

The cold cathode rectifier is not a thermionic device wherein the operation depends upon electron emission from a hot cathode, but a valve that is specially designed with an ionic-heated cathode.

The cathode sometimes comprises a single wire suitably coated with the oxides of barium and strontium. The coating material varies, dependent upon the manufacturer. Nevertheless, such cathodes do exist as flat discs. However, no matter what the design of the cathode, they must consist of, or be treated with materials of low work function such as the oxides already mentioned.

The anode, on the other hand, usually consists of a straight wire that either passes through the cathode or is placed adjacent to it. There again this depends upon the actual manufacturer.

It is as well to mention, however, that the surface area of the anode is smaller than that of the cathode, but this is also coated with oxides similar to those of the cathode.

Both electrodes are sealed into a glass envelope, which in turn is filled with an inert gas. The pressure of this gas, and the cathode material, really determine the voltage drop of the rectifier.

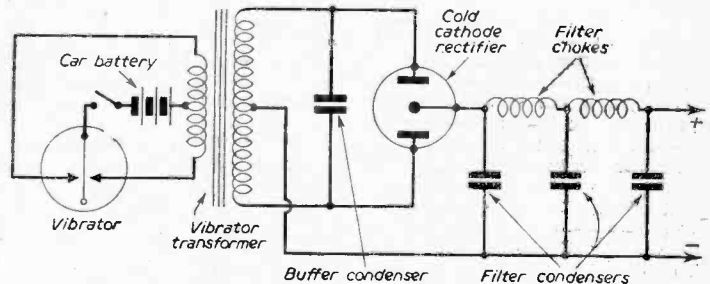
The operation of the cold cathode rectifier can be fully appreciated by remembering that when the electrical potential is increased between the anode and the cathode, a discharge occurs, assisted by the gas, thus creating an ionisation phenomena. The difference in the areas of the electrodes result in a larger voltage having to be applied in one direction than in the other. Furthermore, the discharge causes

the cathode to be bombarded with positive ions, and thus secondary emission is created. To produce this phenomena a very high field strength is, therefore, very necessary.

This type of rectifier has its limitations, however, in actual applications, although it is found in many car-radio receivers. The reason for its inclusion in such receivers is to safeguard against the drain on the car battery, because such valves do not require any heater voltage. One disadvantage with such rectifiers for everyday use is that there is always a small amount of current flowing in the reverse direction.

One must not forget that these, wherever they may be used, must be suitably screened. Failure to do so will only result in R.F. interference in nearby equipment, such as television receivers, as well as the equipment in which it is incorporated.

A typical power supply circuit in which a cold cathode rectifier is connected is shown. This uses the conventional type of filtering, but as will be noted, a vibrator is incorporated, and it is always essential to include a buffer condenser as indicated, otherwise severe arcing at the vibrator contacts will result, which in turn will destroy the vibrator.



Typical power pack as used in car radio equipment.

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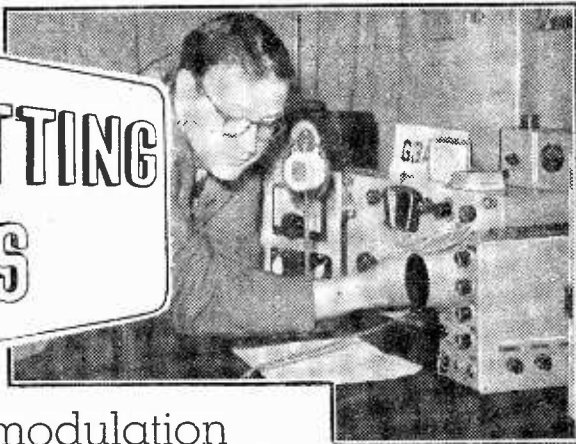
By F. J. CAMM

CONTENTS: The BBC Television System; The Television Camera; From Transmitter to Receiver, Projection Receivers; Stereoscopic and Colour Television; Time Bases; DC Receivers; Aerials; A London-Birmingham Converter; Servicing; Interference; A Pattern Generator; Choosing a Receiver; The Beveridge Report; Dictionary of Television Terms.

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TRANSMITTING TOPICS



Supermodulation

SOME FACTS, FANCIES AND FALLACIES By B. H. Jay

MUCH has been written and said recently concerning supermodulation. It is clear, however, that a great deal of confusion exists concerning this system.

Supermodulation arises from the very human desire to get something for nothing. In a normal amplitude-modulated transmitter, the received speech energy lies in the sidebands. With 100 per cent. modulation, the total energy in the sidebands with modulation by a sine wave is exactly one half of the energy of the steady carrier wave (Fig. 1). Clearly it is wasteful to employ, say, 100 watts of carrier in order to convey 50 watts of information. The sidebands contain the wanted speech or information of the signal. If, therefore, less energy were used to produce a carrier, while the sidebands remained at the same energy level, power would be saved. Alternatively, by saving energy on the carrier, more energy could be put into the sidebands.

If one attempts to overmodulate a normal amplitude-modulated transmitter, the sudden interruption of the carrier as the anode is swung negative corresponds to a violent distortion of the modulation envelope. In consequence, spurious sidebands are radiated. The effect of this is shown in Fig. 2 for sine-wave modulation. It is clear that the spurious sidebands broaden the signal, and overmodulation is a potent source of interference. So-called "controlled carrier" systems do not effect any economy in carrier power. In one form of controlled carrier system the modulation percentage is always around 100 per cent., and the carrier power is increased on modulation peaks so that overmodulation does not occur. This type of operation is indicated in Fig. 2. In less drastic carrier control systems only a relatively small degree of carrier control is used, say a four-to-one boost of carrier. In all such cases, however, the modulation percentage does not exceed 100 per cent.

The new feature of supermodulation is that it provides for modulation percentages effectively greater than 100 per cent. One way of ensuring this is to provide a "negative carrier," so that negative modulation peaks below the zero line can be accommodated. If this is done instead of the carrier

becoming cut off on excessive modulation peaks, and thus introducing distortion, a negative modulation envelope is also produced. The oscilloscope appearance of a true supermodulated carrier is shown in Fig. 3. The result is that with sine-wave modulation there are no spurious sidebands, yet the sideband energy is far greater than with 100 per cent. sine-wave modulation. This enables more energy to be transmitted in the form of information than with normal amplitude modulation. Provided the energy in the sidebands is not too great such a signal can be received on an ordinary receiver with no complications. With higher degrees of supermodulation it is necessary to boost the carrier level at the receiver. One way of doing this is to use the usual crystal filter centering the tuning on the carrier, so that the sideband energy is reduced compared to the carrier. As interference is similarly reduced also, the gain of the supermodulated signal is realized.

Care in Adjustment

As systems to achieve supermodulation require the most careful adjustment, it is unfortunate that this is not stressed in descriptions. They are definitely

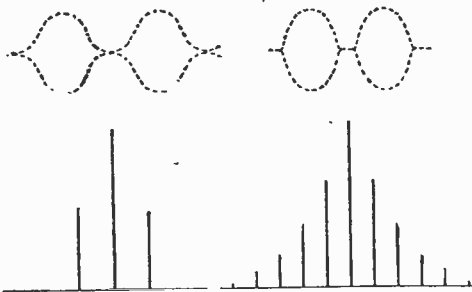


Fig. 1.—Modulation envelope of 100 per cent. sine modulated wave. Lower half shows carrier and sidebands.

Fig. 2.—Overmodulated wave. Lower half shows how this creates spurious "splatter" sidebands and consequent distortion.

not suitable for beginners, as severe interference and distortion will be created by incorrect adjustments. Further, the exaggerated claims made should be treated with caution. It is even claimed that the bandwidth is less than with normal modulation. Actually, in a

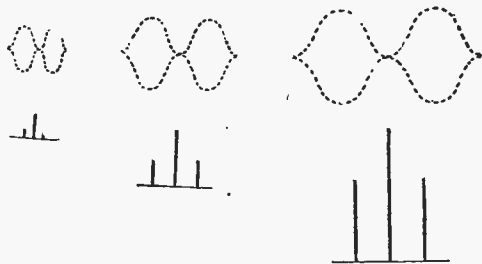


Fig. 4.—“Controlled carrier” system. Modulation does not exceed 100 per cent. under any conditions.

perfect supermodulator, the bandwidth is the same, as the sidebands are unaltered in all except energy. However, to judge from operation, it is not realised that incorrect adjustment will create sidebands spaced over a very wide band of frequencies. A further point, again not stressed by some writers, is that the equipment must be capable of providing the high instantaneous peak powers required for the modulations peaks. As these exceed considerably the requirements of a normal amplitude-modulated transmitter, unless designed correctly, distortion can readily occur on the positive peaks. The post office rate supermodulation systems on a peak basis, which offers little advantage over a full-dress amplitude-modulation transmitter of the conventional kind. Thus, while a 50-watt carrier could be “supermodulated” to equal a normal anode-modulated 150-watt transmitter, it would be illegal to use a 150-watt transmitter and supermodulate it to the equivalent of a 500-watt transmitter. Furthermore, in view of the adjustment and complication of a practical supermodulated transmitter, it would be easier, simpler and probably

cheaper to obtain the same results by normal anode-amplitude modulation. In point of fact, many of the “benefits” of supermodulation can be legitimately obtained by the intelligent application of technical principles to orthodox amplitude-modulation transmitters. In this case no question of satisfying the post office as to “peak” performance arises, and special monitoring or measurement devices are not required. It will also be appreciated that in the case of anode-modulated supermodulated systems, the modulator must be capable of a much greater audio output than usual. This again is an added disadvantage. The true value of supermodulation lies in its original use—as a preventative of the dire distortion created by accidental overmodulation peaks rather than as a means of boosting modulation percentages unduly. Intelligent use as a negative peak overmodulation cushion gives a little extra punch to the transmission, with no excessive demands upon the modulation equipment. Those hopeful of getting something for nothing will find a price has to be paid—in complication and delicate adjustment—with finally little advantage under the present post office regulations.

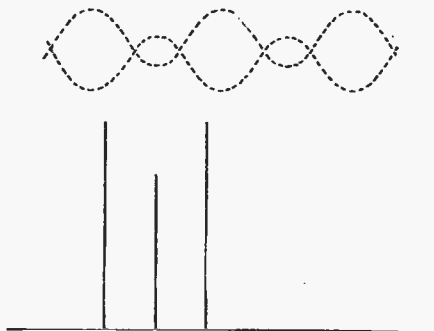


Fig. 3.—With supermodulation sideband energy can exceed that for 100 per cent. modulation, yet no spurious sidebands are produced.

Mullard Educational Service

AN educational service has been instituted by Mullard Ltd. to provide teachers and instructors in electronic subjects with information concerning recent developments and applications in this field. The details of this service are described in a pamphlet recently issued by the Mullard Technical Publications Dept., Century House, Shaftesbury Avenue, London, W.C.2, entitled “The Mullard Educational Service.” Included in the services listed in this pamphlet are: Technical Publications; Assistance to Individual Instructors; Filmstrips; Wall Charts; and Class Instruction and Work Sheets.

The technical publications provide useful background information. They are issued free of charge and include technical descriptions of new valves, electron tubes, and other products; bulletins describing new developments in circuitry and application notes on new products.

The rendering of individual assistance on technical

problems is another important part of the Mullard Educational Service available to instructors.

Filmstrips

The 35 mm. filmstrips which are included in the Educational Service deal with radio valves, cathode-ray tubes, television, high-frequency heating and similar subjects. The strips contain, on an average, about 35 frames, and each strip is accompanied by a printed booklet containing very full teaching notes.

Explanation of graphical methods of solving various problems in electronic practice are given in a series of Class Instruction and Work Sheets which Mullard are now making available to schools. Typical graphs are provided in these sheets on which the student can work out practical examples.

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On Your Wavelength

By Thermion

Old Receivers Still In Use

MY inquiry in last month's issue as to how many receivers of the 1920/1930 vintage are still in operation has elicited a large number of replies of which a letter from Mr. T. H. Pettipher is typical. He still has in daily use a receiver which began life as the Anglo-American Six. I remember this receiver well. It had a 36 in. panel and was almost a complete window display on its own. It had three stages of H.F. with neutrodyne tuning, detector and two stages of L.F. transformer amplification and it was battery operated.

Of course, in those early years anything which made a cacophonous squawk was considered *le dernier cri*. In fact, it was horrible, it suffered from instability, hand capacity, the valves blue-glowed at any H.T. voltage above 60 and was one of the worst receivers of the period. I am not surprised that Mr. Pettipher lopped a foot or so off the panel and converted it into a four valver with valves mounted on copper screens. This gave place later to our Triple Tune Four (blueprint No. WM293, issued in 1932). Even this has been converted and at present it has two pentodes, triode-detector and Mullard 22A output valve following the transformer. When I tell you that Mr. Pettipher is rising 80 years of age and did not take up radio until he was 50 you will know what pleasure it has given him.

An Analysis

I HAVE said on a number of occasions that we have too much dance music. A reader has gone to the trouble of analysing the amount of programme time devoted to dance bands. The reader concerned is a Mr. N. A. S. Fitch, of London, E.10. He took the *Radio Times* as his guide, using issue dated March 9th-15th. Here is his analysis.

Housewives' Choice	}	12½ hrs.
Family Favourites		
Down Your Way		
"Disc Jockey" Programmes.		
Jazz and Dance music	20¾ hrs.
Light Music	27¾ hrs.
Cinema Organ music	5¾ hrs.
Recitals and Chamber music	16½ hrs.
Symphony concerts	27¾ hrs.*
* Including 2¼ hrs. of repeats.		

These statistics rather bear out my comments. I realise that some people like dance music and that they must be catered for. I do wish, however, that they would keep their feet and bodies *still* when listening to it. I have yet to see a *pas de deux* being danced to radio.

Rarity Value

I WAS interested to read the following advertisement in the *Yorkshire Evening News*, "2/6d. paid for latest copy of "PRACTICAL WIRELESS with blueprint." The blueprint, of course, was of the Mini-Four. The other day at the office we received an advertisement for the same issue which would have cost 17/6d. to insert. It invited those with copies to spare to sell them at over the published price. Fortunately, we were able to oblige this reader and save his money.

The Fascination of the Blueprint

THE blueprints given in this and our companion journal *Practical Television* and the success which attended them indicates that after a lapse of over twelve years the blueprint has lost none of its fascination. Up to 1939, when the war put paid to free gift blueprints, all of the radio journals, including this one, issued about four boom blueprints per year. Those issues, of course, always sold out. Journals were on sale or return then, but they are not now. It is thus a delicate task for a publisher to assess in advance how many copies he should print, and he has to decide this, of course, long before publishing day. Newsagents are advised well in advance, but even they can only arrive at their orders by a shrewd guess. They know their regular customers, but they can only roughly estimate how many new readers are likely to be attracted into their shop by the national publicity drawing attention to the blueprint. It was thought the blueprint had not the same appeal as hitherto, but events have proved that belief to be wrong. As journals are not now on sale or return, the only way of ensuring a copy of this or any other journal is to become one of the regular readers.

The Northern Radio Show

READERS prowling around the Northern Radio Show, which opens on April 23rd, may like to know that I shall be present during the run of the exhibition on our Stand No. 1.

Northern dance music bands, lovers of *cryners*, and all others whose views disagree with mine, will thus have an opportunity of crossing swords with me.

Incidentally, I have found from correspondence that Northerners are much more interested in dance music than the Southerners. I have also observed that they are keener lovers of music generally.

Anyway, if you see someone in armour with a Sten gun, that will be me!

Heard It?

A PUPIL was asked by his tutor, "What's an ohm?" to which the pupil replied, "A place where a volt lives!" Although humorous there is an inkling of truth in it.

R.E.C.M.F. EXHIBITION, 1952

GROSVENOR HOUSE, LONDON—APRIL 7th-9th

LIST OF EXHIBITORS

	<i>Stand No.</i>		<i>Stand No.</i>
A. B. Metal Products, Limited	21	Long and Hambly, Limited	30
Acoustic Products, Limited	71	Magnetic and Electrical Alloys, Limited	12
Advance Components, Limited	26	Marconi Instrument, Limited	105
Antiference, Limited	59	McMurdo Instrument Co., Limited	43
Associated Hiffe Press	93	Micanite and Insulators Co., Limited	51
Associated Technical Manufacturers, Limited	75	Morgan Bros. (Publishers), Ltd.	90
Automatic Coil Winder and Electrical Equip- ment Co., Limited	94	Morganite Resistors, Limited	22
Belling and Lee, Limited	23	Mullard, Limited	28
Bird, Sydney S., and Sons, Limited	72	Mullard Overseas, Limited	70
Birmingham Sound Reproducers, Limited	31	Mullard, Limited (Valve Division)	69
Bray, Geo., and Co., Limited	87	Multicore Solders, Limited	14
British Electric Resistance Co., Limited	68	Murex, Limited	76
British Insulated Callenders Cables, Limited	27	Mycalex, Limited	92
British Mechanical Productions, Limited	60	N.S.F., Limited	64
British Moulded Plastics, Limited	102	Painton and Co., Limited	36
Bulgin, A. F., and Co., Limited	39	Parmeko, Limited	15
Bullers, Limited	99	Partridge Transformers, Limited	55
Carr Fastener Co., Limited	17	Permanent Magnet Association	91
Clarke, H., and Co. (Manchester), Limited	81	Plessey Co., Limited	42
Collaro, Limited	29	Plessey International, Limited	96
Colvern, Limited	66	Reliance Electrical Wire Co., Limited	48
Cosmocord, Limited	25	Reslosound, Limited	46
Daly (Condensers), Limited	89	Rola/Celestion, Limited	56
Dawe Instruments, Limited	49	Salford Electrical Instruments, Limited	47
De La Rue, Thomas, and Co., Limited (Plastics Division)	97	Scharf, Erwin	24
Diamond "H" Switches, Limited	3	Scott, Geo. L., and Co., Limited	79
Dubilier Condenser Co. (1925), Limited	50	Simmonds Aerocessories, Limited	52
Du Bois Co., Limited	74	Stability Radio Components, Limited	4
Duratube and Wire, Limited	63	Standard Telephones and Cables, Limited	18
Edison Swan Electric Co., Limited	61	Standard Telephones and Cables, Limited (Valve Division)	103
Egen Electric, Limited	9	Static Condenser Co., Limited	6
Electro Acoustic Industries, Limited	45	Steatite and Porcelain Products, Limited	32
Electronic Components, Limited	88	Suflex, Limited	7
Electrothermal Engineering, Limited	85	Supply, Ministry of	106
English Electric Co., Limited	107	Symons, H. D., and Co., Limited	86
Enthoven, H. J., and Sons, Limited	58	Tannoy Products, Limited	40
Eric Resistor, Limited	19	Taylor Electrical Instruments, Limited	1
Ever Ready Co. (Gt. Britain), Limited	5	Telegraph Condenser Co., Limited	34
Ferranti, Limited	54	Telegraph Construction and Maintenance Co., Limited	13
Fine Wires, Limited	84	Telephone Manufacturing Co., Limited	62
Garrard Engineering and Manufacturing Co., Limited	67	Thermo-Plastics, Limited	2
General Electric Co., Limited	104	Trade, Board of	108
Goodmans Industries, Limited	35	Truvox Engineering Co., Limited	73
Guest, Keen and Nettlefolds, Limited	83	Tucker, Geo., Eyelet Co., Limited	82
Hallam, Sleigh and Cheston, Limited	80	Vactite Wire Co., Limited	100
Hassett and Harper, Limited	98	Vitavox, Limited	44
Hellermann Electric, Limited	8	Walter Instruments, Limited	78
Hunt, A. H., (Capacitors), Limited	20	Walter, J. and H., Limited	77
Igranic Electrical Co., Limited	11	Wego Condenser Co., Limited	37
Imhof, Alfred, Limited	95	Welwyn Electrical Laboratories, Limited	53
Jackson Bros. (London), Limited	16	Westinghouse Brake and Signal Co., Limited	65
London Electrical Manufacturing Co., Limited	38	Weymouth Radio Manufacturing Co., Limited	10
London Electric Wire Co. and Smiths, Limited	101	Wingrove and Rogers, Limited	57
		Wireless Telephone Co., Limited	41
		Woden Transformer Co., Limited	33

British Radio Components Show

ADVANCE DETAILS OF SOME OF THE EXHIBITS

THERE are again over 100 exhibitors in the annual British Radio Component Show to be held at Grosvenor House, London, from April 7th to 9th. As Easter immediately follows the Exhibition it will be noted that this year it opens on a Monday, instead of Tuesday, and closes on the following Wednesday.

Each successive show brings new evidence of successful research by British component manufacturers to enable them to design and produce components which are increasingly reliable under extremes of atmospheric conditions, technically more efficient and—many of them—smaller in size. In spite of the defence programme manufacturers can still meet demands for components for every need, at home and abroad, including domestic radio and television. Shortages, however, are experienced from time to time and it may be found also that supplies of certain new items are confined to Government use.

The following notes give details of some of this year's exhibits as so far received.

Wires, Cables and Insulating Materials

A new grade of P.V.C. compound, styled "VO," which can be used continuously at temperatures up to 150 deg. C., and retains its flexibility at that temperature, is shown in the form of sleeving by Associated Technical Manufacturers, Ltd. (Stand 75.)

Another firm exhibiting heat-resisting sleeving is H. D. Symons and Co., Ltd. (Stand 86.). This is known as Yellow Varnished Terylene, and may take the place of varnished glass fabrics where the operating temperature is up to 150 deg. C.

Enamelled wire weighing only 1 oz. for a length of over 3½ miles is shown, amongst a very wide range of wires and specialised cables, by British Insulated Callenders Cables, Ltd. (Stand 27.). Oil base enamel is used in successive layers even on this microscopic gauge of wire.

Ceramic insulators made from over six different types of material, each with special properties, are shown by Geo. Bray and Co., Ltd. (Stand 87.)

There are now something like a dozen different grades of Delaron laminated plastic made by the Plastic Division of Thomas De La Rue and Co., Ltd. (Stand 97.) The importance of the textiles used for covering wires is emphasised on Stand 84 by Fine Wires, Ltd.

A cable-sorting machine which automatically indicates individual wires in a multi-way cable is an interesting exhibit by Hellerman Electric, Ltd. (Stand 8.) A moulding material which will absorb X-rays is among the exhibits of the Mycalex Co., Ltd. (Stand 92.)

A new form of Micanite, to which the description "High Heat" has been given is shown by the Micanite and Insulators Co., Ltd. (Stand 51.) It is built-up mica which, owing to the use of an inorganic bond, is self-supporting at temperatures up to 500 deg. C.

Capacitors

Special Nitrogol paper dielectric tubular capacitors for E.H.T. flyback or R.F. oscillator circuits are

shown by Dubilier Condenser Co. (1925), Ltd. (Stand 50.) These are assembled in a glazed ceramic tube with metal end-cap terminals.

Midget tubular capacitors measuring only 3/16in. by 7/16in. are produced by A. H. Hunt (Capacitors), Ltd. (Stand 20), under the name "Moldseal." New silvered mica capacitors, known as "Catacon" (category A condenser) are introduced by London Electrical Manufacturing Co., Ltd. (Stand 38.) These have a new moulded finish. Telegraph Condenser Co., Ltd. (Stand 34) show a range of new high-temperature electrolytics which will work at 85 deg. C. without voltage derating.

Resistors

During the past year the British Electric Resistance Co., Ltd. (Stand 68), have developed a new protective coating for wire-wound resistors which will withstand temperatures up to 400 deg. C., yet does not require the high firing temperatures of vitreous enamel. Examples of Berco resistors with this coating are exhibited. The firm also show a new range of power rheostats, the "Bercostat," available up to 100 watts dissipation.

Morganite Resistors, Ltd. (Stand 22), show their latest range of Government "type-approved" potentiometers and fixed resistors.

Switches, Plugs and Sockets

A new range of rotary switches with ceramic insulation is shown by A.B. Metal Products, Ltd. (Stand 21), who also feature the "Minibank" switch, still the smallest multipole type in the world.

A. F. Bulgin and Co., Ltd. (Stand 39), add to their thousands of products a new range of micro-switches. These include miniature types, and models for high operational pressure. Their ordinary switches have been improved as to moisture resistance and peak handling capacity.

Belling and Lee, Ltd. (Stand 23), show a miniature thermal delay switch for the protection of T.V. and electronic circuits, as well as new types of plugs and sockets, including a shrouded 3-pin mains input type, and a double-screened coaxial connector.

"Diamond H" Switches, Ltd. (Stand 3), also have several new switches, including a range of 3 amp. 1-hole fixing toggle types.

Test Instruments

Several firms are exhibiting instruments for laboratory, workshop and industrial use. Dawe Instruments, Ltd. (Stand 49), show a new ultrasonic thickness gauge and a dynamic balancing machine. Marconi Instruments, Ltd. (Stand 105) have a comprehensive form of signal generator. Advance Components, Ltd. (Stand 26), show five different signal generators for various uses, while the Automatic Coil Winder and Electrical Equipment Co., Ltd. (Stand 94), are now manufacturing a wide range of electronic instruments, including a fully tropicalised 96-range valve voltmeter.

Permanent magnet speakers with totally enclosed magnets specially designed for T.V. receivers (Acoustic Products, Ltd., Stand 71).

(Continued on page 234.)

Reactivating Dry Batteries

MAKING A SMALL UNIT FOR PROLONGING THE LIFE OF H.T. BATTERIES

By H. H. Jay

A RECENT article under this title gave a description of a battery regenerator now on the British market. Readers may be interested in the construction of a similar device that the writer has had in use for some five years with very satisfactory results. The apparatus is based on some American work that appeared in 1942 and makes the assumption that battery failure is, in fact, failure of the depolariser.

If a dry battery is short-circuited the voltage will drop to a very low value. A period of rest will restore the battery. The book explanation is that the depolariser is not capable of dealing with the large amount of evolved hydrogen and that the accumulation of gas polarises the cell. The remedy would seem to be a larger amount of depolariser, but as the present amount is about three-quarters of the whole cell volume, no great improvement can be expected.

The Depolariser

Manganese dioxide is the usual depolariser, and the interesting point is that a discharged cell is found to contain manganese *oxide* in the depolariser. Discharge apparently converts the dioxide to monoxide. Charging might then reconvert the oxide to dioxide. According to the American work this can be done, provided that the proper technique is used. Tests show this to be so. A battery has been in use for the past two years for periods of about 15 minutes daily and it still shows no sign of failure. This is the method.

A dry battery does not charge in the same way as does an accumulator. The current drops sharply at first, then rises and again falls, this time gradually for a period of up to 22 hours. Current then increases sharply and this rise marks the completion of the process. Partially discharged batteries show this rise earlier.

The apparatus used is nothing more elaborate than a small transformer, a metal rectifier, variable resistance, and an electrolytic condenser. A meter for reading current is useful but not essential, while the variable resistor could be replaced by a fixed one if all cells are of one type. For high-tension batteries, a disused battery eliminator fitted with a series output resistance would be all that is needed.

Charging Methods

Charging rate varies with the size of the cell, and the table in the next column gives suggested values:

Set the initial current to an appropriate value for the cell and see that there is no excessive temperature rise after about one hour. No further attention is needed until the current rise starts. The cell should then be removed. After charging, a period of rest should be given before the cell is put to use.

Full results may not be achieved at the first charge. Batteries vary. Some show an immediate improvement, others may need several charges. Good cells may be put through as many as 20 charges before failure. The life on re-charge varies from half to one-and-a-half times that of the new cell. The

Table of Charging Rates

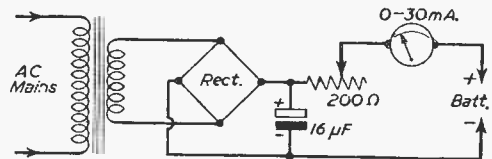
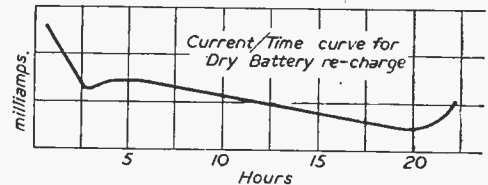
Cell size	Current in mA
6in. by 2½in.	15-20
3½in. by 1in.	10-15
1½in. by 1in.	7-10
1½in. by ¾in.	5-8
1¼in. by ¾in.	4-7

saving is appreciable, particularly for large users, for the cost of charging is only about 0.01d. with power at 2d. per kilowatt/hour.

Warning

Not all cells are suitable for rejuvenating. Discard those that are corroded, that have been idle for long periods after discharge, and those over 18 months old. The best results are given by cells used for short periods of relatively heavy discharge. They will respond to short—three- to six-hour—periods of charging.

H.T. batteries showing 70 volts or over can usually be saved. Current should be 6 to 10 mA for full-size



Charging rate curve, and circuit of the charging unit.

batteries and 2 to 3 mA for miniature and deaf-aid types. Defective cells should be short-circuited before charging starts, otherwise heating may develop because of the local high resistance.

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Miniature Station Selector Unit

A MULTI-STATION SELECTOR FOR USE WITH SUPERHET CIRCUITS

By F. G. Rayer

THOUGH this unit was built up for use in a small mains receiver, it can be used in battery-operated sets equally well. Originally employed for selecting any of four pre-determined stations, manual tuning was subsequently provided for. This only requires leads to be taken from spare tags on the six-way switch to the gang condenser. Actually, the arrangement adopted will provide for six pre-determined stations, or five pre-determined stations and manual tuning. The total cost of the parts, purchased new, is about 16s. A high standard of efficiency is maintained.

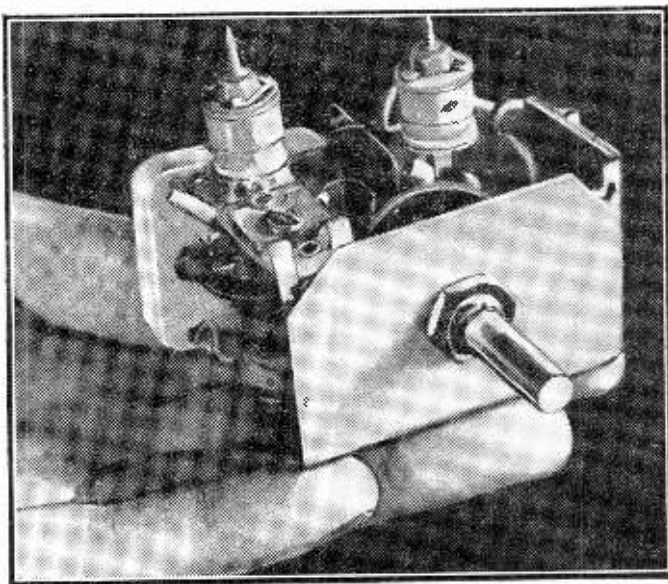
The circuit, shown in Fig. 1, illustrates wiring actually in the unit. Midget, iron-cored coils are used in conjunction with a two-pole, six-way rotary switch. The actual switch specified is only 1½ in. in diameter, thus keeping size down. The pre-set condensers are switched into circuit in pairs, thus providing four stations automatically. If a manual tuning arrangement is to be added (and it is often felt this is necessary, as it does enable the user to tune to foreign or other stations when desired), then the leads "X" and "Y" are taken to the fixed plates tags of a standard two-gang .0005 µF tuning condenser. The remaining switch position was left unused.

The pre-set capacitances indicated enable stations throughout the medium-wave band to be selected. No long-wave band is provided.

Constructional Points

The unit is made on a small chassis bent up from a piece of metal 2¼ in. by 3½ in., with a bracket for the

oscillator coil, as illustrated in Fig. 2. This diagram does not show the smaller condensers, which come above the coils and switch and are supported in the



This illustration gives an idea of the size of the tuner.

wiring, which was carried out with 18 s.w.g. insulated wire. After fixing the parts as in Fig. 2, much of the wiring can be done. The smaller condensers can then be added, and Fig. 3 illustrates the switch and oscillator coil connections, which cannot be included in Fig. 2. All the pre-set condensers are returned to the chassis. They were soldered in place, but if aluminium is used the tags will require to be soldered to leads secured under the various bolts in the assembly.

The completed unit occupies very little space, and may be positioned at some convenient point in the receiver chassis. Note the chassis connection in Fig. 2—this must be sound. The unit should be bolted securely to the receiver chassis, or good contact between the two otherwise assured.

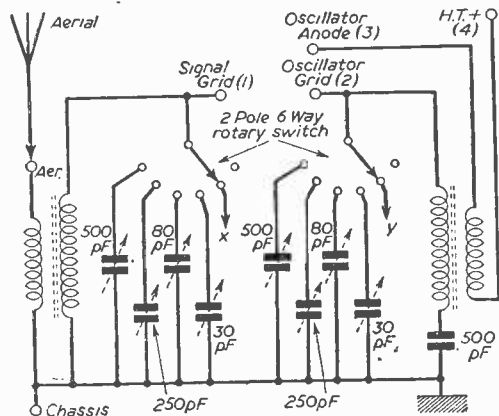


Fig. 1.—Theoretical circuit of the tuner.

LIST OF COMPONENTS

- Two-pole, 6-way rotary switch. (Type C1779T, Coventry Radio.)
- Two 3-30 pF trimmers.
- Two 30-80 pF ditto.
- Two 250 pF ditto, and twin 100-500 pF trimmer. (Coventry Radio.)
- 500 pF fixed condenser.
- Midget medium-wave aerial coil, iron cored ; ditto oscillator coil. (Supacoils.)

Circuits and Adjusting

The mains circuit employed is seen in Fig. 4, but other circuits could of course be used. That shown gives good overall results. Connections for the unit are given in Figs. 2 and 3, but Fig. 4 is numbered in accordance with the numbers in Fig. 1, to ensure that this is absolutely clear. The arrangement has also been tried in an experimental all-dry midget receiver with excellent results.

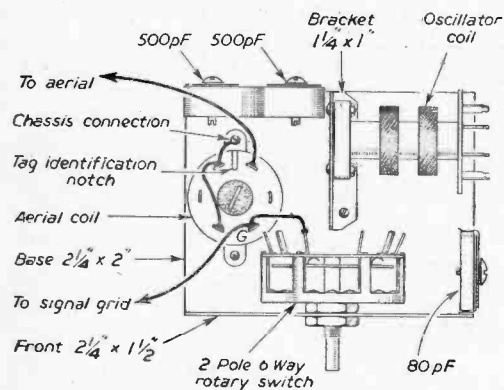


Fig. 2.—Layout of the tuner.

Afterwards, the switch is set to each position in turn and the respective trimmers adjusted for maximum volume of the desired station. It is best to use an insulated screwdriver, or some similar means such as a slip of paxolin, for all adjustments, otherwise the

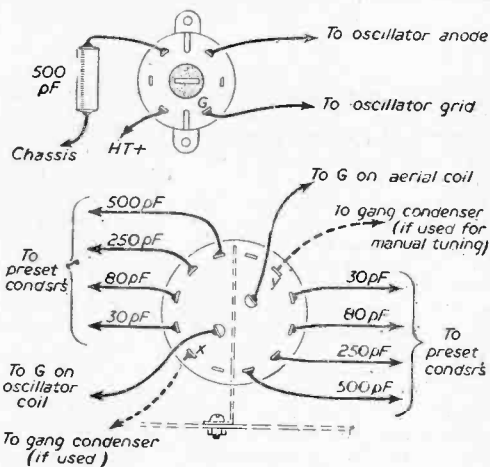


Fig. 3.—Switch-wiring details.

If a gang-tuning condenser is being used, adjust the trimmers on this for best volume while tuning in some low-wavelength station. Then tune to the high-wavelength end of the band, and adjust the cores of the coils for best results. The procedure should be repeated two or three times to secure proper alignment.

settings will be influenced by the proximity of the tool. For those who like to experiment along original lines, the possibility of using a frame-aerial instead of the aerial coil might be considered. If wound according to reliable data, this should enable satisfactory alignment to be obtained.

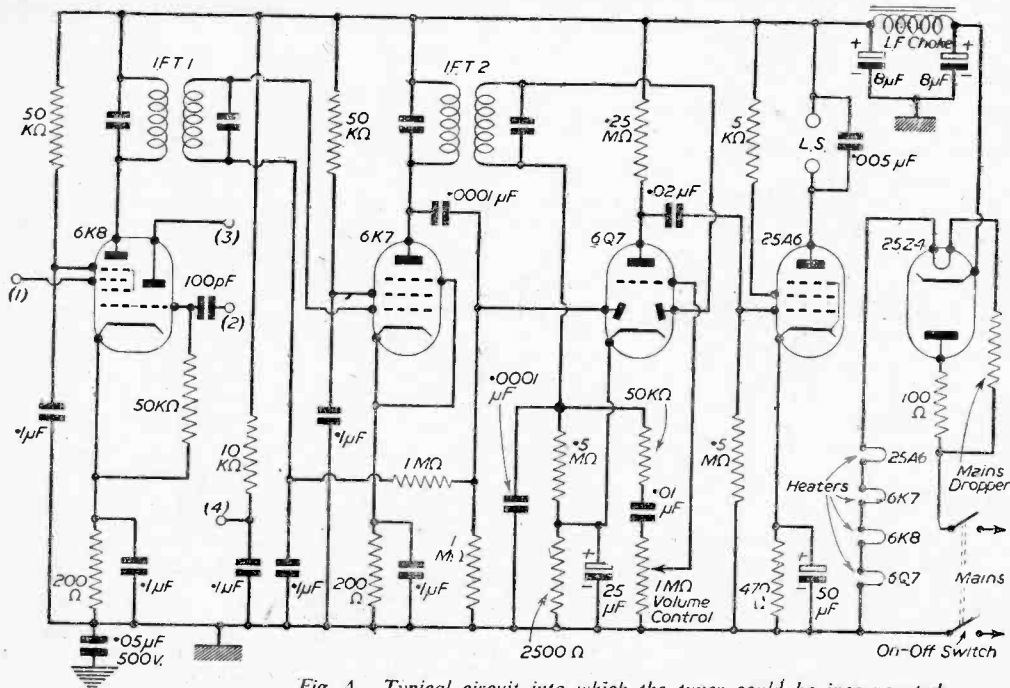


Fig. 4.—Typical circuit into which the tuner could be incorporated.

The Experimenter's Workshop

DETAILS OF THE MOST SUITABLE LOW-COST TEST EQUIPMENT FOR THE EXPERIMENTER

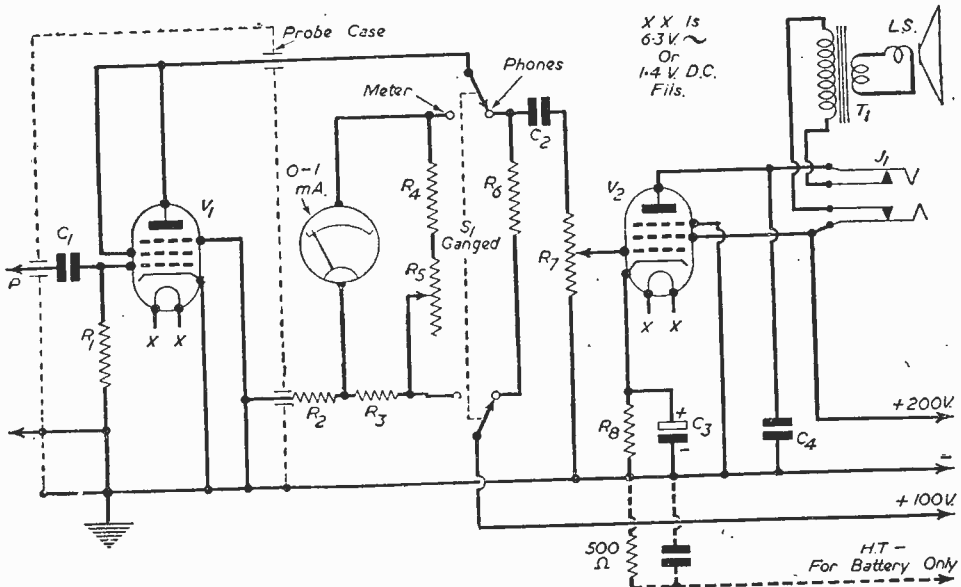
By W. J. Delaney (G2FMY)

WE are constantly being asked to recommend suitable equipment for the beginner—some apparatus which will not cost a lot but will enable most ordinary testing to be carried out. It is realised, of course, that the keen experimenter who is not restricted to the amount he can spend on his hobby will equip himself with multi-testmeters, signal generator, and perhaps even an oscilloscope. The beginner, on the other hand, or those who can only afford sufficient to enable them to build an occasional experimental receiver, is not inclined to spend a large sum on apparatus which will, perhaps, only be used very occasionally. When making up a receiver, however, it is often necessary to make some kind of test—either to find a fault, or to find out whether the equipment is operating in a satisfactory manner. It is also worth while having some type of servicing equipment which will be of use in tracing faults in the normal broadcast receiver which may be used in the home. The experimenter will, of course, prefer to service this rather than call in the serviceman, and therefore the problem arises as to what should be obtained in the way of the minimum—so far as concerns not only the price but the nature of the apparatus to enable normal testing to be carried out.

Test Meter

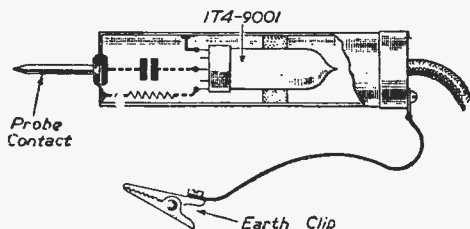
It is obvious that the first essential is the testing of voltages, and this applies to both battery and mains

equipment. This would indicate some form of multi-range voltmeter, but odd components also have to be tested from time to time, and most normal radio components may be tested by passing a current through them. As most readers know, a voltmeter is actually a current meter with a series resistor to limit the current passed by the meter, and it actually reads the current flowing. In the case of condensers, these will not pass a current unless they are leaky, so this remark does hold good in a way. Now, the passage of a current implies the application of a voltage across the component, and therefore a meter to read current can be applied also here—no current through a component indicating an open circuit, and the value of the current in conjunction with the value of the applied voltage indicating the resistance of the item being tested. From this it is obvious that a good current meter may be used for almost any type of test, and to give its full value under almost any condition a very low reading component should be chosen. There are a number of 500 μ A (half-a-milliamp) ex-Service meters now on the market, but a 0 to 1 mA meter may be used. As has been pointed out many times in these pages, such a meter may be used to read voltage values by including a resistance in series so that the current is limited to the maximum which the meter is intended to pass, and for currents outside the range of the instrument the excess is shunted through a resistance connected across the



Circuit of a signal tracer for use with either battery or A.C. mains supplies.

instrument. This is the basis of the multi-range meter and should be regarded as the first and most important item of the workshop or experimental den. If serious work is to be undertaken later, then the very best instrument which you can afford should be obtained, and to prevent damage a fuse or some means of protecting the delicate meter should be included. The meter may, of course, be adapted to read A.C.



Construction of the test prod for use with the tracer shown on the previous page.

values by adding a suitable rectifier, and thus for a fairly small first cash outlay a meter may be obtained which will form the nucleus of a very elaborate unit which may be added to gradually as various additional ranges are called for.

Signal Tracer

Such items as signal generators, oscilloscopes, etc., are not considered to form part of the ordinary small experimenter's workshop, but some means of testing a faulty receiver will be found a useful adjunct to the instrument already mentioned. For instance, in a three- or four-valve receiver which has broken down, a multimeter will not easily find the stage in which a fault has arisen unless the broken or faulty component has modified voltage or current readings. Therefore an instrument which will locate the actual stage in which the fault has arisen will save considerable time, and in some cases may be essential. The simplest form such an instrument can take is that known as a "signal tracer," and although there are many circuits which may be employed, probably the simplest is that shown on page 209, which is a design published two years ago in these pages. Unfortunately, all issues are out of print, but this tracer was built in considerable numbers and has proved most effective. As may be seen from the circuit, it may be used for battery or mains operation—alternative

valve types being indicated in the list of parts. It may be used for testing either mains or battery receivers and also for amplifiers, record players, etc. Instruments of this type are preferably enclosed in a screening box such as those supplied by the Eddystone people, or a box may be constructed from sheet aluminium, and total screening prevents erroneous indications being obtained due to radiation effects.

LIST OF PARTS

R1—20 M Ω $\frac{1}{2}$ w.	C1—.0002 μ F mica.
R2—20 K Ω $\frac{1}{2}$ w.	C2—.01 μ F.
R3—1,000 Ω $\frac{1}{2}$ w.	C3—25 μ F 25v. elec.
R4—500 Ω 1w.	C4—.002 μ F.
R5—500 Ω rheostat.	M1—0-1 D.C. milliammeter.
R6—50 K Ω $\frac{1}{2}$ w.	S1—D.P.D.T. switch.
R7— $\frac{1}{2}$ M Ω pot.	J1—Closed circuit jack.
R8—Bias resistor to suit.	T1—Output transformer.
V1—A.C.—9001 (Batt. IT4).	L.S.—5in. L/S.
V2—A.C.—6F6 (Batt. 3Q5).	P—Metal probe.

With a signal tracer the method of use is to apply the instrument from the aerial stage and work through the circuit to the output—the opposite method to that used in other fault-finding apparatus, such as a signal generator. The tracer will enable the aerial to be tested first, as a signal should be heard when the R.F. probe is applied to the aerial, the signal being rectified as in a normal receiver. By proceeding from one stage to the next the signal can be followed, and the moment it ceases it will be obvious that the fault occurs between that point and that at which the signal was last found. As it is possible to test at the grid and anode of a valve, one is enabled with this type of tester to check valves as well as components and wiring, and it will be found that the expense is well justified. Most of the odd components may, no doubt, be found in the spares box and there is very little wiring to be done. If batteries are used to operate the tracer, it is, of course, essential to make certain that they are up to rating, as otherwise the tracer may not function.

There is no necessity for any other equipment in the average "den," and with the multi-range meter and the tracer practically any circuit may be made up and tested, and the beginner will find that these will give him an insight to radio theory and practice which will prove very valuable, as well as forming the basis of a good workshop or laboratory at a later date.

Physical Society Exhibition

AMONG the exhibits to be seen at the above, which is being held at the Imperial College, South Kensington, from April 3rd to 8th, is the Metropolitan Vickers' High-speed Recurrent Waveform Monitor.

This equipment will display on a cathode-ray tube a recurrent waveform having frequency components as high as 300 Mc/s and, if necessary, of less than 1/10-volt amplitude.

The method used is to measure, during one cycle, the instantaneous amplitude of a point in the waveform. On successive recurrences the instantaneous amplitudes of other points in the waveform are

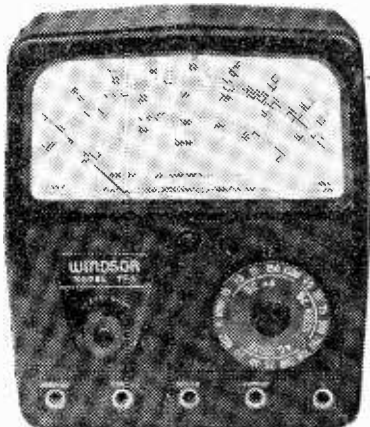
measured, and it is arranged that after some 200 cycles the whole of the waveform has been sampled. The whole process is then repeated. When a measurement of instantaneous amplitude has been made it is amplified in a relatively low-frequency amplifier and is applied as a steady voltage of some 100 microseconds duration to the Y-plates of a cathode-ray tube. At the same time a steady X-deflection, indicative of the time-interval between the beginning of the waveform and the instant of amplitude measurement, is applied to the tube. Thus, after any one recurrence of the waveform, one element of a graph of the waveform is applied to the tube.

The measurements of instantaneous amplitude are carried out in a single small valve which is placed very close to the circuit being monitored.

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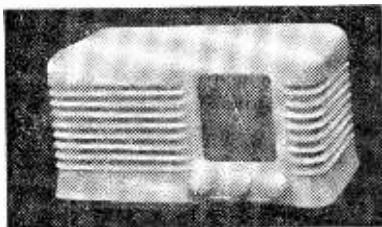
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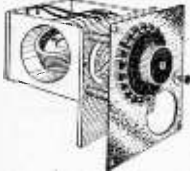
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The most important thing, of course, is the cabinet, and for this we can offer a complete kit of parts which includes cream plastic lid base and escutcheon, cracked metal body and all accessories such as knobs, hinges, lid arm, clips, etc. Price 22/6, but remember this brings the complete cabinet, size 7in. x 4in. x 3in. Other items available are:—Metal Chassis, five-part assembly comprising the main chassis and sections for holding the batteries and the loudspeaker. Price 4/8; Frame Aerial, 3/6; Frame Aerial Cover, 1/6; Oscillator Coil, 3/6; I.F. Transformers, "Wearite" midget, per pair, 17/8; Volume Control, 1 meg. midget, 3/6; Speaker, midget "Plessey" 3in., 14/6; Output Transformer to match 5"-; On/Off Switch, lid operated, 1/6; Resistors, total 9, 4/8; B7G Amphenol Valve Holders, each, 8d.; Battery Stud Connectors, per pair, 9d.; Tuning Condensers, 8/6; Assembly Instructions, including wiring diagram and alignment data, 2/6.

NOTE.—All these parts are offered separately. Valves required are IR5, IT4, IS5, 3S4, or 3V4, all available.

PORTABLE CABINET

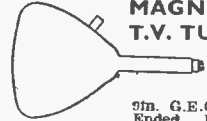
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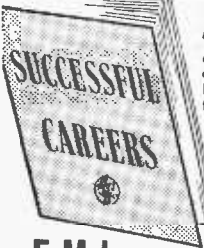
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Radio Receiver Design at V.H.F.—7

FURTHER NOTES ON SPECIAL V.H.F. AERIALS

By G. P. Lowther

(Continued from page 158 April issue.)

NORMALLY one or more directors are used to increase the gain, while the reflector improves the back/front ratio. They are best adjusted empirically. Examples will be given later.

While the low impedance of a dipole renders it suitable for feeding directly with 75Ω coaxial cable, the amateur may well prefer to use open wire transmission line in view of its lower losses and cheapness of construction. In this case a multi-wire or folded dipole is used.

The two limbs of the dipole are folded back upon themselves and separated by about 2in. at 100 Mc/s, less at higher frequencies. Theoretically, the input impedance is four times that of a simple dipole, but in practice it is nearer 400Ω. This is not at all critical, and may, in fact, be fed with coaxial cable without excessive loss. Another advantage of this type of antenna is its much broader resonance curve. It may also be adapted for three or four wires with corresponding impedances of 800Ω and 1,500Ω, but as the number of wires increase so the length becomes more critical and the standing wave ratio increases.

This type of dipole may also be combined with a reflector and directors. As already stated, the radiator length = $\frac{462 \text{ ft.}}{f(\text{Mc/s})}$ or $\frac{5540 \text{ in.}}{f(\text{Mc/s})}$. The reflector is spaced $0.2\lambda - 0.25\lambda$ away and is about 5 per cent. longer, i.e., $\frac{5820 \text{ in.}}{f(\text{Mc/s})}$.

The first director is spaced about 0.1λ away and is 5 per cent. shorter, i.e., $\frac{5260 \text{ in.}}{f(\text{Mc/s})}$ while the second director (if used) has the same spacing, but is about 6 per cent. shorter, i.e., $\frac{5210 \text{ in.}}{f(\text{Mc/s})}$.

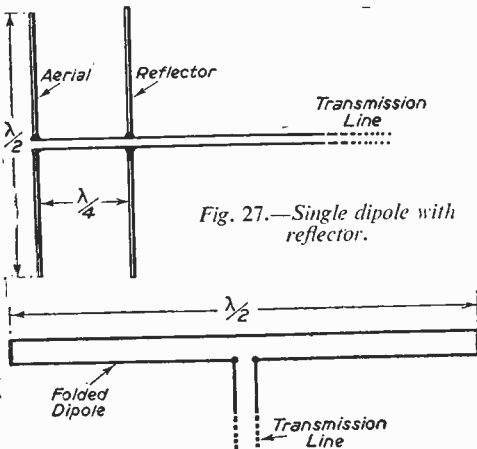


Fig. 28.—Folded dipole.

Instead of rods, plain copper reflectors may be used spaced about 0.2λ away, the gain being 6 db, but a better form is the corner reflector.

If $\theta = 60^\circ$, $X = 0.35\lambda$, $H = L =$ approximately λ (not critical).

Then gain = approx. 15 db and radiation resistance = 70Ω. A simple dipole may be used satisfactorily with, say, $\theta = 90^\circ$ and $X = 0.6\lambda$. Gain = approx. 10 db. Parallel wires spaced about 0.1λ apart may be used instead of a solid reflector, particularly at the highest frequencies. Horns abstract more energy but are too bulky until micro-waves are reached.

The antennae so far described have their directivity mainly in a horizontal plane, but the rhombic aerial has also sharp vertical directivity. Other advantages are that the output changes little over a wide band and the gain is high.

In Fig. 34, $R = 600\Omega - 800\Omega$. A 600Ω transmission line is satisfactory, otherwise matching must be used. Increasing L, which should not be less than 2λ , increases the gain, thus $L = 2\lambda - 4\lambda$, corresponds with gains of approximately 8 db-12 db. Careful design can enable the realisation of gains of 20 db-30 db.

If $L = 2\lambda$, $\theta = 58^\circ$, and the height from the ground = λ , the wave angle (vertical directivity) = 14° . If $L = 3\lambda$, for a wave angle of 14° , θ must = 65° . Full design data is readily available from the larger textbooks.

A very convenient non-directional (e.g., transmitting) aerial fed directly from concentric cable is shown in Fig. 35. Since the $\lambda/2$ aerial is end-fed, the impedance is high and a $\lambda/4$ matching section is required for the low impedance cable. The spacing may best be found by trial and error but should be about 3 in. to 4 in.

For wide-band working, rhombics and folded dipoles may be used or simple dipoles constructed from large diameter (e.g., 1in.) tube. This reduces the

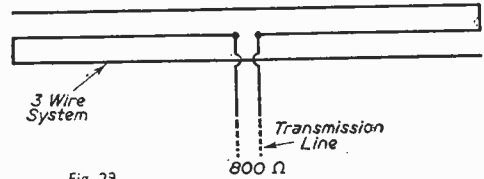


Fig. 29

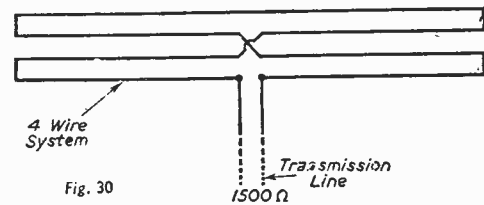


Fig. 30

Figs. 29 and 30.—Alternative forms of folded dipoles

Q to about 2. The length must be reduced by anything up to 20 per cent. according to the size of tubing.

2. Transmission Lines

These are devices to transfer power efficiently from the aerial to the receiver (or transmitter to the aerial), and may be:

(a) two-wire open feeder, (b) concentric line.

(a) Two-wire open feeder

This has the advantages of cheapness and low attenuation and the disadvantage of requiring careful

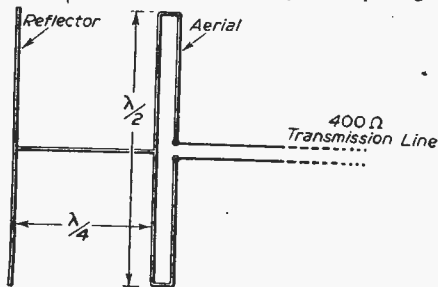


Fig. 31.—Folded dipole with reflector. Gain (over simple dipole) = 4.5 db. Back/front ratio = 5.9 db.

fixing. Its useful impedance range at V.H.F. is from 200Ω to 600Ω.

This is calculated from the expression $Z = 276 \log s/r$ (see Fig. 36).

Fig. 37 shows the spacing necessary for a transmission line of given impedance, while Fig. 38 indicates the attenuation per thousand feet of line for different sizes of wire at an impedance of 600Ω. It is evident that this loss can usually be neglected.

(b) Concentric line.

Owing to the difficulty of realising high impedances at V.H.F., low impedance coaxial cable is frequently

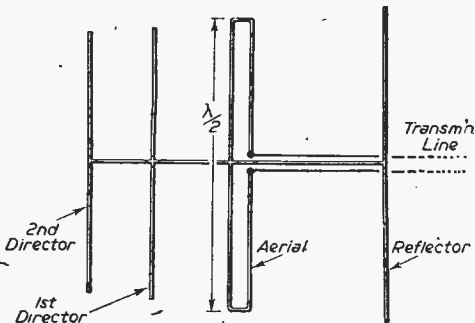
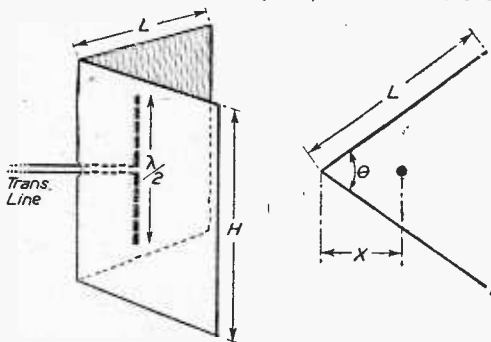


Fig. 32.—Multiple aerial array. Gain (over simple dipole) = 8-10 db. Back/front ratio = 15-20 db.

more convenient than open feeder and has the advantages of being light, flexible and needing no fixing. Its impedance varies between about 40Ω and 150Ω, the most common being 75Ω. It is essential to use cable with low losses and commercial varieties are available for V.H.F. working. The attenuation varies widely according to the diameter and the dielectric used, e.g., with 3/8 in. Polystyrene bead coaxial cable it is 1.3 db/100ft. at 30 Mc/s, 2.1 db/100ft. at 100 Mc/s

and 3.2 db/100ft. at 300 Mc/s. Normally, however, thinner cable is used with considerably higher attenuation. It should be borne in mind that this attenuation may offset the effects of raising the aerial to increase the signal.

Two-wire feeder may be taken directly to a folded dipole or a rhombic, while coaxial cable may be used to centre feed a simple dipole. If, however, the impedances do not correspond, recourse must be



$H \theta = 60^\circ$ $X = 0.35\lambda$
 $H = L = \text{approximately } \lambda$ (not critical)

Fig. 33.—Sheet-type aerial system.

had to matching as described below. (It is not advisable to use resonant lines at V.H.F. as they should not be more than one wavelength long and must be balanced.)

3. Aerial Matching

When the feeder is correctly matched to the antenna, energy is absorbed as fast as it is supplied so that no standing waves are set up. The following methods are frequently used:—

(a) Quarter-wave Section.

In this method of matching, if the aerial impedance = R_a and that of the transmission line = R_t , the impedance R of the $\lambda/4$ section must be made equal to the square root of the product of R_a and R_t , i.e., $R = \sqrt{R_a \times R_t}$. Large-diameter tubing is used for the

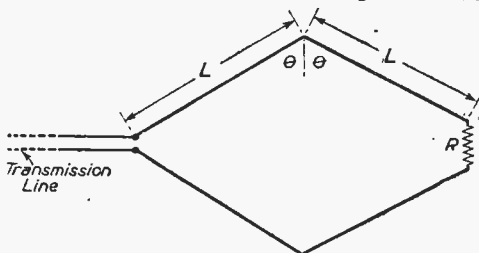
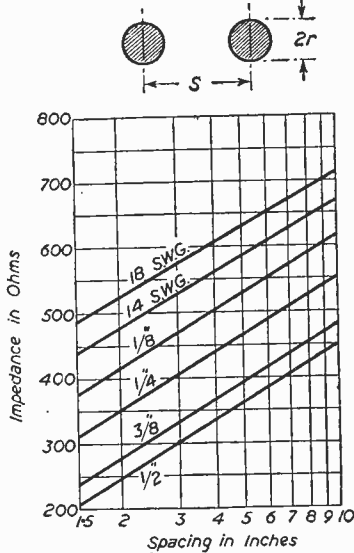


Fig. 34.—The rhombic aerial.

matching section enabling the spacing to be similar to that of the feeder. This minimises the discontinuity at the junction of the two. Suppose, for example, a $\lambda/2$ dipole at 150 Mc/s (impedance 72Ω) is required to be fed from a 600Ω feeder. $R = \sqrt{72 \times 600\Omega} = 208\Omega$. Reference to Fig. 37 shows that this can be constructed from 3/8 in. tubing with a spacing of 1 1/2 in. It will, however, still be narrower than the feeder spacing, though this is of no great

importance. The length of the $\lambda/4$ line is obtained from the expression: $L=2770 V/f$. Where L is in inches, f is the frequency in Mc/s and V is the velocity factor. With open wire sections $V=0.97$ and thus, $L=2690/f$ in. With coaxial cable $V=$ approx. 0.65, and with twisted pair $V=$ approx. 0.6 (twisted pair flex, e.g., electric light flex, can be used as approx. 75Ω transmission line for short distances, though,



Figs. 36 and 37.—Twin-wire feeders and table showing impedance.

of course, losses are high). In the example given above, the length of the $\lambda/4$ matching section = $2690/150$ in. = 18 in.

(b) Delta match

AB Dipole Transmission line

The matching section in Fig. 40 functions as an auto-transformer, the dimensions depending both on the relative impedances of feeder and aerial and the frequency of transmission. If the dipole impedance = 72Ω and that of the feeder = 600Ω , $A = \frac{1420}{f(\text{Mc/s})}$

and $B = \frac{1776}{f(\text{Mc/s})}$

(c) Perhaps the most convenient method of antenna matching at V.H.F. is to utilise the properties of the folded dipole. This has already been described, but it should be noted that the impedance may be raised by making the feed wire thinner, as shown in Fig. 41.

If $\frac{3}{4}$ in. tube and 18 S.W.G. wire are used, the impedance will be of the order of 500Ω .

If it is necessary to match the transmission line to the receiver input a $\lambda/4$ section is the most satisfactory method.

In most cases matching (and impedance values generally) can be checked by soldering an appropriate resistor across the points in question. Thus,

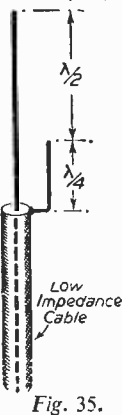


Fig. 35.

if a 600Ω line is matched to a 75Ω input, soldering (not holding in position!) a 300Ω resistor—with the shortest possible leads—across points A and B, or a 37.5Ω resistor across points C and D in Fig. 42,

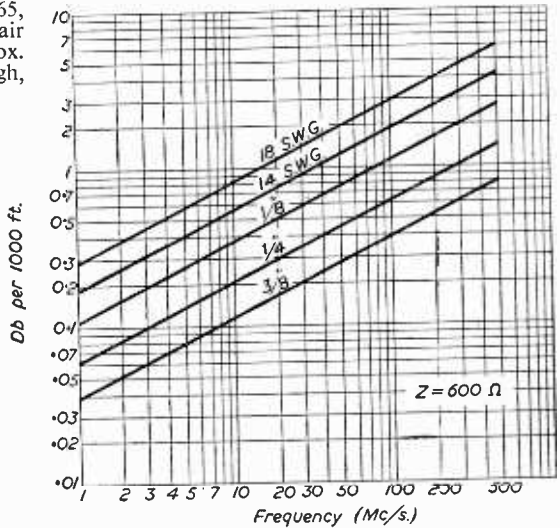
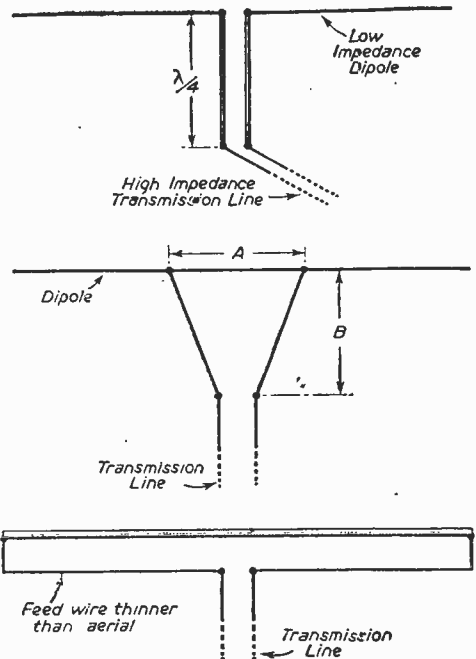


Fig. 38.—Table showing attenuation.

(to be given next month) will result in a fall in signal level of 6 db (assuming there is no limiting or A.V.C. action).

(To be continued.)



Figs. 39, 40 and 41.—Alternative aerials and matching systems.

THE controversy between T.R.F. and superhet communication receiver enthusiasts has existed since superhets were first introduced and will, without doubt, continue to do so until some other, better, method of receiving short waves is evolved. It is a question difficult to settle, although it cannot be disputed that on some counts at least the superhet definitely has the advantage. Where it does fail is precisely on the very points in which the T.R.F. is superior, those of sensitivity and low noise level. But at no

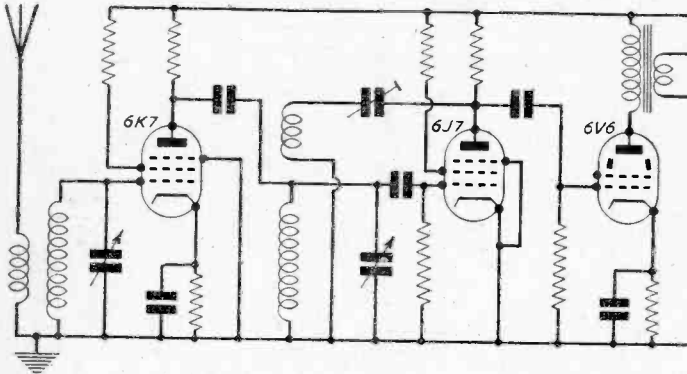


Fig. 1.—The basis of most popular T.R.F. receivers.

time can the T.R.F. offer the same degree of selectivity that is the main feature of the superhet circuit, and it is well to bear this fact in mind. That apart, however, a well-designed T.R.F. receiver can give infinite satisfaction on short waves, and the absence of noise and second channel whistles and the inherent sensitivity of the circuit adds considerably to the pleasure of using it.

The majority of T.R.F. receivers, whether intended for communications purposes or for mere domestic listening, usually rely on the old, well-tried combination shown in Fig. 1, though, occasionally, there are variations on the theme. It is a useful and sensitive arrangement but it can be considerably improved upon without much effort or expenditure. Again, it is almost customary to use tuning condensers of 100 to 160 pF and seven or eight coils to cover 200 down to 10 metres in such receivers, when they are designed primarily for short waves, in order to secure a good L/C. ratio. But even this is only a compromise, for it is obvious that a 20 pF condenser and a larger inductance would give a better L/C. ratio on the higher frequencies. As a compromise has to be used in any case it would appear better practice to restrict the number of coils to, say, five, increase the tuning capacitance to 365 pF, and use a good slow-motion drive to achieve something like the same purpose. This is, in fact, particularly desirable where the range covered extends above 200 metres, and has also the advantages of reducing circuit wiring, the number of trimmers and switch contacts and simplifying actual construction work. These ideas, together with others which have some pretensions to novelty, were embodied in a receiver built some time ago by the writer. The main purpose

A T.R.F. Comm

A FOUR-VALVE PLUS RECTIFIER A.C. MAINS

By T.

in building it was to secure "a quart from a pint pot" and apart from the froth that aim was pretty well achieved!

As a former Merchant Navy radio operator the writer is naturally interested in morse and in shipping, and as a one-time short-wave transmitter engineer equally interested in "shorts." The set, therefore, had to cover the international shipping band of 600 metres, the medium wave broadcast band—and short waves from 200 to below 10 metres, which all adds up to a very hybrid sort of communication receiver!

Circuit

The circuit is given in Fig. 2. The first valve is a 6SK7 vari-mu

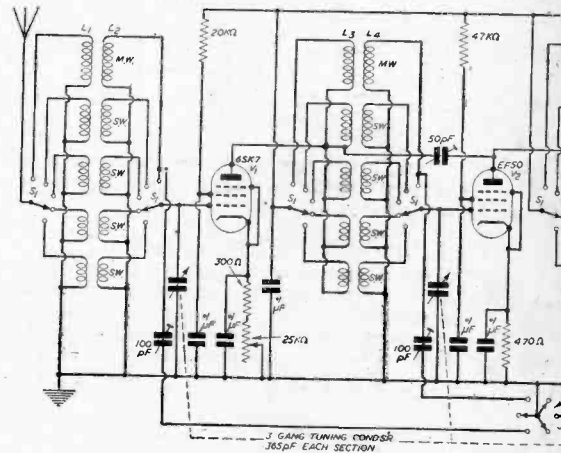


Fig. 2.—Theoretical circuit

LIST OF COMPONENTS

- | | |
|--|--|
| Three International octal holders (Ceramic). | One .01 μ F. condenser (working). |
| Two EF50 holders (Ceramic). | One .0002 μ F. mica condenser. |
| One 2-pole 6-way 4-bank Yaxley switch (Ceramic preferably). | Six .1 μ F. mica condensers. |
| One 3-pole 2-way 1-bank Yaxley switch. (Ceramic insulation). | One .25 μ F. electrolytic condenser (working). |
| One 3-gang 365 pF. variable condenser (Ceramic insulation). | One 8 x 8 μ F. electro. condenser (working). |
| One Muirhead, National or similar dial (for self-calibration), high ratio. | One 10-20 henry. inductor. |
| Fifteen 3-30 pF. variable trimmers (grid coils). | One mains transformer (input; output, 275 v. at 2 amps. size). |
| Three 100 pF. variable trimmers. | One phone jack (tip size). |
| One 50 pF. variable trimmer. | One 25,000 ohm potentiometer. |
| One .0003 μ F. mica condenser. | One 1 megohm potentiometer. |
| One .02 μ F. condenser (350 volt working). | |

Reaction Receiver

EIGHT RECEIVER FOR THE EXPERIMENTER

Dresser

R.F. pentode, and is used principally in order to simplify gain control. The second R.F. amplifier is an EF50 in a fairly normal circuit except for the fact that a certain amount of reaction is applied by means of a pre-set trimmer to increase the gain and selectivity. Following this is another EF50 functioning as a leaky-grid detector and having variable reaction to improve still further the selectivity. It is worth noting that the form of reaction used and the way in which the valve electrodes are connected ensure very smooth reaction down to the limit of the tuning range, 9.2 metres. With two EF50's in circuit, and EF50's having such a high gain, it is obvious that screening must be

good between stages, and here a leaf has been taken from television practice by placing a small sheet of tin across the EF50 base, as shown separately in Fig. 5. The coils, of course, are separately screened, and the wiring layout such that there is no noticeable interaction. From the detector the signal passes through a normal R.C. network into the output valve, which is a 6V6.

Five coils are used to cover the required range, the medium-wave coils being padded up with trimmers to cover the 600 metre band. In this

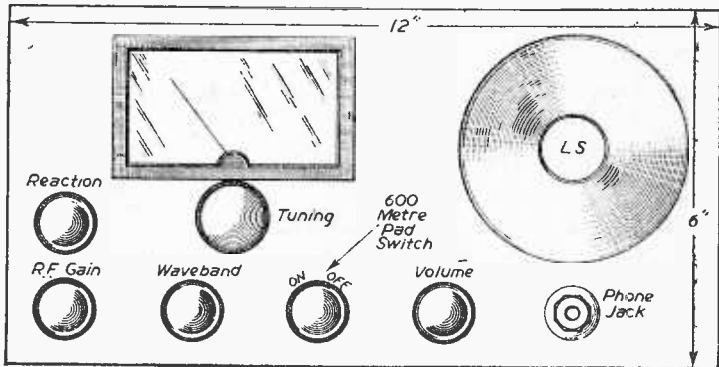
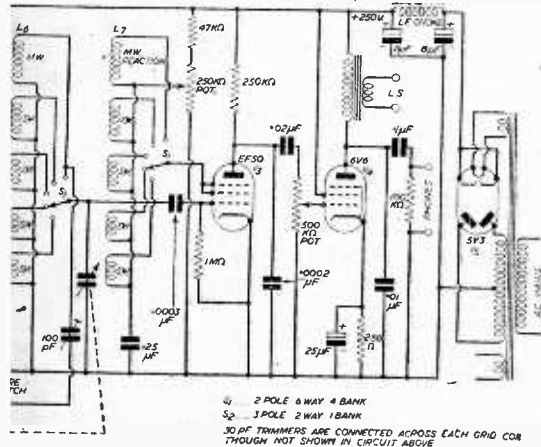


Fig. 3.—Panel layout.



the receiver described here.

COMPONENTS

- 0 volt working). One 1 megohm potentiometer.
- resistor. Two 47,000 ohm, 1/2 W. resistors.
- 1 volt working). One 20,000 ohm 1/2 W. resistor.
- 1 volt working). One 1 megohm resistor.
- condenser (25 volt One 1 megohm resistor, 1/2 W.
- condenser (350 One 300 ohm resistor.
- Headphones.
- One 470 ohm resistor.
- One 250 ohm resistor.
- 200-230 volts One 100,000 ohm resistor.
- 100 volts, 60 mA. One 6SK7 valve.
- 2 amps (small in Two EF50 valves.
- One 6V6 valve.
- One 5Y3 valve.
- leave type). One 3 1/2 in. permanent magnet speaker (opt.
- eter. to match 6V6 to voice coil).

connection it is worth while studying the coil data given on page 218. It will be seen that the figures given there for the aerial coupling coils are not at all standard, for, whereas for a large number of years it has been customary to use only about 10 or 15 turns with a grid coil of 100 turns, the coil data given indicates three times that number.

Selectivity

Older readers may remember that in the days before high power and myriads of stations it was common practice to couple tightly by either feeding the aerial directly into the grid circuit or by a large coupling winding, and the station-getting qualities were very high in consequence. The loose coupling of to-day was instituted purely as a measure towards selectivity, but it does not necessarily follow that it is the best answer to the question of selectivity versus sensitivity and in the coils used with this receiver a compromise has been arrived at which promises greater sensitivity with very little sacrifice of selectivity. This is particularly noticeable on short waves. The moderate amount of reaction on the second R.F. valve and that on the detector help considerably in sharpening the tuning and retaining a fair degree of selectivity, while a gain control in the cathode of the 6SK7 effectively prevents any overloading of that or the following valves. Provision has been made for using headphones.

Here readers are strongly advised to use either moving-coil headphones, which provide outstanding 'phone quality on broadcasts or amateur 'phone signals or, alternatively, a pair of Brown's moving-reed 'phones obtainable on the surplus market at about five shillings. Both are well worth buying for their response characteristics alone.

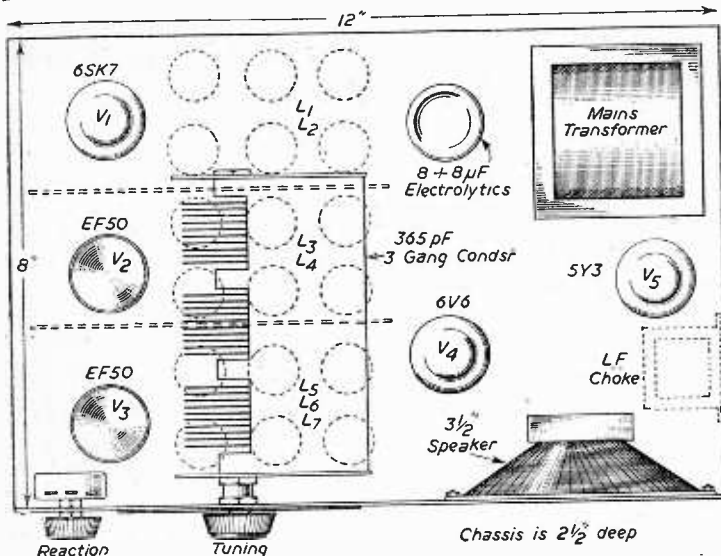
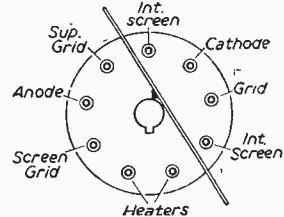


Fig. 4 (left).—Layout and dimensions of chassis.

Fig. 5 (below).—Method of screening valveholder.



COIL WINDING DATA

Band (Mc/s)	Turns						
	L1	L2	L3	L4	L5	L6	L7
0.55 to 1.5	40	110	30	110	30	110	60
1.4-4.0	30	35*	20	35*	20	35*	25
3.5-8.0	8	13†	12	13†	12	13†	15
7.0-15	5	7‡	6	7‡	6	7‡	8
14.0-33	2	3§	2	3§	2	3§	3

Controls

The controls are R.F. gain, wavechange, tuning, L.F. volume and reaction in a symmetrical layout which does not impair the efficiency. The receiver is built on an aluminium chassis of 20 s.w.g. to the dimensions indicated in Fig. 4, which also shows the location of the components and drilling details. Fig. 3 gives the front panel layout and dimensions. A 3 1/2 in. P.M. speaker is used and is quite capable of giving all the volume one is likely to require in an amateur shack.

Aligning the receiver is quite a straight-forward matter. The trimmers on the detector grid coils are adjusted to approximately half their capacitance, and the preceding stage and first R.F. grid coils trimmers are then adjusted to peak signal aurally or preferably on an A.C. voltmeter across the output transformer secondary winding. Finally, the detector trimmers are again slightly adjusted either way, and trimming is complete.

If either R.F. trimmer appears to peak with the trimmers hard in add a turn to its associated coil or parallel a 10 pF condenser with the trimmer. Equally, if the trimmers appear to peak wide open remove a turn or portion of a turn, or series another 30 pF trimmer with the original one.

All coils wound on 1in. ceramic formers of 32 s.w.g. enamel wire, except those marked *, †, ‡ and §. All closewound.

- * Wound with 24 s.w.g. enamel wire.
- † Wound with 22 s.w.g. enamel wire.
- ‡ Wound with 20 s.w.g. enamel wire.
- § Wound with 18 s.w.g. enamel wire.

- L1, L3, L5 spaced 1/4 in. from L2, L4, L6 at earthy end.
- L3 interwound with L4 on 14-33 mc/s coil.
- L7 spaced 1/4 in. above "hot" end of L6 in every case.

Daventry Unattended

THE new high-power (150 kilowatt) Third Programme transmitter at Daventry, which came into service in April last year on 464 metres, has been working unattended since January 13th. This is a notable achievement, since it is the first high-power transmitter to be operated by remote control.

The BBC has been operating several low-power stations in this way for some time past, but the unattended operation of high-power equipment is a much more difficult problem and its solution represents an important step towards easing the present-day shortage of skilled man-power. Normally at least two engineers per shift would be needed to

operate a high-power broadcasting transmitter, but by making possible the remote control of the station from another point, already and necessarily staffed, the trained technical staff normally in local attendance can be released for duties elsewhere. The remote control system being used has been jointly developed by BBC engineers and by Marconi's Wireless Telegraph Co., Ltd., the manufacturers of the transmitter.

It seems fitting that this important development should be at Daventry with its long history as a BBC transmitting station where much pioneering work in broadcast engineering has been done. It was from here, over 26 years ago, that the first high-power long-wave broadcasting transmitter in the world (5XX) commenced its transmissions.

All-wave Receiver Switching

PRINCIPLES OF DESIGN IN MULTI-WAVEBAND RECEIVERS

By L. Butterworth

THE designer of commercial radio equipment at the present day has, of necessity, to practise stringent economy in components and materials. It is probable that this trend will eventually transform the broadcast receiver of the present time into something vastly different in every respect, and even now the effects of it can be seen in most modern receivers.

To avoid any deterioration in performance, as compared with the less austere designs of past years, much ingenuity is employed in circuit design, and it is essential for an understanding of the modern broadcast receiver to be familiar with this type of design for economy.

One of the first sections of the all-wave receiver to receive the attention of the economy designer was the tuning unit, that is to say, the aerial, H.F. and oscillator tuning and switching. The H.F. stage disappeared entirely, the cost of it outweighing, in most receivers, the advantages derived from its use, and the construction of coils, mounting and screening, greatly simplified. But the main interest, both to the professional and the amateur radio man, lies, of course, in the circuitry employed. This is, at first glance, much more complex, but if the need for economy is borne in mind when studying the various circuits it will be seen that effective circuits are still basically the same as before, and it is in the avoidance of switching that the circuit departs from standard practice.

The type of wavechange switch, required by the text-book circuit, of an all-wave receiver, is an expensive item. It will be seen from the circuit of Fig. 1 that to provide switching over four ranges, long, medium and short waves, and "gram," a five-pole, four-way switch must be employed. If it is considered necessary to earth the live ends of unused windings then the switch required must have three banks, and becomes a costly item. This can be reduced by not short-circuiting the coils, provided care is taken in the layout to avoid absorption, but the switch will still require five poles and a minimum of two banks to carry them.

By omitting the switching of the pick-up input (a very undesirable practice) the number of poles is reduced to four, and the switch could be built on one wafer (Oak type), but there would be considerable danger of capacity coupling between sections on the front and rear of the wafer with attendant troubles.

If, on the other hand, the circuit could be rearranged to use only three poles, gram switching being retained, these could be accommodated on one wafer of a miniature type switch, which has the advantage of being cheap and of having little coupling between

sections in the switch itself. It is found in practice that the aerial circuit can be switched satisfactorily on one pole, and the oscillator on another pole, with a little help from the gram-switching pole.

The Aerial Circuit

To permit the use of one pole only it is necessary to switch only the tuned windings, and devise a method of aerial coupling which will work efficiently on all bands with no switching.

The standard circuit, employing an untuned aerial winding on each band, is probably the most well known, but, in many ways, the method known as shunt-capacity coupling is superior for long and medium-wave operation. The circuit takes the form shown in Fig. 2, and it will be seen that the long and medium-wave coils have a capacitor connected between their common earthy ends and chassis. The aerial is taken to the junction of coils and capacitor. Obviously then, the capacitor is a common impedance between aerial and tuned circuits, and voltages developed across it are transferred from aerial to grid coil. The voltage transfer is lower than with other methods, but selectivity is improved, and the response is fairly level over the bands concerned. It is necessary to insert a series condenser in the aerial lead to reduce the effect of abnormal aerial constants, and to tie the circuit down to chassis by means of a resistor connected either from aerial to chassis or across the coupling capacitor. If series feed is employed for the A.V.C., the coupling capacitor serves as the A.V.C. decoupling capacitor, its value, around .002 μ F, being adequate for this purpose. If, now, the aerial is taken to the top of the coupling capacitor via a low-impedance coupling winding on the short-wave coil, this does not affect the performance on long and medium waves, and gives us, additionally, an efficient short-wave circuit.

The Oscillator Circuit

The oscillator circuits in general use employ

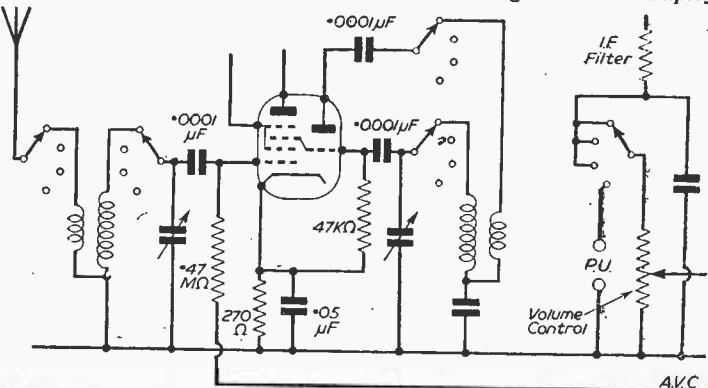


Fig. 1.—Standard aerial and oscillator switching. Only one coil is shown for clarity.

reaction feedback, and on long and medium waves a form of reaction-cum-Colpitts circuit, but, in practice, a Colpitts circuit will function adequately without the assistance of reaction and if a common series padder is employed for both bands, as in Fig. 4, will only require one switch pole operating in the tuned circuits. The additional padding required on long waves can take the form of a capacity of about 300 pF, connected across the long-wave coil. It will be seen that the tuned circuit

It will now be apparent that the long-wave coil, trim and parallel padder are effectively a closed circuit which will have a resonant point approximately at 600 kc/s. Therefore the coil should be kept well away from the medium-wave coil.

Pick-up Switches

The two circuits given above employ only two poles of the suggested switch, leaving the third pole free for gram switching in the normal manner.

Unfortunately, the use of a parallel padder on long waves means that the coil required will be smaller than the standard long-wave coil, its inductance being little larger than that of the medium-wave coil.

If it is desired to use a standard long-wave coil then a series padder of about 220 pF must be used, and the circuit rearranged. The long-wave padder is wired from the earthy end of the long-wave coil to the top of the short-wave padder. This leaves the effective pad on long waves as 220 pF in series with, say, 6,000 pF. The oscillator anode condenser connects to the short-wave coupling coil and through

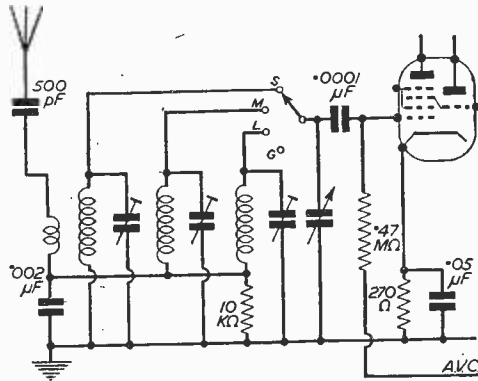


Fig. 2.—Parallel-fed A.V.C.

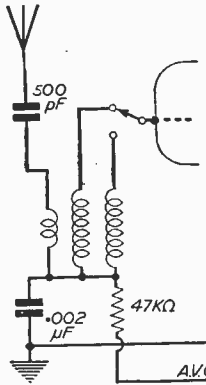


Fig. 3.—Series-fed A.V.C.

is in the grid of the valve, and the anode is connected through the anode feed condenser to the junction of coils and series padder. The Colpitts action is derived from the fact that the padder and the gang condenser form an effective capacity of about 500 pF (when the gang is at maximum) tapped to chassis. Unfortunately, the value of padder required for short-wave working, about 6,000 pF, precludes the use of a Colpitts circuit, and a reaction oscillator is a *sine qua non*. This can be achieved by taking the anode through a coupling coil on the short-wave coil before its connection to the top of the padder. This, again, will not affect long and medium-wave operation, and gives an effective reaction oscillator on the short-wave band. Performance on the short-wave band is improved if the medium-wave padder is connected to the top of the short-wave padder instead of to chassis. The effective padder on long and medium waves remains substantially the same. The complete circuit is given in Fig. 5.

this to a coupling winding on the medium-wave coil, the earthy end of which is taken to the earthy end of the long-wave winding. The medium-wave tuned winding is earthed through a normal padder of about 500 pF. As the circuit is now, the reaction winding consists of a short-wave and a medium-wave winding in series. While this is satisfactory for medium-wave operation, it is certainly not so for S.W. operation, and it is necessary to by-pass the medium-wave winding when on short waves. Obviously, then, a second switch pole is needed—and, if the switching is to be confined to three poles only, the gram section of it must be pressed into service. This necessitates a special arrangement of the gram input. Instead of taking the top of the volume control to the fixed contact of the switch and connecting it, in turn, to the diode load, for radio, and the pick-up input for gram, the procedure is reversed and the pick-up input is taken to the fixed contact, being connected to the top of the

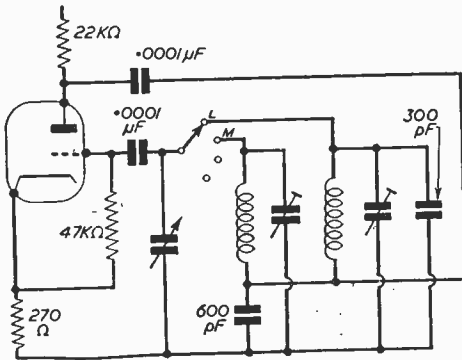


Fig. 4.—Long and medium-wave oscillator circuit.

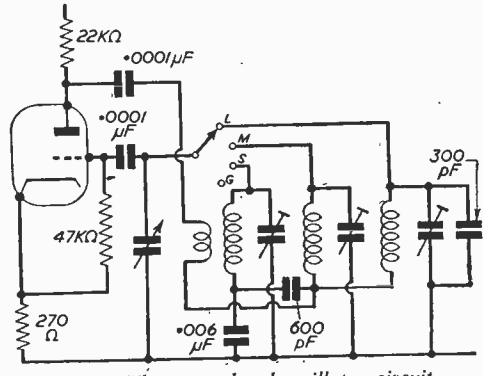


Fig. 5.—Three-waveband oscillator circuit.

volume control when moved to gram. If a standard correction circuit, e.g., a series resistor and parallel condenser, is incorporated in the pick-up input, the correction condenser, of say .001 μF becomes available on the unused tags of the pick-up switch pole, and can be used as a by-pass condenser where necessary. Accordingly—for our present circuit—the short-wave tag of the pick-up switch pole is wired to the junction of the short-wave and medium-wave reaction windings so that in this position the medium-wave winding is adequately by-passed by the correction condenser. Greater efficiency is achieved with a short-wave oscillator if the reaction winding is returned to the top of the padder, and this is effectively done by wiring the earthy end of the correction condenser to the top of the short-wave padder. This improves oscillation at the low-frequency end of the short-wave band, and, since a short-wave padder is usually of 6,000 pF, the actual value of tone correction on gram is appreciably unchanged.

Precautions

The method of pick-up switch wiring outlined above is extremely useful since the correction condenser is available on all the radio positions, if needed, for by-passing or effectively short-circuiting unused coils which might otherwise cause absorption spots, but there are one or two points which need careful attention if the receiver operation on gram is to be satisfactory.

In the first place this method of wiring the volume control to the switch does not allow for the muting of the radio section by open-circuiting the diode load as is standard practice. The frequency changer is, naturally, rendered inoperative, as the various coils are not connected in circuit but none the less, a considerable volume of noise may still be heard. This can be removed by mistuning the hexode anode, and a simple way to do this is to wire this anode so that when the switch is in the gram position, the anode is connected to the oscillator grid. The various capacities in the oscillator grid circuit mistune the hexode anode circuit, i.e., the I.F. transformer primary, and remove mixer noise completely.

A second point is that since the diode is not

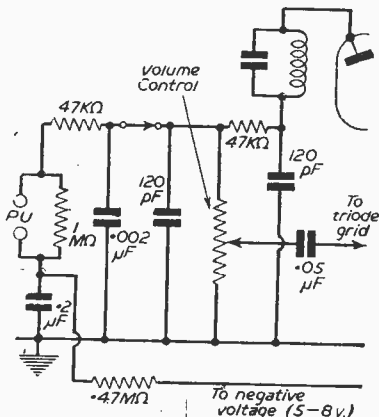


Fig. 6.—Alternative circuit of three-waveband oscillator.

disconnected it will be effectively in parallel with the pick-up circuit and will conduct if the pick-up voltage swings sufficiently positive—causing a varying short-circuit across the input. In practice the effect is reduced by including an I.F. filter resistance between the volume control and the diode

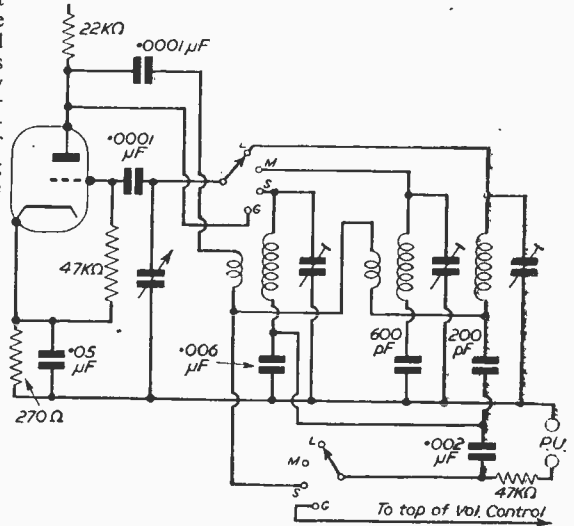


Fig. 7.—Pick-up circuit arranged to give paralyzing bias on diode to prevent distortion due to diode when using high impedance pick-up.

winding. This has a value of 50 k Ω and, provided a pick-up of fairly low impedance—such as the standard magnetic type, is used—is sufficiently high to prevent the diode having a noticeable effect. However, if a high-impedance pick-up having a fairly high output is used, serious distortion is evident, which can be removed by open-circuiting the diode. Unfortunately, on the three-pole switch under discussion, no pole is available for this purpose. However, the same result can be achieved by applying a negative bias of some 5-10 volts to the diode, and provided a blocking condenser is used between the pick-up and the L.F. grid following it, the bias can be applied to the diode via the pick-up itself. This is done by connecting the pick-up negative terminal to a point negative to chassis by the required amount. Decoupling of this negative lead may be necessary to prevent hum, and this can be achieved with a high series resistance and fairly small by-pass condenser, say 2 μF , as no current flows in the circuit. The complete circuit is given in Fig. 7.

It will be obvious that there are many different versions of the above circuits and that the devising of them is an interesting pastime, but one which should not be attempted unless equipment is available for thorough checking of the results. It is hoped, however, that the above discussion will at least prove thought-provoking, and possibly arouse more sympathy for the present-day designer who works under handicaps unknown before the war.

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Programme Pointers

A MONTHLY CRITIQUE BY MAURICE REEVE

THE tragically sudden death of His Late Majesty confronted the BBC with a programme crisis it had not experienced before. Certainly not since the passing of George V or the declaration of war, both of which events were different, because not unexpected. Was the problem handled wisely or unwisely; would a less abrupt termination, or cancellation of the published programmes have met the situation with an equal dignity and affectionate salute? In my opinion it was tackled with something of masterly nobility, and Lafeu's "Moderate lamentation is the right of the dead; excessive grief the enemy of the living" (All's Well that Ends Well) might have been spoken in criticism of those ten days.

They were the leading event of the month under review, so a few words on them will not be out of place.

That there was a sharp division of opinion was manifest from both press comments and the verbally expressed opinions one heard from the listening public. I quote from one of each. In a very thoughtful and well-judged leading article, the *Daily Telegraph* said: "... Many thought the initial hush more eloquent than words, and few can be so addicted to the banalities of the Light Programme as to lament their absence at such a time as this. For the rest, what the BBC has given us has been of the best..." I entirely concur, and of those sets that were silent in protest, one can only sigh in despair.

The other side was rather racily expressed by Mgr. Heenan, Roman Catholic Bishop of Leeds, who, in the course of a memorial address, said: "... It (the BBC) wrapped the nation in organised gloom for more than a week. . . . I cannot think that the memory of our gracious King was well served either by the melodrama of prolonged silences on the day of his death or by the sombre and mirthless programmes which the afflicted among our fellow countrymen were offered without alternatives for more than a week. Catholics hold that mourning does not mean misery. . . ."

Ye Gods and Little Fishes! So listening to the most glorious music gloriously played and the most wondrous poetry beautifully read is "misery"! "Sombre and Mirthless"! And why, pray, shouldn't the "afflicted" take their place in the national homage? Really, I give it up! The Enigma Variations and the Unfinished Symphony, etc., organised gloom! They were ten memorable days in the annals of broadcasting, and if the high festival of the Coronation is handled with equal regard for the temper and character of the occasion, we are in for some more programmes far above the daily average.

My one regret was for the many artists whose engagements had to be broken, and the lesser known of whom were looking forward to their microphone rendezvous with pleasure and enthusiasm. Let us hope they will not be overlooked in the future.

Plays

The mention of W. Somerset Maugham's play, "The Letter"—adapted by the author from his celebrated short story of the same title—will recall

to many Gladys Cooper's great success of many summers ago, 1927 to be precise. Mr. Maugham vouches for the authenticity of the story, which is of Leslie, the wife of a typical British—Maugham—agent or something who, on learning that her lover has thrown her over for a native Chinese woman, sends him the incriminating note begging him to come round to see her that night for one more chance at a reconciliation. But, to try and save herself from the worst consequences of her folly, she has tried to make out that it was merely a request to see him about a gun for her husband. Again, when she shoots him for his final desertion of her, it is said to be because of his unwelcome attentions and in defence of her honour. The poor wretched husband pays more than everything he possesses to gain possession of the letter, which act of self-sacrifice results in the wife's acquittal at the subsequent trial.

The story is a masterpiece of the baser passions, of a husband's misplaced faith and of the poisonous, fetid and overcharged-with-sex atmosphere of the tropical Far East. The performances of the various actors didn't quite succeed in infusing their parts with this atmosphere, and the whole production seemed on the rather pedestrian side. Catherine Lacey played the former Gladys Cooper part, with James McKechnie, Howard Marion Crawford and John Witty in chief support.

Gogol's comedy of Russian bureaucracy and class snobishness of a hundred years ago is, on the other hand, one of those ageless masterpieces which, like Shakespeare and a handful of others, is of any age and any place. They deal with the fundamentals of human character and folly found all over the world, in all ages, nations and climes. Gogol's classic deals with the imminent visit of the Government Inspector to an incompetently run municipality, or district, how all the nincompoops fawn round and kow-tow to the wrong man, signalled out by gossip as the dreaded gentleman, and of how, when the real Inspector arrives at the end of the play, all chances of covering up inefficiency and corruption have been lost. Perhaps because it was on the fear-some Third, the production seemed more alive than "The Letter," and to go with more swing and verve. Norman Shelley, Raf de la Torre, Frank Atkinson, Bryan Pawley, Viola Lyell, and Nicolette Bernard were of the very good cast.

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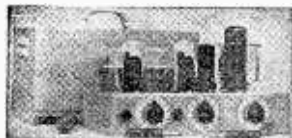
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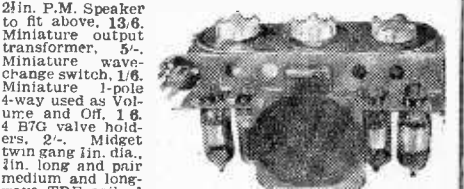
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Partly stripped by M.O.S. Tx. section removed still contains 7 tropicalized 30 Mc/s. I.F. Trans. motor generator BTG and other valveholders, etc., etc., in metal case. 151 x 71 x 7in. Wgt. 121 lbs.

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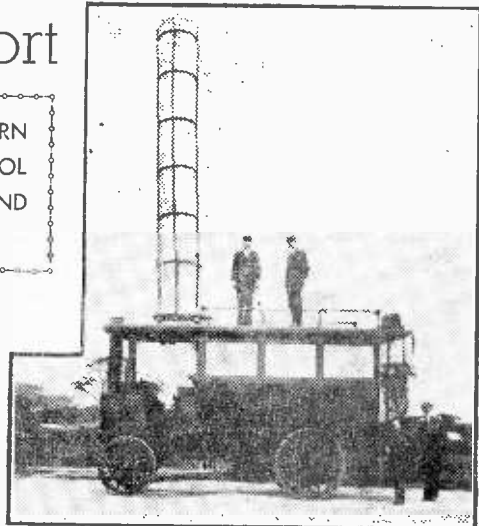
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Radio and Transport

AN INTERESTING ACCOUNT OF MODERN METHODS OF TRANSPORT VEHICLE CONTROL FROM A CENTRAL CONTROL POINT, AND THE EQUIPMENT WHICH IS USED

THE use of mobile radio to control and co-ordinate road transport of every type has raised many problems in recent years. Perhaps the greatest of these has been the suitability of sites and the choice of equipment, both problems which can hardly be overcome by the transport operator without expert research and advice. In order to provide such a service, at an extremely high technical standard, Marconi's Wireless Telegraph Co., Ltd., have now organised a fully equipped team of vehicles and engineers whose survey work, reports and advice are proving of inestimable value to prospective users of V.H.F. equipment.

Modern methods of miniaturisation have allowed the design and manufacture of compact, dependable transmitter/receivers which can be accommodated unobtrusively in vehicles, and which can be run off the normal vehicle's battery. With these mobile installations and a headquarters transmitter/receiver to act as control a network is set up which saves time and money for the operator. Without a preliminary survey and an accurate diagnosis of the problems arising, such a network might well cost too much money. A headquarters installation, for instance, which has been set up without a survey can very often show "blind spots" when set to work. This fault is mainly due to the siting of the station and can usually be obviated by careful aerial planning and choice of equipment. This is the type of service which the Marconi mobile team performs.



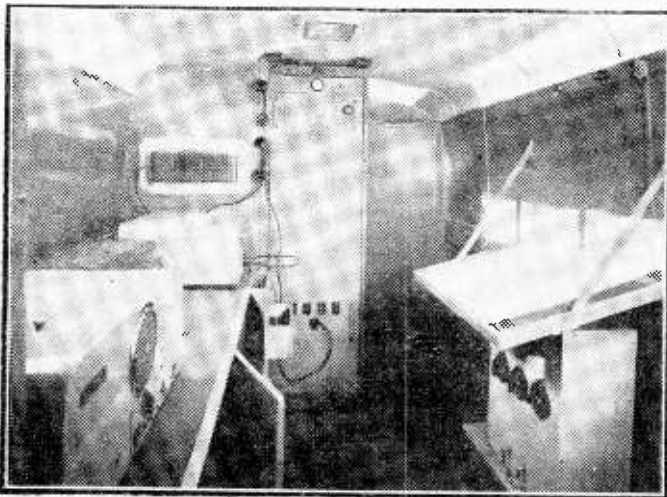
The first radio-equipped road vehicle—a steam-driven omnibus. Marconi is standing on the right on the roof.

Not New!

Despite the apparent newness of mobile radio its history actually begins when wireless was invented. It was first visualised as a link between land and ships at sea; it entered quite early into the development of aeronautics; and most road users to-day would be surprised to know that a steam-driven omnibus was fitted with wireless by Marconi in 1901. In 1919 a public demonstration of communication by wireless between a road vehicle and a "headquarters" was given by Marconi when signals were passed between a mobile station in Chelmsford, Essex, and a fixed station in London. The vehicle used in this demonstration was a steam omnibus belonging to the National Steam Car Co., Ltd., Chelmsford and District, and is pictured above.

The modern fleet of Marconi mobile wireless stations to-day contain a comprehensive collection of the modern mobile and fixed station equipments which, used during their survey work, allow the engineers and prospective users to decide which equipment is the best for their specific purposes. Efficient survey work and reports call for a wide range of equipment, for the team will cover areas ranging over vastly different terrain, tackle a wide range of individual problems, and be able to plan, on the spot, installations and networks to satisfy existing conditions and requirements.

The survey team has a Commer van and two Hillman Minx station wagons, the former equipped as a headquarters station and the two Hillmans as mobile stations. Their



Interior of the specially equipped modern Marconi road-survey van

initial object is to survey a given area, operate over that area the type of equipment suitable for the particular purpose envisaged, and plan and advise on the siting of headquarters stations to ensure maximum coverage over that area.

The Commer, particularly, is of interesting design. The special coachwork, mounted on a 2½ cwt. chassis, follows the conventional lines of a large ambulance, and was built to Marconi's design by J. S. Keam and Co., Ltd., Hackney Wick. The normal side windows have been eliminated in this design; the interior fittings, benches and equipment of varying heights making it difficult to ensure symmetry. Top windows, curved to conform with the lines of the bodywork, are fitted between the top of the sides and the roof, and these give excellent working light within the vehicle.

Comfort during long-distance tours was of major importance and superior bucket seats have been installed. The Commer is completely self-contained and can remain away from base indefinitely.

Equipment

It carries three main types of headquarters equipments. They are a 5-watt transmitter/receiver used in conjunction with similar mobile sets; a large power model giving 10 watts output; and a main headquarters installation designed to cover a wide area. Aerial mast sections are carried on the roof of the vehicle and are held in position by clamps. Hinged footholds at the rear of the van give access to the roof and a compartment for stowing mast rigging together with two sets of clips for erecting an aerial on the van are also fitted to the rear.

A petrol-driven alternator is carried in the Commer and it is stowed in a compartment on the near-side of the van. When the door of this compartment is swung down it rests on collapsible legs and makes a platform for the alternator. On the off-side is a lead-lined battery compartment which accommodates four normal-size batteries.

Barnstaple Transmitting Station

IN accordance with the previously announced plan to improve reception of the Home Service programmes in certain areas, the BBC is building a new low-power transmitting station at Fremington, between Barnstaple and Bideford, Devon. As, however, the building and installation will take some considerable time to complete, a temporary transmitter installed in a caravan will be used on the site in order that listeners in this area may have an improved service much earlier than would otherwise have been possible.

The caravan transmitter was brought into service on March 9th with a wavelength of 285 m. (1,052 kc/s), and radiates the West of England Home

The interior is divided into a demonstration section and a workshop. Ancillary equipment in the van includes cable drum storage, a map table, and a battery charger. All power supplies are brought



The external appearance of the van shown on p. 225.

through a main distribution panel which supplies 230 volts A.C. or 12 volts D.C.

Apple green and cream are the colours which decorate the interior, with bench tops covered with cork linoleum. The exterior is finished in light grey with blue linings and the Marconi trade mark.

The Hillmans are fully equipped mobile stations and can rove in any area, communicating with the Commer as they go. Two of them can cover wide areas rapidly and an excellent picture of prevailing conditions can be appreciated by the engineers. This three-vehicle team is complete in itself and capable of exploring all difficulties and problems attached to suggested schemes. They can then present to the prospective user a complete and accurate report, together with a suggested plan for efficient and dependable radio control of vehicles.

Service. The aerial system already erected for the permanent station is being used for the temporary transmitter.

The station is intended to serve Barnstaple, Bideford and their immediate surroundings, but maximum coverage of the outlying areas will not be achieved until the permanent station is in operation. The temporary transmitting equipment consists of two 250-watt medium-wave transmitters, one normally being a reserve for use in the event of a breakdown, but provision is being made for paralleling the two outputs to give a total aerial power of 500 watts.

The programme will be fed to the transmitter over Post Office circuits. Four G.P.O. lines are terminated in the vehicle, a programme line and a spare programme line, a control line to the nearest BBC centre and a G.P.O. telephone circuit.

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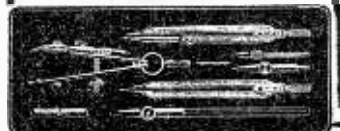
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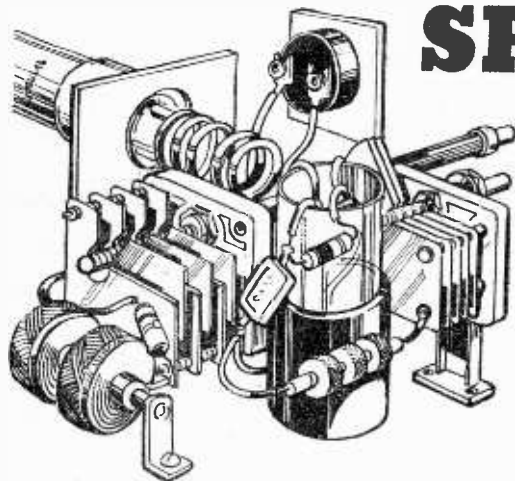
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SHORT-WAVE SECTION

Pre-war Communication Receivers

DETAILS OF CIRCUITS, ETC., OF SOME OF
THE POPULAR COMMERCIAL MODELS

By A. W. Mann

IN the November, 1951, issue of this journal the writer discussed the progressive development of the short-wave receiver, including those of the communications type.

The Americans have been well to the fore in the design and development of the communication receiver, and some of the more expensive models are not only pleasing to the eye but are highly efficient precision instruments.

Such receivers, however, were not designed with the retail price factor alone in view, but rather to a definite standard of efficiency, reliability and versatility. Thus the amateur who could afford them was assured of a product which, in many instances, met his most exacting requirements with a little to spare.

The same applies in connection with British and American communications receivers as produced at the present time. Briefly we get what we pay for, and the little extra in price between two different models is usually found to be justified in terms of performance.

Although the writer can recall some so-called communications receivers which were obviously built down to a price, and were little better than a standard superhet., there were some which though comparatively cheap were outstandingly good in every way.

The average short-wave listener is not in a position to study receiver specifications and chooses with a total disregard as to the price asked. It is, in fact, safe to assume that if he desires one of the top-class receivers he must in most instances resort to the second-hand market.

Everyone can no doubt recall adverts in the broadcast receiver field in which they were offered the last word in broadcast receivers which would out-perform everything else. Thus the previous year's model was made obsolete. In some instances there were but minor differences.

Study the valve line-up, the availability of spare valves of the original types, and the possibility of obtaining specialised component parts. Fixed condensers and resistors, of course, if required as replacements, raise no difficulty as a rule.

Proof

In the previous paragraphs the personal opinions

expressed will perhaps not meet with the full agreement of everyone, especially as applied to the obsolescence factor of outdated receivers.

We need not go far to find proof of this. One of the best-known names in short-wave radio is National. Another, Hallicrafter. Current advertisements for second-hand HRO receivers as produced by National, together with others in which Hallicrafter SX24, SX27 and SX28 are required, speak for themselves. Such receivers, quite regardless of the year of manufacture, are still capable of meeting at least some amateur's requirements, at a price he can afford to pay.

New and Second-hand

If you require a communications type receiver and can afford the latest model of any particular manufacturer, by all means buy it if the specification suits you. Full technical details are always available on request, and there are some outstanding British products available, too.

Unfortunately, when one is considering the purchase of second-hand radio apparatus, technical data is usually unobtainable. I would suggest, therefore, that this article should be filed in case it should be required for future reference.

Skyrider 23

This was a popular Hallicrafter model which was available in 1939. There were four general coverage bands from 10 to 540 metres. The 10, 20, 40 and 80 metres amateur bands were band-spread. Also included was four-step crystal selectivity control, built-in signal strength meter calibrated in S and Db units, noise limiter, and frequency stabilisation.

The output of this receiver was rated at five watts audio. The I.F. transformers were of the iron-cored type tuned to 455 Kc/s.

Here is the valve line-up:

1st R.F. 6SK7, 1st det. 6SA7, H.F. Oscillator 6SJ7. 1st I.F. 6SK7, 2nd I.F. the same. Second det. 1st audio 6SQ7. A.V.C. 6B8, power output valve 6FG6, B.F.O. 6SJ7, rectifier type 80 and noise limiter 6N7.

This receiver incorporated a very accurate band-spread system, had eight panel controls and three QMB switches, and a first-class tuning dial.

SX24

Among the DX fraternity there are a number who use the SX24, another Hallicrafter production. This receiver will sometimes be seen mentioned in DX reports. Known as "The Defiant," it covered from 6.8 to 555 metres in four bands, with band-spread on the amateur bands from 10 metres to 80 metres. The calibration of this receiver was very accurate and frequency meter tuning was a salient feature. Others were noise limiter, break-in facilities and crystal filter, the usual S meter being included.

The SX24 is a nine-valve superhet. and the valve line-up is as follows: R.F. amplifier 6SK7, first det. an oscillator 6K8, first I.F. amplifier 6SK7, second I.F. the same. Diode det., A.V.C. and first L.F. 6SQ7, power amplifier 6F6G; B.F.O., 76; noise limiter 6H6; rectifier type 80. This receiver with a built-in noise limiter provided a very good signal-to-noise ratio, and was very popular.

Among the lower-priced models, mention must be made of the Sky Buddy and Sky Champion respectively. These were sold in considerable numbers. The earlier Buddys did not include band-spread, neither did they cover the 10 metres band. The New Sky Buddy of 1939, however, did so. This was a five-valve receiver of the superhet. type, with 6K8 first det. oscillator, 6L7 B.F.O., 6Q7 second detector A.V.C. and L.F., 6K6 power output valve and an 80 rectifier.

It should be noted that the Sky Buddy did not include an H.F. stage. Provision for headphone listening was, however, included together with send-receive A.V.C. and pitch control switches. The tuning range, 16 metres to 550 metres.

The New Sky Champion

Here we had one of the best low-priced communication receivers ever produced. Its salient features were H.F., L.F., and tone controls, variable pitch B.F.O., band-spread with separate band-spread dial, as in the case of the Buddy. Sensitivity control, inertia tuning, and a tuning range of from 6.8 metres to 550 metres. Here is the valve line-up: R.F. stage, 6K7; first detector, 6L7; oscillator, 6J5; I.F. stage, 6K7; second detector; A.V.C. and first L.F., 6Q7; power valve, 6V6 output; B.F.O. 6J5 rectifier 80. This receiver was of high sensitivity and selectivity, and the band-spread was better than the standard requirements laid down by the A.R.R.L. I was in contact with several amateurs and S.W. listeners who used this model, all of whom were enthusiastic with regards to its performance.

The three receivers described have been chosen because they are sometimes advertised in the second-hand market, at attractive prices, and are thus within the reach of the average enthusiast who desires an American type receiver.

British Communications Receivers

One of the most outstanding British productions before the war was, in my opinion, the Hamrad. This set had a tuning range of from 9 to 600 metres, and was fitted with all the controls desirable for communication purposes. The valve line-up being R.F. 1851; frequency changer, 6J8; R.F. oscillator, 6F6; first I.F. and second, 6K7; second detector, 6H6; first L.F., 6F5; second L.F., 6L6. Mains rectifier, 5Z4; A.V.C. negative rectifier, 6H6; A.V.C. D.C. amplifier, 6C5; B.F.O., 6J7; meter amplifier, 6C5.

One seldom sees these receivers for sale, and there must be a large number still in use. The specification was the hall-mark of a first-class receiver, with 465 kc/s, I.F.s, electrical band-spread, undelayed amplified R meter, crystal filter, delayed A.V.C., and several other features.

In 1939 Peto Scott introduced the Trophy Six and the Trophy Eight. The Six incorporated electrical band-spread and the following valves: 6TH8, 6K7, 6V6, 6C5, and 5Z4 (all international octal types), built-in speaker, 'phone jack, A.V.C., B.F.O.

The Trophy Eight, which utilised mechanical band-spread, was an excellent performer on the amateur bands, and superior on 10 metres to several other receivers of higher price. While I have no details of the valve line-up to hand, these were EF8 low noise, R.F. pentode, and international octals.

Final Notes

The receivers outlined are all pre-war types and designed during a period when QRM conditions were less exacting than at present. While they may individually have their shortcomings compared with their modern counterparts, so has the simple two-valver.

Old receivers sometimes come one's way at bargain prices, and can be made to suit individual requirements if one is of an experimental turn of mind. Under those circumstances any information concerning them is useful. I would ask readers interested to note, however, that the writer cannot give any theoretical circuit details concerning the models discussed in this article.

B.I.R.E.

THE following meetings of the Institution will be held during April.

North-eastern Section.—Wednesday, April 9th, 6 p.m. Neville Hall, Westgate Street, Newcastle-on-Tyne. "V.H.F. Broadcasting: the Case for Amplitude Modulation." J. R. Brinkley (Associate Member).

Scottish Section.—Thursday, April 10th, 7 p.m. Works of Metropolitan Vickers, Ltd., Watling St., Motherwell. "X-ray Equipment and its Control Gear." C. S. Norton. The lecture will be followed by a visit to the works.

London Section.—Wednesday, April 16th, 6.30 p.m. London School of Hygiene and Tropical Medicine. "Current Radio Interference Problems." E. M. Lee (Member).

South Midlands Section.—Wednesday, April 16th, 7.15 p.m. Winter Gardens, Malvern. Thursday, April 17th, 7.15 p.m. Exhibition Galleries, Public Library, Rugby. "Acoustics and the Radio Engineer." E. G. Richardson, B.A., Ph.D., D.Sc.

North-western Section.—Wednesday, April 30th, 7.15 p.m. Reynolds Hall, College of Technology, Manchester. "V.H.F. Broadcasting: the Case for Amplitude Modulation." J. R. Brinkley (Associate Member).

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- * **THE MIDGET A.C. MAINS 3-VALVE RECEIVER**, as designed and published by "Wireless World," covering Long and Medium Wavebands. Cost of all Components to build this set is £5/5/0. A reprint of the complete Assembly Instructions, including Practical Layouts, is available for 9d.
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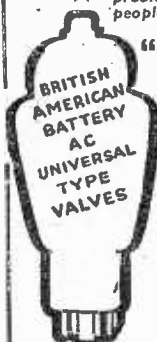
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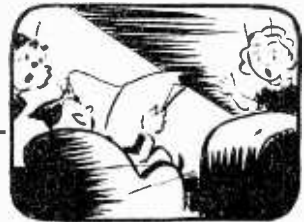
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OPEN TO DISCUSSION

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).

Noise Levels

SIR,—The ways of a radio contributor are fraught with more perils than even those of a politician.

I am impelled to these observations by the letter from Mr. Drew in the March issue. I have no quarrel with many of his conclusions, but any radio man is aware that all receivers are compromises. By the very nature of the demands made upon them they cannot be otherwise. In the case of the "Personal communication receiver," the choice was between R.F. stages with their complicated switching and ganging arrangements—and it is not easy for an amateur to "line up" such an arrangement with inadequate gear—and the simpler circuit I employed, which I maintain, in all the circumstances, is preferable. Equally, I am fully aware of the noise and A.V.C. angles—I have, indeed, written highly technical papers on these subjects, with direct reference to the points Mr. Drew raises—but what would Mr. Drew suggest?

While I value criticism at any time, because in looking at the picture as a whole one is apt to overlook some point of detail, I feel that had Mr. Drew redrawn the section to which he takes exception—in other words, provided constructive criticism—it would have been more helpful than damning the arrangement wholeheartedly, particularly as he is at an advantage in having all the details in front of him, whereas the whole of my papers and the receiver are in England and at the moment I have no access to them.

Arising from this I wish to thank reader Howard. He is, of course, correct in his assumption that a 6A8 is intended at V2. Originally a 6A7 was used, but in order to avoid valve base complications a 6A8 was subsequently substituted.—**T.W. DRESSER (Morocco)**

Car Static

SIR,—In publishing my recent letter to you re Car Static in the "Open to Discussion" section, two errors appear, the first doubtless due to my bad writing! The case of shock from a car was CURED, not caused, by the owner fitting his spare wheel!!!

Secondly, S.W. terminal on a car ignition coil is not the "short wave" terminal! S.W.

stands for the *switch* side of the coil as opposed to the C.B.—contact-breaker terminal.—**K. S. ROGERS (Ledbury)**

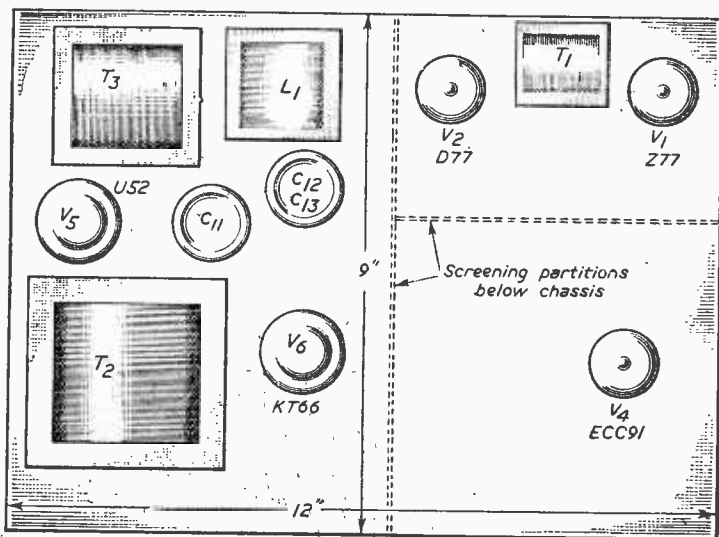
Mutual Conductance Bridge

SIR,—I have been very interested in the Bridge described in the March issue, and might mention that I have no fewer than six test instruments in my "den" all made from details in your pages. The Signal tracer, particularly, I have found invaluable, and I also have two test sets of the multi-use type which have proved worth their weight in gold. I wish to make up this Bridge, but you did not give a practical layout, and I would like, if possible, to keep to the original. You gave a panel layout and I should be glad if you could give a rough diagram of the layout of the main items.—**H. PERRY (Northolt)**

[As mentioned in the article, the layout is not critical, provided that care is taken to screen the oscillator and those leads carrying signal voltages. The accompanying diagram shows the main dimensions and layout of the original model.—**ED.**]

MCR1 Receiver

SIR,—I would very much like to get in touch through the medium of your excellent journal PRACTICAL WIRELESS with any reader who owns one of the



Layout of the original mutual conductance bridge as requested by Mr. Perry.

MCR1 receivers. I am anxious to modify or build a coil unit to tune over the 160 metre band.

If there is any reader who has done this, I would be grateful if he would be kind enough to let me have details, etc.—R. BEAUMONT (4, Wellington Close, Melbourne Park, Chelmsford).

A.C. Preset-two Coils

SIR,—A circuit was published in the issue of November last which recommended the use of one of our coils in an A.C. preset-two receiver. As a result of this circuit, we have supplied large numbers of coils, both to the trade and to individual customers. We have received numbers of queries regarding the circuit and would like to bring one or two points to the notice of readers, who may have raised similar questions.

We should first of all like to point out that the coil for this receiver is our type CT2W2 H.F. transformer coil, which incorporates a common aerial coupling winding, long- and medium-wave grid windings, and a reaction winding. It is somewhat difficult to follow the recommended switching arrangements, but if you examine the diagram you will note that one of the wafers is redundant, and by slightly modifying the connections to the other two wafers the same results can be achieved.

We have already passed this information on in answer to inquiries and should be glad to do the same for any other interested constructor of this receiver.—W. BUDD (Sales Department, Weymouth Radio Manufacturing Co., Ltd., Weymouth, Dorset).

Song Plugging

SIR,—Although Thermion's points on dance bands are timely and necessary, he misses the thorniest issue of all—the BBC's persistent practice of broadcasting every new popular tune as it appears, several times every day for weeks and weeks on end.

The BBC were going to do wonderful things after the war to stop song plugging, but it still goes merrily on. The officials must be as hard as flint, otherwise they would surely see how fantastically ridiculous the practice is.

Any complaints to the BBC bring the most stupid and fatuous replies; they also sneer at people who listen to the radio all day. They appear to have no thought whatever for hospital patients, sick people, cripples and invalids, for whom wireless is indispensable, and to whom constant repetition of new tunes, where there is a continual desire for a little more variety, with more of the old favourites, becomes a very real grievance.—A. J. SWEENEY (Gloucester).

R.F. Unit

SIR,—I wish to rectify an error in my article "A Tuned R.F. Amplifier For Use With R1116 Receivers." The value of the by-pass condensers should be .1 μ F (point one) and not as specified. The responsibility for the error is mine.—A. W. MANN (Middlesbrough).

Push-pull Detection

SIR,—I think it might be of interest to your correspondent David H. Collins (April, 1952) to know that two examples of push-pull detection appeared in the eighth edition of "Sixty Tested Wireless Circuits," published by you some time before the war.

Both these circuits use two-volt battery type valves, the first using a Cossor 240B class B type as a push-pull detector, while the other uses two 210HL type triodes.

Both circuits are extremely simple and would, I think, form an excellent basis for experiment with modern components. All details of construction are given, including coil winding data.

I doubt very much if this excellent little book is now readily available, though a local library may have a copy.

Failing this, I would be quite willing to loan my copy to Mr. Collins, should he be interested enough to get in touch with me, although since it represents my introduction to radio as a hobby, the book has become of some sentimental value to me.—M. BAILEY (Melton Mowbray).

[The circuits referred to appear in the latest version of the book, now known as "Practical Wireless Circuits"—price 6/6 by post.—ED.]

Tape Recording

SIR,—Regarding Thermion's note on Tape Recording in the April issue of "Practical Wireless," I think that the main difficulty arises from the mechanical side. I have carried out experiments for some two years and find that unless some sound tape-handling mechanism is purchased quite a number of snags arise. As you are aware this is very expensive, and I think most experimenters would prefer to make their own gear but, like myself, do not possess either the mechanic's tools or knowledge to do the job efficiently.

It is extremely difficult to find anyone that supplies bearings, spindles or other parts that can be utilised for this job.—ERIC G. SHEAD (Chelmsford).

BRITISH RADIO COMPONENTS SHOW

(Continued from page 205.)

"Tri-Sol" resin-cored solder output is now doubled. Shipments are going to many places overseas (The Du Bois Co., Ltd., Stand 74).

A new public address pressure-type loudspeaker unit, and vibration equipment for industrial research (Goodman Industries, Ltd., Stand 35).

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News from the Trade

Plessey "S" Type Miniature Variable Condenser

IMPROVED design and production techniques have enabled The Plessey Co., Ltd., Ilford, Essex, to introduce a new miniature variable condenser which, while maintaining the highest standards of electrical and mechanical efficiency, meets, by virtue of its small size and simplified construction, the present-day need to conserve metal and check rising production costs.

Available only to manufacturers, the "S" type miniature variable condenser is obtainable with either a left- or right-hand swing, giving a capacity range on standard units of 523 pF., and features a new form of bearing which not only contributes substantially to the saving of material, but reduces crackling to a minimum. Included in this bearing are four integral earth tags contacting the ends of the shaft, thus reducing coupling between the two sections and facilitating simple wiring.

Built-in trimmers, which are optional, are mounted on the underside of the baseplate. Alternative trimmer arrangements are available providing the adjusting screws either to the left or right, according to manufacturers' requirements.—The Plessey Co., Ltd., Ilford, Essex.

"Jewel-Microphone"

A NEW brooch microphone unit has been introduced for use with the Belclere Model 101 Ultimate match-box size hearing-aid.

The inevitable noise generated by the microphone unit within a hearing-aid rubbing against the clothing has always been a disturbing feature to the user of such an instrument, and the new brooch microphone completely overcomes this disadvantage.

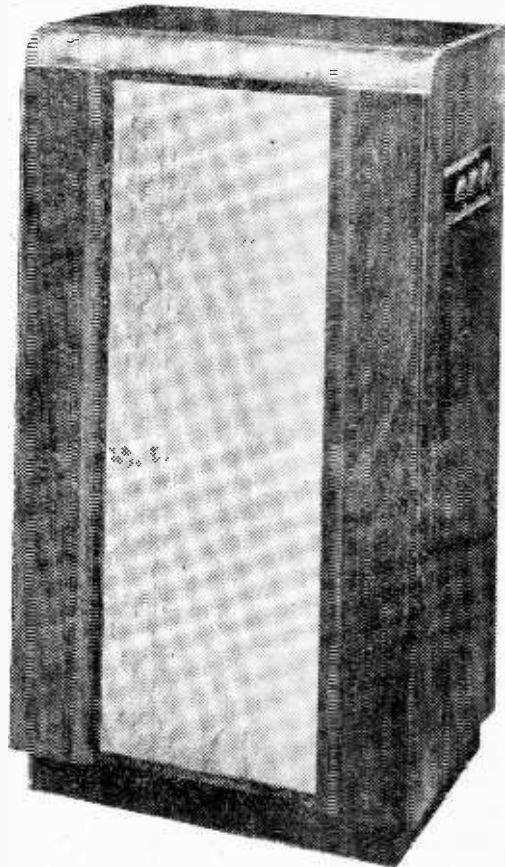
Several forms of brooches are available (about 1½ in. overall diameter), employing either a filigree silver pattern or a hand-painted silver plaque with a deposit enamel finish. The fine-screened plastic-covered cord for connecting the brooch to the amplifier is also inert and free from surface noise.

For gentlemen a lapel badge is available which is both unobtrusive and effective. The separate microphone units are offered as an optional standard with the Model 101 instrument at no extra cost.—John Bell & Croyden, 117, High Street, Oxford.

The Jonell Amplifier

THIS unit, which we recently had the pleasure of hearing, consists of a bass reflex cabinet containing a 10 in. loudspeaker, and in the upper portion an amplifier designed for use with a record-player or radio unit. These are not fitted but are obtainable separately, as it is thought by the designers that in many cases it is preferable to have them separate so that the speaker may be placed in a suitable part of the room whilst control is carried out from a remote

point. The input is designed for a .5 megohm load, and the output stage utilises two EL33 valves delivering approximately 6 watts. A very comprehensive tone-control network is fitted, and the three controls seen at the side of the cabinet provide volume and bass and treble lift and cut. These operate most effectively and give a wide range of tone, so that the user may adjust any record or radio programme to suit his individual preference. The cabinet measures only 34 in. by 18 in. by 12½ in., and weighs approximately 40 lb. Sockets are provided for mike, radio or gram input, and the mains consumption is 70 watts approximately. The price is 35 guineas.—John Lewis Partnership, Radio Dept., Oxford Street, W.1.



The Jonell amplifier referred to above.

Editorial and Advertisement Offices:

"Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Phone: Temple Bar 4263.
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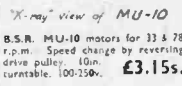
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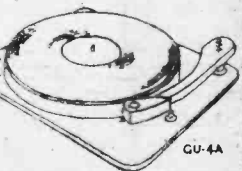
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