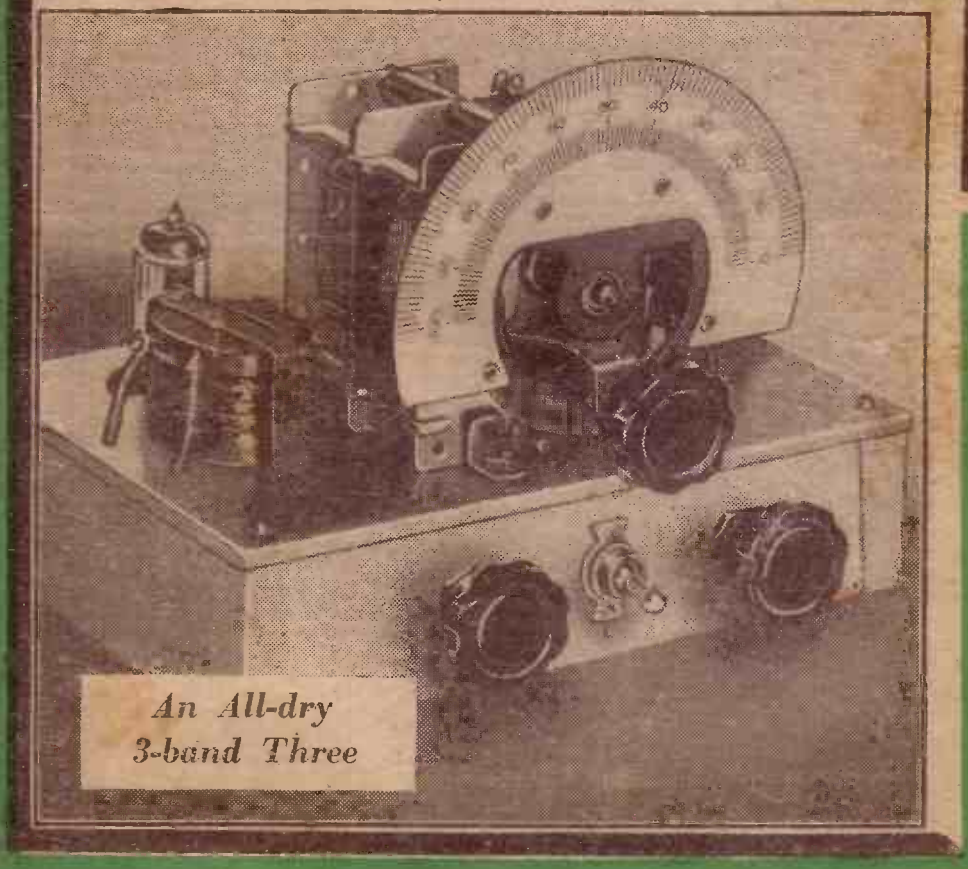
1/-

Vol. 27. No. 538
AUGUST, 1951

EDITOR:
F.J.CAMM

PRACTICAL WIRELESS



An All-dry 3-band Three

IN THIS ISSUE

Practical Wireless

19th YEAR OF ISSUE

EVERY MONTH.
VOL.XXVII. No.538. AUGUST, 1951

Editor F.J.CAMM

COMMENTS OF THE MONTH

By THE EDITOR

Old Sets Disowned

WE have already referred to the increase in purchase tax on radio and television receivers, cathode-ray tubes and valves from 33⅓ per cent. to 66⅔ per cent.

In a letter to the British Valve Manufacturers Association from the Treasury, it is stated that the purpose of the increased tax on radio sets is to stimulate exports, and at the same time to free productive capacity for the vital defence orders which will make increasing demands upon the industry during the next few years. This can be achieved, with the industry's existing resources, only if home sales are reduced.

The Economic Secretary " appreciates that, if people in this country are going to make old sets last longer, replacement valves may be in greater demand. But the importance of the valve-manufacturing side of the industry to defence is such that the pressure of home civilian demand must be curbed." In other words, you may not be able to buy new receivers nor be able to service the old. In this connection the trade expresses concern. Yet, before the purchase tax was increased some manufacturers had already adopted an inflexible policy of refusing to service pre-war receivers, and declined to supply spares for them.

One of our readers, for example, owned a set of a famous make and of pre-war vintage. It was a radiogram in excellent condition, but required a new valve and a new transformer. Attempts to get it serviced locally by the appointed agent and by other service engineers failed, and in his extremity he appealed to us.

We telephoned the service manager of the company concerned, and were informed that they could not in any circumstances undertake to service pre-war receivers.

We think it is a dangerous policy for the trade to abandon interest in its products once a certain period of years has elapsed, particularly in these difficult times. How different in the bicycle and motor-cycle trade, for example! The manufacturers of one famous make of motor-cycle who have been in business for over 40 years still carry spares for the first machines they made, and pride themselves in the fact that, irrespective of year, spares are available by return.

We agree with the Radio Industry Council that there is no reason to suppose that the artificial shrinkage of home sales will still further stimulate export. It may even have the opposite effect because of dislocation of production and increased costs due to smaller scale output.

The placing of defence orders with radio manufacturers in order to absorb redundant labour is not an entire answer to the problem. The Government in the first place is not ready to place increased orders on a sufficiently large scale to take up the slack. Production work on Government orders cannot be commenced until months of development work have taken place. Moreover, there is a shortage of manufacturing equipment for the new Service gear.

The R.I.C. give interesting statistics showing the very small amount of raw materials required by them as compared with the total requirements of industry. For example, of the total home consumption the radio industry uses only 1.34 per cent. of aluminium, 1.17 per cent. of copper, 0.15 per cent. of lead, 3.40 per cent. of molybdenum, 3.90 per cent. of nickel, 0.32 per cent. of steel, 4 per cent. of tin.

The Government, as with the motor car, still regard radio and television as luxuries, because they have singled them out from all other domestic equipment for increased tax. A radio receiver is a necessity, an essential part of every home, not alone for entertainment, but as a means of disseminating Government announcements.

The new tax must limit sales and penalise the owners of existing sets. In 1948 manufacturers were advised by the Television Advisory Committee to invest substantial capital amount in equipment for the production of tubes and valves. The manufacturers have followed a policy which is in strict accord with official advice. As recently as March 20th, the Minister of Defence said: " Meanwhile, we are most anxious that civilian production should be continued by everyone concerned on the largest possible scale for as long as possible! All skilled labour should be retained in full employment in order that no existing capacities or resources should be dispersed."—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 April 30th, 1951.

Region	*Number*
London Postal	2,376,000
Home Counties	1,656,000
Midland	1,770,000
North Eastern	1,913,000
North Western	1,608,000
South Western	1,070,000
Welsh and Border Counties ..	731,000
Total England and Wales ..	11,124,000
Scotland	1,122,000
Northern Ireland	206,000
Grand Total	12,452,000

The above total includes 825,000 television licences.

School Radio Order

A. K. COLE LTD. announce that they have received a further order from the Derbyshire Education Committee for 46 10-watt School Radio equipments.

Stanley Smith recording a message to America before setting out on his long sea trip.

Srinagar Radio Station Gutted . . .

THE building which housed the Srinagar radio station was gutted by an accidental fire on March 31st. The fire broke out about 4 p.m. and the building was wrecked.

The fire was caused by short-circuiting of electric wires in the transmitting room. The authorities were, however, able to salvage almost all valuable equipment, including two transmitters.

Thanks to the marvellous engineering organization and determination of the station staff, Radio Kashmir was on the air at 7.42 p.m. the same day, within two hours after the flames were brought under control.

Wireless and Colonial Development

COMMUNICATION and broadcasting networks contribute greatly to colonial and overseas development and some of the recent orders placed with Marconi's Wireless Telegraph Co., Ltd., indicate a steady expansion of these networks.

The Broadcasting Department of Nigeria has ordered a 20 kW. high-frequency transmitter for Lagos, and also a 7½ KW. high-frequency transmitter. Full equipment for four studios and a control room are on order for Lagos, and for three provincial stations at Enugu, Kaduna and Ibadan, comprising two studios and one control room each, together with 12 outside broadcasting installations.

Cyprus has ordered one 10 kW. medium-frequency transmitter and three outside broadcasting units, for the modernisation of their broadcasting service.

The latest overseas order received by Marconi's is for a 1¼ kW. unattended transmitter for Tanganyika.

The "Nova Espero" Sails Again

IN November, 1949, the world thrilled to the amazing voyage of Stanley and Colin Smith, who sailed their 20ft. sloop—the *Nova Espero*—from Dartmouth, Nova Scotia, to Dartmouth, Devon, in 43 days.

Stanley Smith, together with his friend, Charles Violet, set sail again recently from the Festival South Bank site, London, in an attempt to recross the ocean in the opposite direction.

Just prior to their setting sail "His Master's Voice" recorded a message to America from Mr. Smith, and it is hoped that "His Master's Voice," through their associates in America, will be able to arrange for this to be broadcast throughout the United States.

Sweden Orders British Radio Equipment

FOLLOWING the completion of the new broadcasting stations at Horby, Sundsvell and Gothenburg, in Sweden, Standard Telephones and Cables Limited have received a further contract

for £100,000 from the Swedish Broadcasting Administration.

This important contract is for a new high-power broadcasting station of the most modern type for Stockholm.

The placing of this latest order confirms the confidence in British manufacture which Sweden has shown over the last quarter of a century, beginning with the inauguration of the Swedish broadcasting service on January 1st, 1925, with a transmitter also supplied by Standard.

Round the World Trip

SO that the Austin A.40 sports car, which recently began a record-breaking trip "round the world in 30 days," can keep in constant touch with the K.L.M. aircraft which will be accompanying it—carrying spares and supplies, etc.—the car has been fitted up with a Pye PTC113 mobile radiophone. This will ensure that delays due to breakdowns are reduced to an absolute minimum when the car is crossing deserts and other areas where no facilities may be available for hundreds of miles.

Radio Industries Club

AT the 20th annual general meeting of the Radio Industries Club, held at the Connaught Rooms, London, on Tuesday, May 29th, Sir Ian Fraser, C.B.E., M.P., was elected president in succession to Norman Collins.

A ballot to fill four vacancies on the committee of the club resulted in the following members being elected: Messrs. F. Jones, R. F. Payne-Gallwey, F. H. Robinson and J. H. Williams.

At the first meeting of the new committee held after the luncheon the following officers were elected for 1951/52: chairman, J. G. G. Noble, M.C.; vice-chairman, Owen Pawsey; honorary secretary, W. E. Miller; honorary social secretary, F. H. Robinson; honorary treasurer, Owen Pawsey.

Electronics Exhibition

THE sixth annual Electronics Exhibition, organised by the North-Western Branch of the Institution of Electronics, will be held at the College of Technology, Manchester, on July 24th (from 2.30 p.m. to 9 p.m.) and on July 25th and 26th (from 10 a.m. to 9 p.m.).

An extensive programme is planned including, in addition to the products of the usual exhibitors, a non-commercial section composed of exhibits from the universities and from scientific associations.

There will be an exhibition of modern scientific films, demonstrations of the Compton electronic organ, of the Ferranti logical computor and of television reception on home constructed receivers. An amateur short-wave radio transmitter/receiver will operate throughout the period of the exhibition.

Admission will be by tickets obtainable from Mr. W. Birtwistle, Hon. Secretary, N.W. Branch, Institution of Electronics, 17, Blackwater Street, Rochdale, Lancs. Catalogues will be available early in July.

Mullard Electronic Products, Ltd.

ON May 1st, 1951, the name of the above Company was changed to "Mullard Ltd." The Company's products are being distributed throughout the world on an ever-increasing scale and the new name has been adopted in order to associate the Company more closely with its trade mark "Mullard."

Cheaper Radiotelegrams to H.M. Forces at Sea

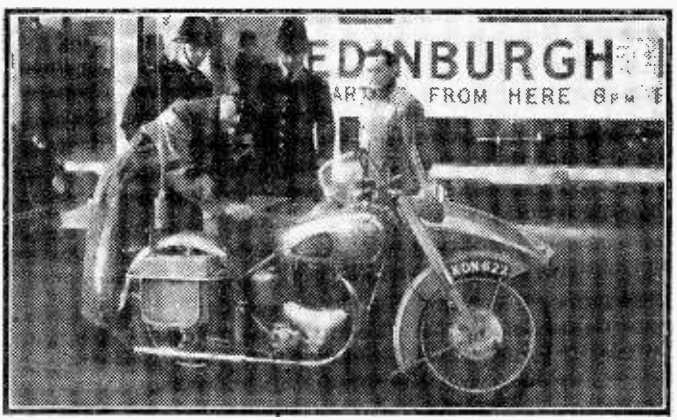
FURTHER to the concession introduced by the Post Office in October, 1950, whereby the maximum charge for the address of a telegram sent to a member of H.M. Forces abroad is as for five words, the Postmaster-General announces that it has now been possible to extend this concession to members of H.M. Forces on ships at sea (whether on board a merchant ship or one of H.M. ships). No alteration is made where the address contains less than five words, and each word is chargeable at the appropriate rate.

Mobile Test

THE first motor-cycle ever to carry two-way radio communication equipment in a sporting event, a B.S.A. "Golden Flash"—competitor in the Motor Cycling Club's Whitsun Edinburgh Rally—provided a thorough test of the Plessey transmitter-receiver as recently supplied to the Metropolitan Police.

At intervals during the 500 mile route of the rally, the B.S.A. was in contact with a series of fixed stations over a wide variety of terrain, the equipment proving trouble-free and reliable throughout, and providing as efficient a service at the close of this prolonged and gruelling test as it had at the start. Valuable information regarding the workable service range and operational functioning of such a system was thus obtained by the manufacturers.

Far from proving an encumbrance, the installation was reported by Mr. Fred Gowlett and his passenger, Mr. Bob Archer, to be quite unobstructive when not in use, and to have no measurable influence on the behaviour of the combination.



B.S.A. "Golden Flash" combination in the Edinburgh Rally, using two-way V.H.F. radiotelephone.

From Disc to Tape

How to Modify Standard Circuits for Tape Recording

By GORDON J. KING, A.M.I.P.R.E.

THIS article is intended to illustrate how the advantages of "tape record/playback" may be added to a standard amplifier, and the more important aspects of such an amplifier, but leaving the more conventional circuitry to the experimenter. The output voltage from the playback head of a tape recorder is not of sufficient magnitude fully to drive a standard amplifier; it is necessary, therefore, to employ a preamplifier to bring the tape signal to a suitable level, enabling its application to be made direct to the standard amplifier. Owing to the characteristics of the recording tape it is essential to incorporate a degree of correction to the amplifier, to counteract the deficiency offered by the tape. Further, special feed circuits are required from the output of the amplifier to convey the signal current to the recording head. A supersonic oscillator is also necessary for tape bias and erase purposes.

The modification that is necessary to change an audio amplifier from the "playback" to the "record" condition can usually be arranged by the function of a playback/record master switch mounted on the main control panel and ganged to the motor drive switch. With the switch in the "record" position, the tape is thus being exposed to the record and erase heads in the correct direction, signal and supersonic bias is applied to the record head, the erase head is energised, the tape preamplifier is rendered inoperative, and also the amplifier response is altered to maintain record correction. On the "playback" position the tape drive reverses, the record head is replaced by the loud speaker, the tape preamplifier is made "live" and the playback head is connected to its input, the supersonic bias is switched off, and the amplifier response is modified for playback purposes.

LIST OF COMPONENTS (Fig. 1)

R1—0.2 MΩ ¼ watt.
R2—25 KΩ ½ watt.
R6—20 KΩ ½ watt.
R7—100 KΩ ¼ watt.
R8—0.5 MΩ ¼ watt.
R11—50 KΩ ½ watt.
R12—0.25 MΩ ½ watt.
R13—50 KΩ ½ watt.
R14—20 KΩ ½ watt.
R15—500 ohms ½ watt.
P1—0.25 MΩ V ar.
P2—3 KΩ Var.
For other components see text.

C1—0.02 μF. 350 volts.
C3—0.01 μF. Mica.
C4—0.002 μF. Mica.
C5—50 pF. Mica.
C6—0.001 μF. 350 volts.
C7—0.1 μF. 350 volts.
C8—0.002 μF. Mica.
C9—0.1 μF. 350 volts.
B1—6.3 volt 0.3 amp. M.F.S.
V1—6V6 valve.
Switch S2 Ganged

The Input Circuits

Slight modification of the input circuit is necessary to enable the tape preamplifier to be switched in, and further it is an advantage to have input channels for (1) microphone, (2) gramo, (3) radio, producing the possibility to take recordings via any of the above mediums, or of their direct amplification. Fig. 1 depicts a block diagram of the amplifier, and is divided into sections. Considering first section (a). The four inputs are selected by the function of a single-pole four-position rotary switch, S1A. With the switch on position 1, the secondary of the microphone transformer T1 is applied to the input of the main amplifier. It should be noted that the gain of the voltage amplifier must be designed to enable the satisfactory amplification of low-level sounds picked up by the microphone, rendering their recording audible. With the selector switch on position 2 the gramo circuit is brought into operation, together with the necessary equalising circuit, formed by the components R1, R2 and C1, the network will produce approximately a bass boost of 6 db. per octave that is required for complete compensation of recording loss. A fair degree of attenuation is offered by this circuit, but since the voltage amplifier should have adequate gain for successful operation of the microphone, attenuation of the "pick-up" voltage is desirable to prevent the first stages of the voltage amplifier from being overloaded, due to the greater output voltage obtained from the pick-up. To record a radio programme the selector switch is set on position 3, the signal is applied across a potentiometer consisting of the resistors R3 and R4, and the attenuated signal is taken from their tapping to the amplifier via the selector switch. Should the signal source be picked up from the external speaker socket of a broadcast receiver, the values of R3, R4 should be adjusted to produce a voltage of similar magnitude to the equalised "pick-up" voltage across R4. Its value may be computed thus:

$R4 = Eo \times R^1/E$,

where Eo = voltage across R4
E = voltage from radio
R^1 = R3 + R4.

R^1 should be made approximately twice the input impedance of the voltage amplifier, to prevent excessive shunting of the voltage amplifier, due to the secondary of the speaker transformer. This formula is intended only as a rough guide, since where the attenuation necessary is small it is upset by the shunt impedance of the voltage amplifier. Where the signal is taken from the detector stage of the receiver, attenuation may not be required, in which case the signal is fed direct to the selector switch. We thus have a four-channel input circuit, with arrangements to render each output approximately equal, permitting the use of a common gain control.

Tape Corrector Circuits

The output from this circuit can now be applied to a voltage amplifier and phase inverter stage (if push-pull operation is desired) to produce sufficient voltage to drive fully the required output valves. It should be borne in mind at this stage, however,

that certain corrector circuits will be necessary to equalise the deficiency of linear output from the tape. A typical uncompensated response curve of the output likely to be obtained from category "A" tape is shown in Fig. 2; it can thus be seen that equalising is essential before anything approaching linear output is achieved. Fig. 3 shows an equalised curve for constant input voltage. The tape speeds in each case are 7.5ins. per second for high-fidelity reproduction. Lower tape speeds should be avoided owing to the rapid decline of the higher frequencies. As will be seen from the uncompensated curve, a sharp increase of output voltage above about 5 Kc/s is required. Further, an appreciable amount of bass boosting is necessary, at the rate of something like 8 db. per octave, for frequencies below about 800 c/s.

High-pass Filter

A high-pass filter brought into operation during the recording process will tend to flatten the higher frequency side of the curve, and the deficiency of bass may be compensated for in the playback amplifier. Bass boosting during the record operation must be avoided, since the tape tends to saturate at the lower frequencies, producing very undesirable distortion on playback.

Since the amplifier is to be used on playback it is obvious that the high-pass filter will have to come into operation during recordings only. Section (b) of the block diagram shows a simple method of achieving this function. The network may be satisfactorily included between the last voltage amplifier and the phase inverter. C2 and R5 are the usual coupling components. R7 and R8 form a potentiometer, the tap of which is connected to R6, thence to a change-over switch S2A, which may be ganged to the main record/playback switch. Capacitor C5 shunts the potentiometer, and its value sets a limit to the amount of bass attenuation. C3 is brought into the circuit on the "record" position only, and controls the degree of top lift. On the playback position a useful variation of frequency response is created by the inclusion of the variable resistor P1, across the capacitor C4. Typical component values are indicated, and apply where the coupling is positioned between two triode valves, but their values are not critical and may be adjusted to suit the standard amplifier circuitry. Further correction may be introduced in the tape playback preamplifier, and will be dealt with when considering this unit.

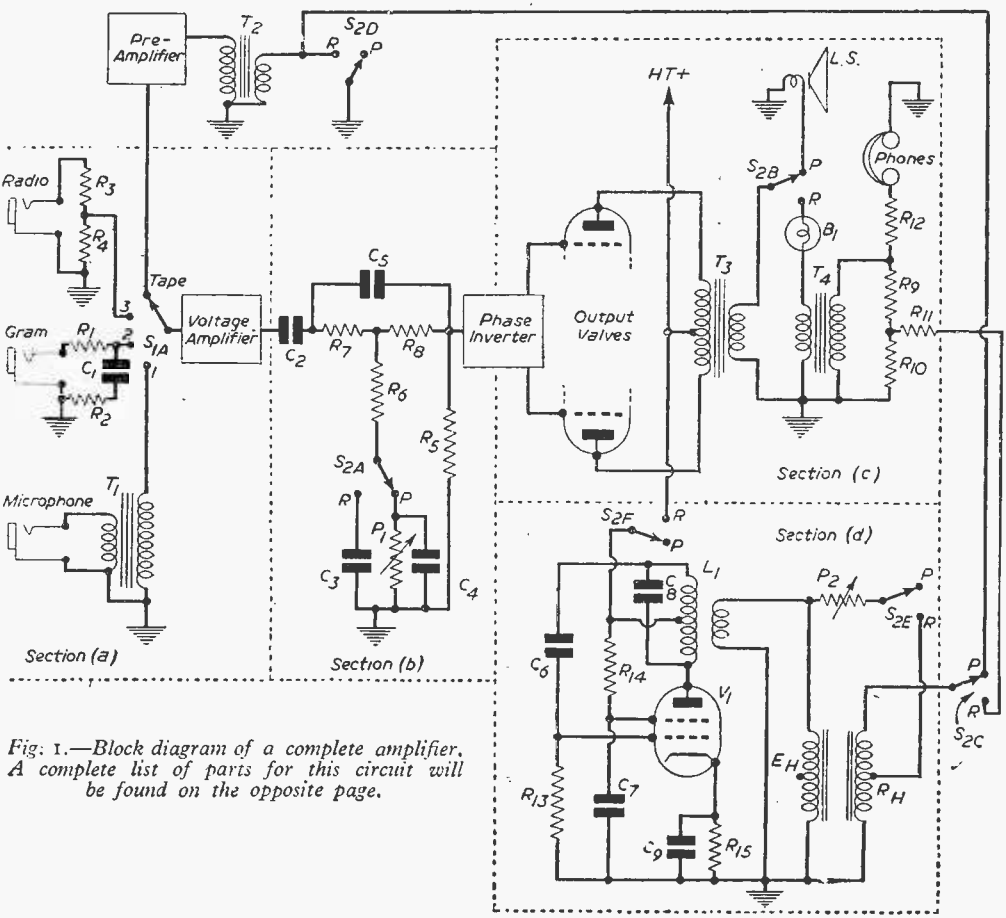


Fig. 1.—Block diagram of a complete amplifier. A complete list of parts for this circuit will be found on the opposite page.

The Output Circuits

The equalised signal, whether originating from a radio programme, microphone, or a disc recording, is conveyed to the phase inverter stage and on to the output valves. On "record" these will have to supply power to the recording head, and on playback feed the loudspeakers as a normal amplifier. Hence, it will be evident that some sort of change-over system will be necessary. A visual recording-level indicator and a pair of headphones for monitoring purposes is a useful addition when recording. A circuit arrangement that is used by the author which is proving to be very satisfactory is shown in section (c) of the block diagram. If we consider the circuit when the switch S2B is in the recording position, it will be seen that the output transformer T3 is loaded into a smaller transformer T4, producing, a step-up ratio. The author is successfully employing a multi-range speaker transformer in this position, with the secondary connected to the secondary of the main transformer, thus performing the functions of a primary winding. The high-impedance side is connected across a pair of resistors R9 and R10. A 50 KΩ resistor R11 is connected to their junction

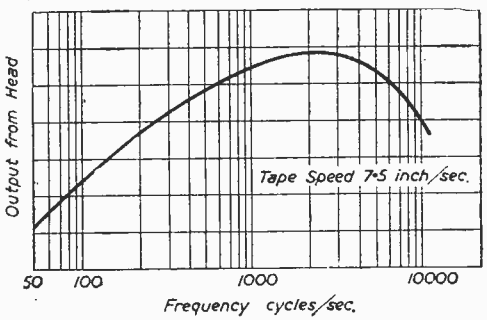


Fig. 2.—Uncompensated output to be expected from the playback head.

and is the feed resistor for the recording head. Resistor R12 is connected in series with a pair of high-impedance phones, thereby producing a monitoring signal without any appreciable load to the circuit. A small pilot bulb B1 is connected in series with the two transformers, giving a visual indication of recording level. The values of R9 and R10 should be so adjusted that the correct voltage is applied across the recording head when the filament of the bulb is just glowing; any increase of illumination will indicate that the tape is running into saturation. When recording, the gain of the amplifier is adjusted so the bulb glows only on transients. By its correct use the mistake of over-recording, frequently made by beginners, is avoided. The recording head feed resistor, R11, is necessary in order to obtain a constant recording current independent of frequency, and its value can be made substantially high since adequate output voltage is available from T4. This point is made clear if reference is made to Fig. 4, where the curve (a) shows the variation of record current against frequency, if a record head of 140 milli-Henry is fed direct and curve (b) if fed through a 50 KΩ resistor. A recording head having an impedance of 350 ohms at 400 c/s, if well designed, requires a signal level of approximately 10 volts across R10 to record fully category "A" tape, but the final value should be determined by experiment. This is made simple by replacing temporarily the resistors R9 and R10 by a variable potentiometer and adjustments made in relation with the record indicator bulb and test recordings. The value of R9+R10 is determined by the transformer ratio T1 and T2. If the output impedance of the transformer be 15 ohms then it is desirable to load transformer T2 to show a 15 ohm impedance at its primary; thus R9+R10 may be computed from the formula:

$R^1 = N^2 \times Z$. Where $R^1 = R9 + R10$.
N = ratio of T4.
Z = output impedance of T3.

I.e., let N = 25 : 1, Z = 15 ohms, therefore $R^1 = 25^2 \times 15 = 9{,}365$ ohms.

The above method of calculating the load resistor for T4 will eliminate any risk of damaging the output valves when recording owing to a mismatch. With the switch S2B on the playback position the loudspeaker will be connected across the output transformer T3 and will follow usual amplifier practice.

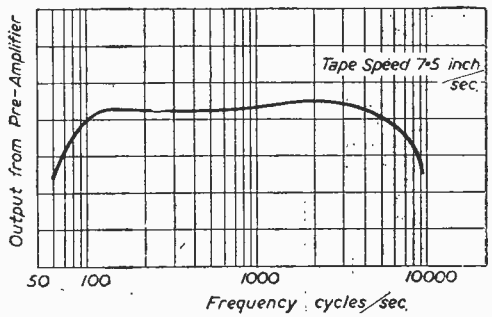


Fig. 3.—Equalised curve for constant input voltage.

The Supersonic Oscillator

A supersonic bias voltage fed to the recording head is necessary while recording to restrict the intensity of the recording field to such a level as will enable the recording to be made on the linear position of the hysteresis curve. Its frequency is usually about 4 to 5 times that of the highest frequency to be recorded and in most instances is set between 30 Kc/s and 45 Kc/s. The mixing of the signal and bias currents takes place in the recording head R/H, section (d) block diagram, the signal winding of which is usually tapped, and the bias fed to the tap via a variable resistor P2. The magnitude of the bias current is thus adjustable, its optimum value depending on the coercivity of the tape used and the signal voltage, but as a general rule a bias voltage of between 2 to 3 times the peak signal amplitude is found to be satisfactory. Section (d) shows a typical oscillator circuit, using a 6V6 class valve, and will provide an R.F. voltage of adequate amplitude, together with a purity of wave-form required for this purpose. The voltage is taken from a coupling winding on L1. A component suitable for this position may be obtained from Park Radio, Romford Road, E.12. Switch S2E applies a bias voltage to the recording head and disconnects it on playback. Switch S2F brings the oscillator into circuit on the recording position only. In addition to

supplying a bias voltage the oscillator may also be employed for the purpose of erasing previous recording from the tape, the voltage in this case being taken direct from the coupling winding to the erase head. The position of the erase head is such that the tape is exposed to it before reaching the recording head, thus erasing existing recordings. The erase head E/H is of similar construction to the recording head, but with a slightly larger air gap. This method of erasure is to be desired since a greater signal/noise ratio is achieved when using demagnetised tape than can be expected if a permanent magnet is used for this purpose.

The Preamplifier

On playback the recording head is used to convert the magnetic induction applied to the tape during the recording process to variations of voltage. The change-over function is performed by the switch S2C, while S2D takes the earth from the input of the preamplifier, rendering it applicable to signals from the tape. Owing to the high gain of the system via the tape preamplifier, the input is earthed while recording to prevent the possibility of feedback. The voltage from the playback head is amplified to a level suitable for its application to be made direct to the input of a standard amplifier. A circuit diagram of an amplifier for such operation is shown in Fig. 5. V1 is a double triode of the high-mu class. A 6SL7 is successfully employed by the author and the units are arranged in cascade, producing a high overall amplification. The low-level signal is fed to the grid of the first

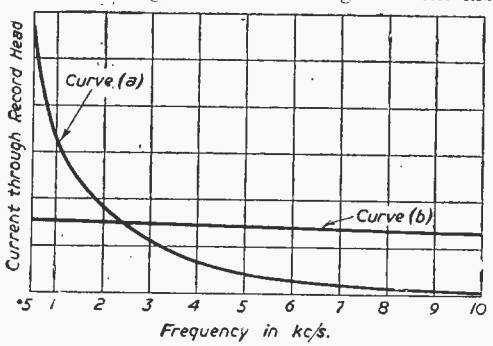


Fig. 4.—Curve (a) where 140 mH recording head is fed direct, and curve (b) where it is fed via a 50 kΩ resistor producing constant recording current independent of frequency.

triode via a step-up transformer. A suitable ratio is about 1 : 4 but its characteristics should be governed by the type of head employed. The transformer should be accommodated in a mu-metal case to reduce inductive hum pick-up, otherwise the added advantages of improving the signal/noise ratio of the amplifier gained by using such a transformer will be lost. The amplified signal from the first triode is fed to the grid of the second triode via the correcting network; the compensated signal is thus further amplified and its output taken via C5 to the switch S1A. The top lift inductor L1 should have an inductance of about 0.3 Henry and, again, in the interest of a high signal/hum ratio, this component also should be encased in mu-metal. A component suitable for this position is readily obtainable from stockists of tape recorder components. The resonant frequency of the circuit is determined by the capacitor C8 according to the formula (Resonant freq. $= \frac{1}{2\pi\sqrt{2C}}$. Thus, using a 0.3 Henry inductor (L) with a shunt capacitor of 0.0025 μF (C8) the circuit will resonate at 6 Kc/s. which is about where we want the top lift. At frequencies far from resonance the presence of L1 and C8 have little effect, but C6 and R9 tend to give a bass lift by attenuating the higher frequencies. At resonance, however, the dynamic resistance of the circuit is rendered greater, producing an increase in gain at that frequency, the combined effect of the two corrector circuits produce a tape output at the preamplifier similar to the response curve shown at Fig. 3, assuming a constant record voltage independent of frequency. The resistor R7 increases the effective load impedance of the first triode, while R10 increases the input impedance to the second triode in relation to the top boost circuit, thus producing a greater output at resonance. All normal hum-reducing precautions will need to be taken in the preamplifier construction (see article by the author, "Hum Problems in Low Level Amplifiers," PRACTICAL WIRELESS, July issue).

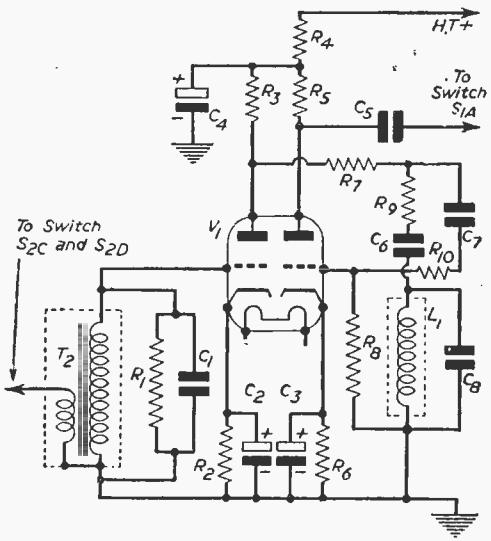


Fig. 5.—A tape playback preamplifier circuit diagram.

LIST OF COMPONENTS

T1—Input transformer.	R9—25 KΩ ¼ watt.
L1—Top lift inductor.	R10—100 KΩ ¼ watt.
V1—6SL7 valve.	C1—100 pF.
R1—0.25 MΩ ¼ watt.	C2, C3—25 μF. 25 volts.
R2—2 KΩ ½ watt.	C4—32 μF. 350 volts.
R3—100 KΩ ½ watt.	C5—0.01 μF. 500 volts.
R4—25 KΩ ½ watt.	C6—0.01 μF. 500 volts.
R5—50 KΩ ½ watt.	C7—0.01 μF. 500 volts.
R6—2 KΩ ½ watt.	C8—See text.
R7—200 KΩ ¼ watt.	L1—See text.
R8—250 KΩ ¼ watt.	

An All-dry 3-band Three

Midget Valves are Used in This Standard Receiver

By "EXPERIMENTER"

THOUGH the all-glass midget 1.4-volt valves which are now so popular are intended primarily for small portable receivers, they can be made good use of in the larger, non-portable type of set. They are economical as regards current consumption, but give very good results—a fact which is perhaps more noticeable in this type of set, as a full-sized moving coil speaker can be used, which is not normally so in small portables. The receiver described here has good range and volume, and tunes the usual long, medium and short wavebands. The constructor who has no mains supplies, or who prefers battery-operated receivers, or requires a good standby battery set, should find it particularly useful.

The circuit employs two pentodes, with a tetrode for output and automatic bias to avoid the need for a grid-bias battery. For maximum sensitivity and selectivity both stages are tuned on all bands, a little simplification of switching being used in the aerial circuit so that a 6-pole 3-way rotary switch can be employed.

Though midget H.T. batteries can be obtained, one of the full-size 60-volt batteries is recommended. This is a good deal cheaper and has a long period of useful life compared with the midget H.T. type of similar voltage. Any 1.5-volt dry battery is suitable for low-tension.

Switch Connections

These are all given in Fig. 5, which shows back views of the two sections of the wavechange switch. Sections A and C provide medium/long wave switching by shorting the appropriate sections of the dual-range coils. Section A also shorts the aerial-coupling winding of the dual-range aerial coil for short-wave reception. Section B switches the R.F. valve grid to the short-wave coil in one position, and to the dual-range coil in the remaining two positions.

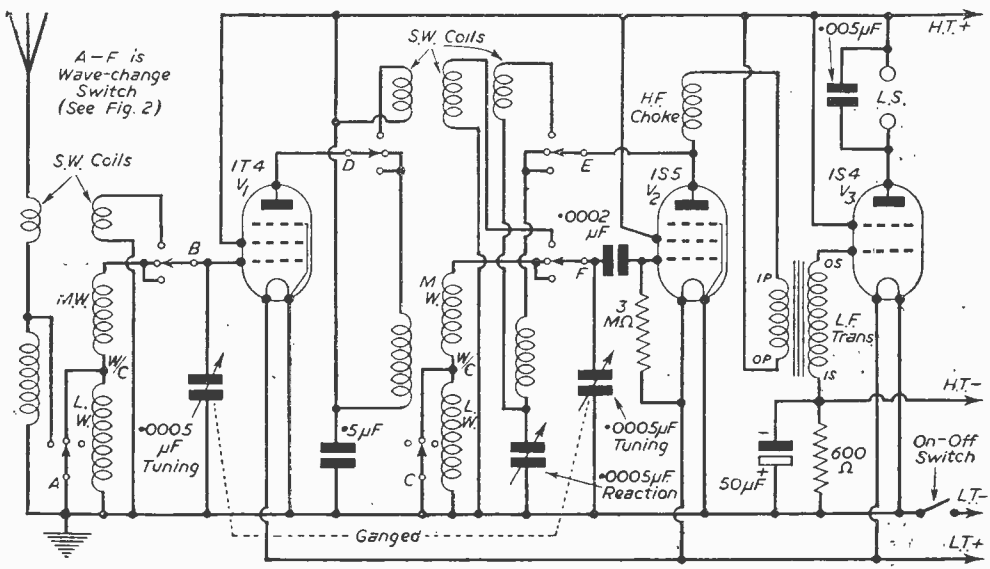


Fig. 1.—Complete theoretical circuit.

LIST OF COMPONENTS

2-gang .0005 μF tuning condenser with trimmers and reduction drive.
.0005 μF reaction condenser with knob.
6-pole 3-way rotary switch with knob.
.0002 μF, .005 μF and .5 μF fixed condensers.
50 μF 12-volt working bias condenser.
600Ω and 3MΩ resistors.
Reaction-type H.F. choke.
Mu-metal 1 : 4 coupling transformer.
Two twin sockets.
Three 7BG type valveholders.
1T4, 1S5 and 1S4 valves.
On/off toggle switch.
Coils, as explained in text.

The sets of contact tags on the second section of the switch are all similarly wired. Section D connects the coil primaries, section E the reaction windings, and section F the grid or tuned part of the coils. As a further guide the leads are marked to agree with the wiring-up plans. The switch is secured tightly to the front runner by its fixing bush.

Mounting the Components

A chassis 7½in. by 4½in. by 2in. deep was found convenient, but this is not in any way critical and a slightly larger chassis would give more room for wiring. Holes approximately ¾in. in diameter will be required for the valveholders, according to type. The filament sockets are given double spacing on the valveholder; usually these sockets are found at the one elongated end of the holder, directly opposite one securing hole. However, the holders produced by some manufacturers have all the sockets in a different position, in relationship to the securing holes. If this is so, bolt the holders to the chassis at the required angle so that the *sockets* come as shown in Fig. 6.

Before mounting the two-gang tuning condenser it is necessary to solder two lengths of insulated wire to the lower tags and thread these down through holes in the chassis. These leads come out as shown by X and Y in Fig. 6, X being the forward section and Y the rear section.

The mu-metal ex-Service transformer is bolted on from below. The coils and H.F. choke are also bolted down, and two small twin socket panels are bolted to the rear runner for aerial, earth and speaker connections.

Wiring Points

Reference to Fig. 6 will enable the majority of the wiring to be carried out, switch connections being taken from Fig. 5. Leads to the coils in particular should not be longer than necessary. Filament and high-tension circuits may be kept close against the chassis, but grid and coil leads should be away from the metal and from each other. All points marked M.C. must be connected to the chassis, convenient bolts being used for this purpose.

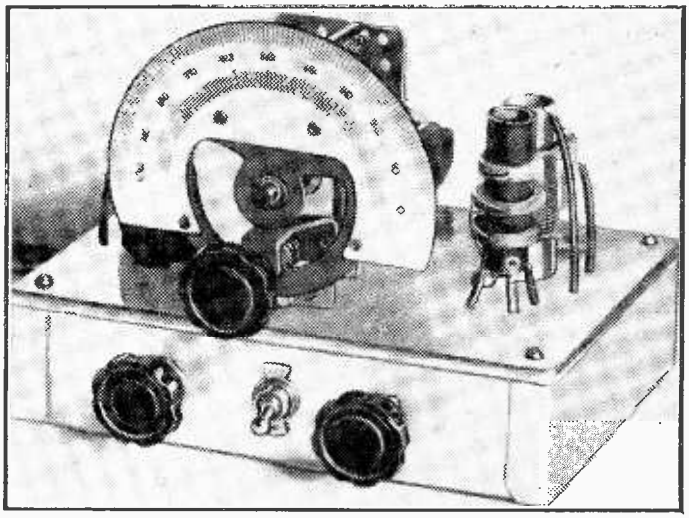


Fig. 3.—Another view of the complete receiver.

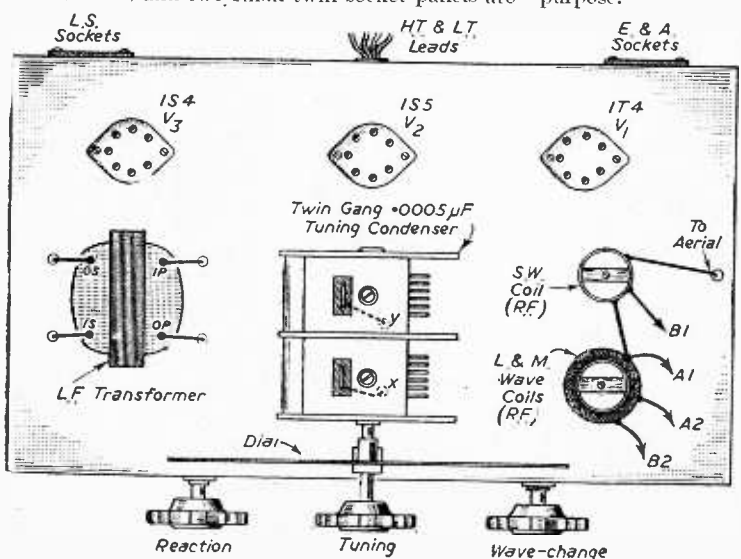


Fig. 2.—Top of chassis layout.

A detailed plan of the two coils above the chassis is given in Fig. 2. Where required the leads pass down through small holes. Lengths of flex form battery leads, and a rubber grommet is desirable where these pass through the rear runner of the chassis to avoid fraying and short-circuits. The transformer connections shown are for the type of component mentioned: if a different transformer is used the markings on it should be followed

The Tuning Coils

For long and medium waves a pair of R.F. type coils, with reaction, are used. The aerial coil has an aerial-coupling winding, and the second coil a primary for R.F. transformer coupling. Ready-made S.W. coils may also be used, or these can easily be wound in view of the small number of turns required.

Referring to Fig. 4, and with a ¾in. diameter paxolin or other insulated former, 14 turns of 22 S.W.G. enamelled wire are used between point B1 and chassis (tuned section). The turns are spaced each from its neighbour by the diameter of the wire. For aerial coupling 7 turns of 32 S.W.G. enamelled wire, turns closely side by side, are used, situated about ¼in. from the top of the previous winding.

Detector Coil

These winding details are repeated in the case of the coil under the chassis, with the addition of a reaction winding ¼in. from the tuned section. This extra winding is of 10 turns of 32 S.W.G. enamelled wire, turns side by side. All windings must be in the same direction and connected as in Fig. 6.

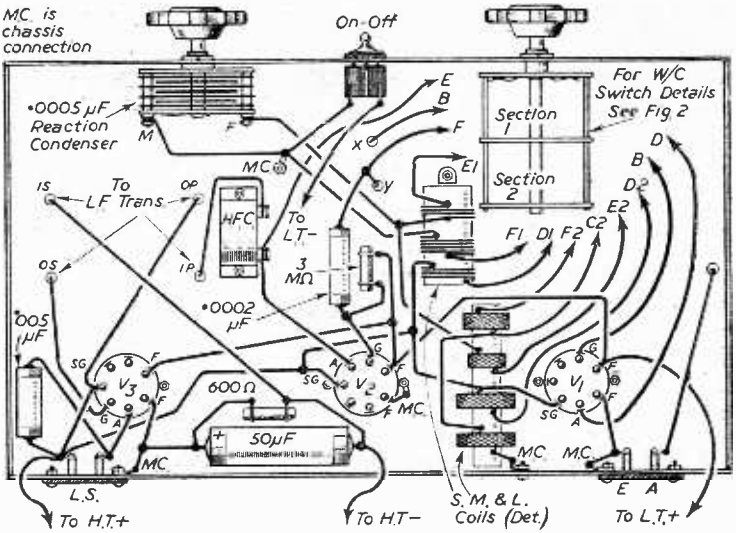


Fig. 6.—Sub-chassis layout and wiring.

Switch Positions

Switch positions are: to left, long waves; in central position, medium waves; to right, short waves. The trimmers on the gang condenser should

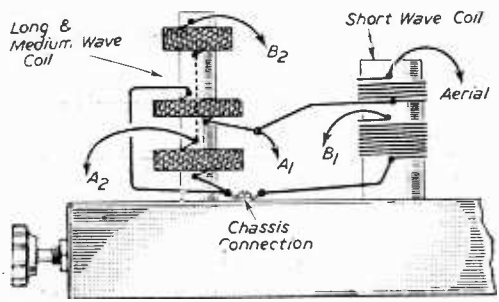


Fig. 4.—Aerial coil connections.

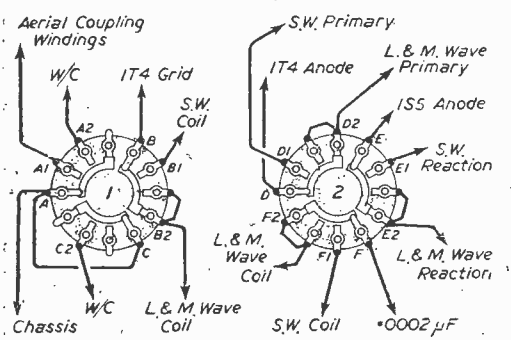


Fig. 5.—Wavechange switch connections.

be unscrewed, then adjusted for maximum volume on the S.W. band. It was not considered necessary to use separate trimmers for medium and long waves as the coils ganged accurately together.

Maintenance Engineers

A FEW months ago an Essex firm of refrigeration maintenance and installation engineers equipped a fleet of their service vans with a Marconi V.H.F. radio-network. This two-way radio system has proved so successful in affording rapid service to users of refrigeration plant that the firm, Marketing and Maintenance, Ltd., are now rapidly extending the system. Their service covers a large and thickly-populated area, including all Essex and parts of Hertfordshire. Should a breakdown occur in any of the many shops, restaurants and other establishments using refrigerator or air-conditioning systems, the firm's head office at Brentwood are notified by telephone.

The value of such a radio system becomes even more apparent in the case of hospitals, where breakdown of the refrigeration system could mean the loss of precious drugs (such as Streptomycin and Penicillin) or blood plasma, which require refrigerated storage.

Time is not the only saving factor, for radio control effects a great saving in petrol, oil, man hours and general wear and tear.

A radio system can also save the customer considerable expenditure, since the cost of refrigeration repairs is calculated on a travelling time and mileage basis.

The transmitting and receiving installation, Marconi Type H.16A, at the firm's offices in Brentwood, is housed in a compact cabinet, designed for desk-mounting, measuring 21½in. x 17¼in. x 9¼in. and weighs only 69 lbs. The mobile equipment in each van is sited under the passenger seat, with a control unit and loudspeaker fitted to the dash-board. A handset microphone is attached to the control unit. This complete mobile equipment, Marconi Type H.16, weighs only 40 lbs., and is powered from the normal car battery, needing no extra power supply.

On your Wavelength

by THERMION

More About Gramophone Needles

I APPEAR to have stirred up a hornets' nest with my comment in the July issue on gramophone needles. Starr British Products, for example, consider that I am a reactionary on this matter. They say that experts to-day are overwhelmingly in favour of the jewel-tipped needle, which is used to an increasing extent in every part of the world, not only by private users, but by broadcasting authorities and other professional bodies. As far as private users are concerned, you can easily verify for yourself whether their statement is strictly true. Check up with your friends who own gramophones or radiograms, and ascertain how many are using jewelled tips. I doubt whether it is 1 per cent. This does not justify the use of the adjective "overwhelming." Members of gramophone clubs and quality fans, I believe, are in favour of jewelled tips, but I think the time is far distant when such needles will come into general use.

This firm go on to say that it can be fairly claimed for the jewelled needle that it gives perceptibly better quality reproduction even after some hundreds of playings than does a new steel needle, the surface noise being less and the wear on record grooves reduced. These results are dependent on certain conditions. Firstly, a pick-up of reasonably light weight should be used; secondly, a sapphire of good point form (not always to be found with the cheaper type); thirdly, the use of sapphires should be limited to a "reasonable" number of playings. Owners of existing gramophones and radiograms, therefore, with the heavy type of pick-up and non-counterpoised tone-arm, must replace these if the jewelled tip is to justify its claims. How is a purchaser without special apparatus to know when a sapphire is of "good point form"? And what is "a reasonable number of playings"?

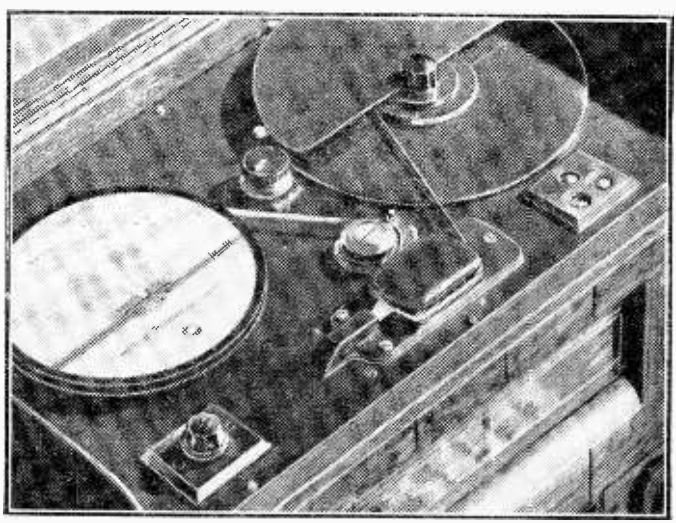
One of my opinions was that if there is any advantage (and this is largely a matter of opinion) it is questionable whether the increased expense and probable modifications of the gramophone or radiogram are justified. The diamond needle, I am told, does not suffer from the same limitations as the sapphire. They, however, are more expensive.

Bearing on this subject is a further letter from Mr. H. Wren, of Dundee. He refers to the general statement I made that soft materials lap hard ones, and he thinks this destroyed my own argument that jewel-tip needles scurf up a groove worse than steel needles. If he will re-read my notes he will see that what I said was that jewel-tipped needles will tear up a record just as much as steel ones, and that the record will lap needles, whether they are made of either of these two materials. He then goes on to say that according to this argument fibre needles should lap a record away very quickly! He quite overlooks the fact that other factors enter into the use of fibre needles, not the least of which is their greater flexibility. Because of this the volume obtained is less than with a more rigid material, and hence the surface noise is less audible. This does not mean that the fibre needle has any special properties. Certainly it is less durable. However, the gravamen of my argument was that the answer to the problem of perfect recording is to eliminate the needle, no matter of what material it is made and to substitute the photo-electric cell and sound on film strip.

Ban on Soccer Broadcasts

ALTHOUGH this is the cricketing season it is not too late to refer to the ban on direct broadcasts of football league matches, which apparently surprised both the B.B.C. and the Football Association. The League will not object to the broadcast of recorded commentaries after a match has been played. When the B.B.C. was refused permission to broadcast the Royal Variety Performance directly, they refused an offer for the broadcast of a recording on a later day.

The attitude of the entertaining profession and the Football League, as well as other national bodies, towards broadcasting, is stupid and out-of-touch with the times.



The playing desk of the Ozaphone radiogram. The light may be seen shining from the lamphousing on the left on to the tape...

A Versatile High-gain Amplifier

A Two-valve Plus Rectifier A.C. Unit Giving 3·5 to 4 Watts Output

By K. KEMSEY-BOURNE

THIS simple high-gain amplifier, simple enough for any beginner to build, is capable of good performance with low-level microphones or pick-ups. Old hands will probably have all the parts needed somewhere in their spares box. This circuit can also be used as a play-back amplifier for tape-recordings or as the basis of a room-to-room intercom. system. It would also serve for a baby alarm, as its current drain is very low.

Specification

The original model was built to fit the following specification. It must be capable of enough power to cover a hall in which 100 young people are dancing, and it must do this from the low-level output of a good-quality microphone placed 2 to 3ft. from a piano. It must be readily portable, simple in operation, easy to service, and as inexpensive as possible to build.

Output Stage

The ideal way to get a reasonably large power output is to decide on a push-pull output stage, but this would mean greater expense, since it would need several more valves than a single-ended output stage and also a larger power-pack. Preliminary trials showed that a power output of 3½ to 4 watts was satisfactory when carefully distributed through a number of loud-speakers each fed at low power. This meant that a single pentode could be used in the output stage, calling for only a moderate H.T. supply. The only remaining problem was to provide sufficient voltage gain in the rest of the amplifier to give full output from the pentode when using a low-level microphone. This was done using a single high-gain stage with an SP41.

A Versatile Valve

The SP41 was originally introduced for television work and is still described in the Ediswan-Mazda data as "a high-slope screened H.F. pentode," but it is a useful valve for audio amplification work, especially since it can be made to give high- or low-gain by different values of the screen and anode resistors. The SP41 is available under its Government numbers CV1335, CV1574 and VR65A. It has a Mazda octal base (B.O.7), which is slightly different from the International octal. The top-cap (grid connection) is the large diameter English type, again different from International octal practice. The bulb is metallised, and no other screening is needed if the metallising is earthed (pin 6).

Amplifier Circuit

Fig. 1 shows the circuit, which is as simple as possible. The output pentode V2 is an AC2PEN (Government number CV2808) giving 3½ to 4 watts with a grid swing of 3.2 volts. Since the anode current is only 32 mA at 250 volts, a heavy-duty output-transformer is not needed. The required anode-load of V2 is 6,700 ohms, so that for a 3-ohm loud-speaker the transformer ratio should be either 45 or 50 to 1; it does not matter which.

V2 is fed through resistance-capacity coupling from V1, and H.T. is provided for both stages by a conventional power-pack, using the full-wave rectifier V3. The total H.T. consumption is under 45 mA but it is good practice to rate the rectifier and smoothing condensers generously.

The gain control R5 is put in front of V2 rather than V1 in the interests of quietness in operation. Since there are only two stages, elaborate H.T. decoupling is not needed.

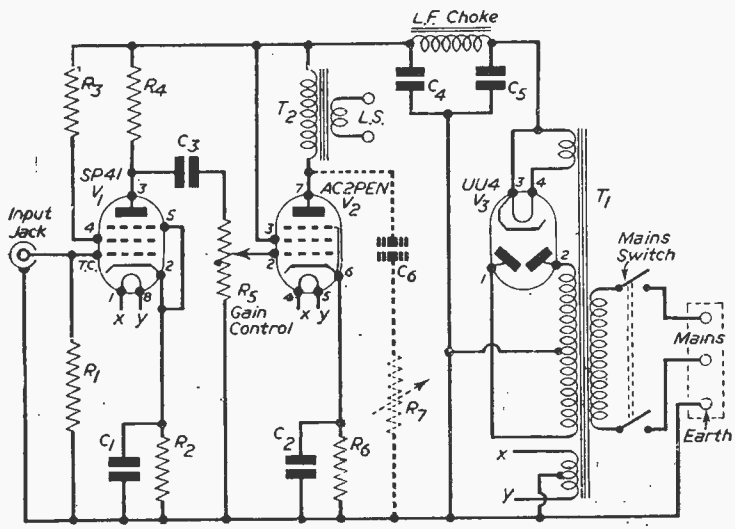


Fig. 1.—Theoretical circuit of the versatile high-gain amplifier. Dotted lines indicate optional top-cut tone control (C6 and R7).

Versatility

This amplifier works well with a low-level microphone, such as the Vitavox Model A, using the component values given on page 351.

The circuit is equally useful as a record amplifier particularly with low-level pick-ups or L.P. equipment. Different pick-ups give different voltage outputs, and the figures quoted by manufacturers are often quite useless as no indication

is given of the conditions under which the measurements were made. We are often reduced to the method of trial and error, and here the possibility of varying the stage-gain of V1 is useful. If the gain is too high the action of the volume control is crowded, and if it is too low we do not get a comfortable sound level.

Variable Gain

Using an SP41, as shown in Fig. 1, the connection between the stage gain of V1 and the value of R4 is given by the empirical expression

$$\text{Gain} = 2.6\sqrt{A} + 20$$

where A is the value of R4 in thousands of ohms and the gain found is the voltage multiplication factor of the stage, grid to grid. R3 always has four times the value of R4.

LIST OF COMPONENTS

R1 : 1 Megohm. C1 : 50 μF., 12 volts.
R2 : 1 KΩ. C2 : 50 μF., 12 volts.
R3 : 200 KΩ. C3 : 0.1 μF., 400 volts.
R4 : 50 KΩ. C4 : 8 μF., 500 volts.
R5 : 1 Megohm (volume control),
C5 : 8μ F., 500 volts. C6 : 0.01 μF., 400 volts.
R6 : 140 ohms, 1 watt.
R7 : 50 KΩ.
All resistors ¼ or ½ watt except R6.
T1 (mains transformer) : Primary—to suit mains voltage. Secondaries—250-0-250 at 50 mA., 4 volts 2 Amps. (rectifier heater), 4 volts 3 Amps. (other heaters).
T2 (output transformer) : To match 6,700 ohms to speech coil. Ratio is 45 or 50 to 1 for 3-ohm speaker. Primary must be capable of carrying 50 mA.
L (smoothing choke) : 10-20 henries, 50 mA., 500 ohms.
V1 : Mazda SP41. V2 : Mazda AC2PEN. V3 : Mazda UU4.
Chassis 9 x 7 x 2½ ; Bulgin P.73 mains connector ; D.P.S.T. mains toggle switch ; screened top-cap connector ; input jack ; valveholders, one each Mazda octal, English 7-pin, English 4- or 5-pin ; wire, insulated sleeving, nuts, bolts, solder tags, knob, dial-plate.

Let us illustrate with an example. What must the gain of the first stage be to give full output from a Decca X/M/S pick-up, model C. This pick-up is available with two heads, one for L.P. and one for 78 r.p.m. discs. The voltage outputs are quoted by Decca as 38 and 70 mV respectively. What we have to do is arrange V1 so that V2 will be capable of giving full output when an input of 38 mV, that is, 0.038 volts, is applied to the grid of V1.

We know that the A.C. swing on the grid of V2 must be 3.2 volts for full output, so that the voltage gain required of V1 will be $\frac{3.2}{0.038}$ or $\frac{3,200}{38} = 85$ times. V1 will have a stage gain of 85 if R4 is 25 KΩ and R3 is 100 KΩ.

The values of R3 and R4 given in the table of components are such that V1 has a stage gain of 150 times.

If we are using a crystal pick-up, such as the remarkable "Acos" unit fitted on the Decca 33A and 33B playing desks, then a stage gain of 50 will be enough. We thus make R4 15 KΩ and R3 60 KΩ. At the same time R1 must be given the value 330 KΩ, to suit the pick-up.

Maximum recommended gain for V1 is about 200 times. This will be obtained when R4 is 70 KΩ and R3 is 300 KΩ.

If a stage-gain of less than 50 is required for any purpose, V1 can be operated as a triode by removing R3 and strapping screen and anode together.

Layout

Fig. 2 shows a suggested layout. A chassis size of 9 by 7 by 2½ inches is adequate. The chassis shown in the photograph has these dimensions. Of course, modifications can easily be made to suit individual requirements. Good layout and reliable wiring are essential.

Before drilling any holes in the chassis, place the mains transformer, choke and valve-holders on the chassis and move them about until the spacing is satisfactory. The output transformer

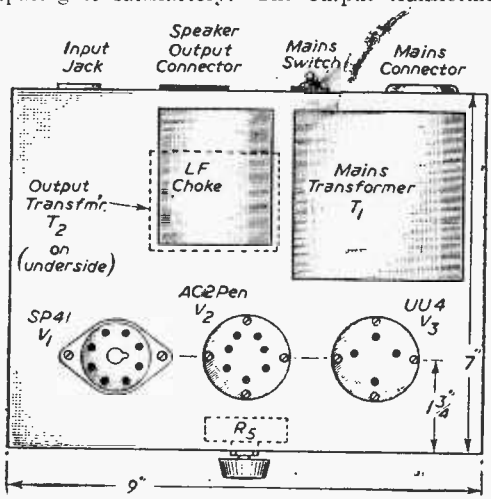


Fig. 2.—Suggested chassis layout.

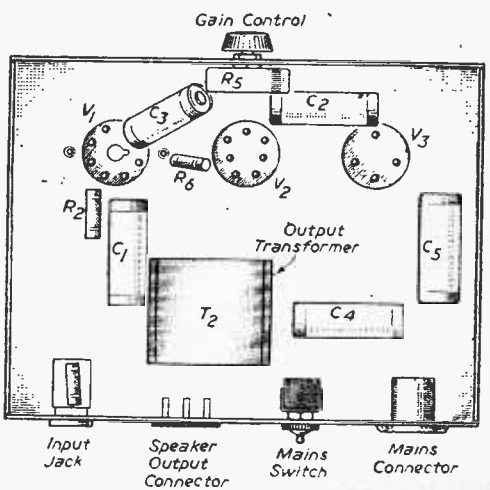


Fig. 3.—Key to the positions of the components shown in the photograph of the sub-chassis view of the amplifier.

can be fitted under the chassis later. Mark the position of all the components other than resistors and capacitors, including the volume control (and the tone control, if fitted), mains plug, and input and output sockets.

Drilling

When you are satisfied, cut the large holes needed for the valve-holders and the mains plug and the smaller ones for the input jack, volume control and mains switch. The Amphenol Mazda octal valve-holder just fits into a circular hole 1¼in. in diameter. This hole may conveniently be cut with one of the special cutters available. The same sized holes will serve for V2, V3 and the Bulgin P.73 mains connector. Since V2 uses an English 7-pin holder, this hole will have to be filed out into a pear-shape until the holder fits in with a good clearance at each pin.

Now mount all the main components and drill the holes for the through-chassis leads to the mains transformer, choke, and the grid-cap of V1. The mains transformer and choke may be mounted, using 4 B.A. or 2 B.A. bolts (clearance drills number 26 and 10 respectively), and for all other fittings 6 B.A. bolts will serve (clearance drill number 31).

It is a good plan to put 6 B.A. solder tags on all bolts under the chassis in place of normal washers. They are then immediately available for making earth connections as required.

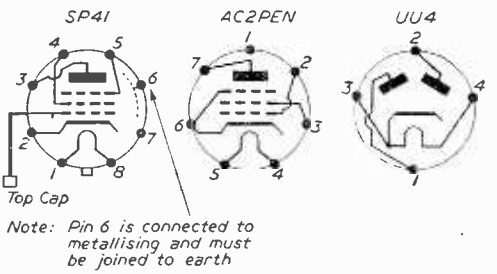


Fig. 4.—Details of connections of valves used.

Wiring

Start wiring with the power supply mains input to the transformer, rectifier leads and all earth connections to the chassis. Then wire the heater leads to V1 and V2, twisting the leads together. Next come all cathode circuits, bias resistors and decoupling capacitors. Now connect the H.T. lead from the rectifier cathode, through the choke, the anode circuits of V2 and V1, the input circuit of V1, and then the resistance-capacity coupling between V1 and V2. Finally, put in the two smoothing capacitors and wire the secondary of the speaker transformer.

Use resin-cored solder throughout, with 18 or 20 gauge tinned-copper wire and 2mm. insulated sleeving.

Points of Construction

A screened grid-cap for V1 is essential, and rubber-covered screened cable should be used for the lead between this cap and the input jack. No screening is necessary at other points.

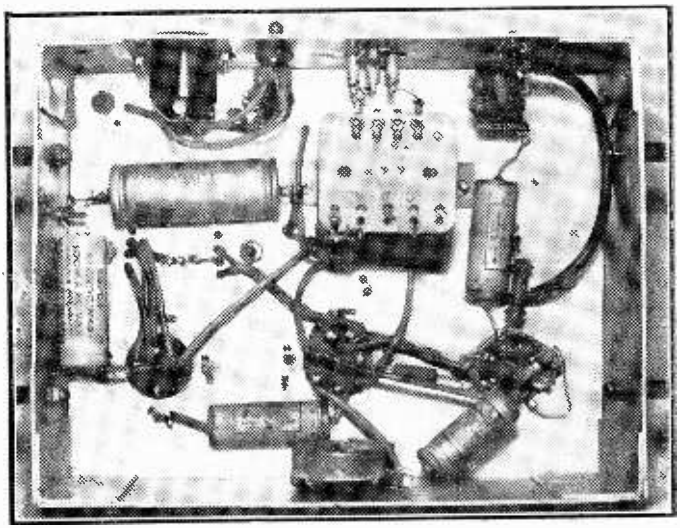


Fig. 5.—Interior of the amplifier showing principal components.

R1 is wired across the input jack, and this jack should be such that it is short-circuited on removal of the jack-plug, so that the grid of V1 is earthed when no input is connected to the amplifier. This will prevent noise caused by the grid of V1 "hanging in the air."

Use good, reliable smoothing capacitors.

Tone Control

If used as a microphone amplifier with a good quality microphone the circuit needs no so-called tone control, and this holds for use with a properly equalised pick-up. However, a top-cut control can easily be added, as shown by dotted lines in Fig. 1 (C6 and R7). C6 must be generously rated, since if it fails the H.T. supply may be virtually earthed.

Using Energised Speakers

A 500-ohm choke is specified for smoothing the H.T. supply. This may be directly replaced by a 500-ohm speaker field-coil, and there will be no very great loss of power if a field of 750 or even 1,000 ohms is used. If a field coil of value higher than 1,000 ohms is to be used the mains transformer must give a voltage output greater than 250-0-250 volts.

Testing

The D.C. voltages read at various points with a 1,000-ohms-per-volt meter should be as follows: rectifier cathode, 300; H.T. line, 275; V2 anode, 250; V1 anode, 40; V2 screen, 275; V1 screen, 26.

If the readings differ appreciably from these figures then something is wrong: for example, incorrect bias on V2, faulty insulation in T1 or L, C4 or C5 damaged or wrongly wired, etc.

An L.T. and H.T. Eliminator

Suitable for Portable or Standard Receivers This Mains Unit Supplies 2 Volts at ·5 A. and 90 Volts at 5 mA.

By H. A. DYKES

THE unit about to be described was actually made for use with a portable set whose H.T. and L.T. requirements are typical of a T.R.F. battery receiver making use of 2-volt valves, that is 2 volts ½ Amp., and 90 volts 5 mA. It is, however, easily modified for use with almost any type of battery set.

The circuit, which is shown in Fig. 1, is fairly straightforward and probably needs little explanation, although it is as well to note that it should not be operated off lead as the L.T. voltage, in particular, would rise and perhaps damage the smoothing condensers. Resistor R2 has been included with the idea of minimising this effect. In many battery sets the on/off switch breaks both L.T. and H.T. leads. It is, therefore, wise to switch the set on before the mains unit. If it is desired, this switch can be shorted out or altered to break the mains lead instead, although this arrangement may make it difficult or inconvenient to use the set with batteries if it is required to do so at any time.

R1 should be carefully adjusted on full load to give the correct heater supply, i.e., two volts. If the set makes use of 1.4-volt valves, or if the L.T. drain is less than ½ Amp., then the value of this resistor may have to be increased.

It is advisable to avoid earthing the H.T. negative lead from the power pack, as most battery sets derive bias for some of the valves from the voltage developed across a resistor between H.T. negative and chassis, and earthing this lead direct would cause the valves to be operated without bias.

The Transformers

Separate H.T. and L.T. transformers are shown, as quite small ones can be used and they are more easily accommodated in a limited space; moreover, midget 6.3-volt transformers are easily and cheaply obtainable, while it may be possible for the constructor to adapt a small transformer (about ½in. core) for the H.T. supply, as the current drain is likely to be very low. The writer used one which had been removed from ex-Govt. equipment and was probably not intended for use on the mains, but nevertheless certain tappings were found to give about 100 volts at 10 mA. from 230 volt A.C. mains. If there is room, however, an ordinary mains transformer can be used for both supplies, provided there is a six-volt winding, but most likely the H.T. voltage will be in excess of that required and will have to be dropped by the inclusion of a suitable resistor in the smoothing circuit, or perhaps it would be possible to remove some of the turns of the H.T. winding. Again, the H.T. transformer can be dispensed with and the supply obtained direct from the mains via a resistor, but this method, although inexpensive, may be considered to be unsuitable because, unless a double pole on/off switch is used and the live side of the mains connected through the switch and dropping resistor to the rectifier, the chassis of the set may become alive and, as some battery sets have exposed metal parts, it could be dangerous.

The Rectifiers

The L.T. metal rectifier is full-wave and rated at 6 volts 1 Amp. (Premier's, 4s.), but it is connected in half-wave because no centre-tapped 12-volt winding was available. A bridge-connected full-wave rectifier is more usual in such circuits and would be better as less smoothing would then be required, but it is more expensive and its larger size may present difficulties.

The H.T. rectifier is a 230-volt 30 mA. selenium type which is readily available on the surplus market, but as the H.T. drain is probably a good deal less than 30 mA. with most battery sets, a rectifier with a lower current rating would do, if available.

The Smoothing Capacitors

A 16 μF.+16 μF. 350-volt electrolytic is used in the H.T. smoothing circuit, because it happened to be on hand; however, a lower voltage working type would be just as suitable, but note that the can, if negative, must be insulated from earth or chassis.

The large value electrolytics used in the L.T. circuit were obtained on the surplus market

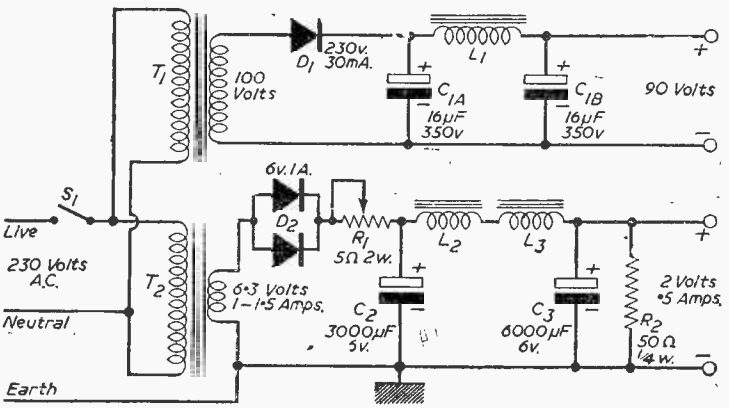


Fig. 1.—Theoretical circuit of the battery eliminator.

(1s. 3d. and 1s. 9d.), and are of quite small physical dimensions, due to their low voltage. If the values in the circuit are followed, there should be no hum in the speaker, and even with C3 reduced to 3,000 μF. the hum is only just apparent.

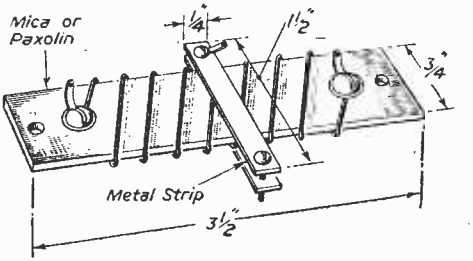


Fig. 2.—Details of the main L.T. dropping resistor.

The Chokes

The two L.T. smoothing chokes are identical and were made from midget burnt-out output transformers. All the original windings were removed and they were then rewound with as many turns as possible of 26 S.W.G. enamel wire. This is not difficult to do, as there is no need to interleave the windings and they may be wound on quite roughly. A single choke, wound on a core about the same size as a standard output transformer, would do just as well provided it can be fitted in. If a larger choke still is used, it should be wound with thicker wire, say 24 or 22 S.W.G., as the D.C. resistance of the greater length of wire may drop too many volts and not leave enough available to provide the full output.

The H.T. smoothing choke is an ordinary midget 30 mA. choke and needs no special mention.

The Variable Resistance

It is not difficult to make this variable resistor, and the constructional details are shown in Fig. 2. The wire used is a length (about 1ft. 6in.) cut from a spare electric fire spiral, which can be obtained for about 1s. 6d. Alternatively, a variable 5-ohm 2-watt resistor can possibly be purchased ready for use.

It only remains for some mention to be made of the form the unit can take when completed, and the measurements of the eliminator constructed by the writer are given only as a general guide, because it is realized that the space available to each constructor is likely to vary considerably, depending on the type of set, also on the size of components used.

It was found possible to assemble the whole unit in a case made of tinplate about the same size as the H.T. battery, and a sketch of this is shown in Fig. 3. Note the holes drilled in front and top of cover which afford some measure of ventilation, although, if the circuit values are followed, there should be no overheating.

It will have been noted that the majority of components mentioned have been either surplus ex-government items, or modified standard of surplus components. There is, of course, no reason why standard parts should not be used by those who wish to make up a similar unit and are not concerned with the economy aspect. New items of standard design may be used throughout and may be obtained from the various firms who advertise in these pages, and before closing the usual admonition should be made concerning the use of surplus equipment, especially the condensers, which must on no account be leaky.

The total cost of this eliminator, if surplus components are used, should not exceed £2, and with use it will pay for itself many times over.

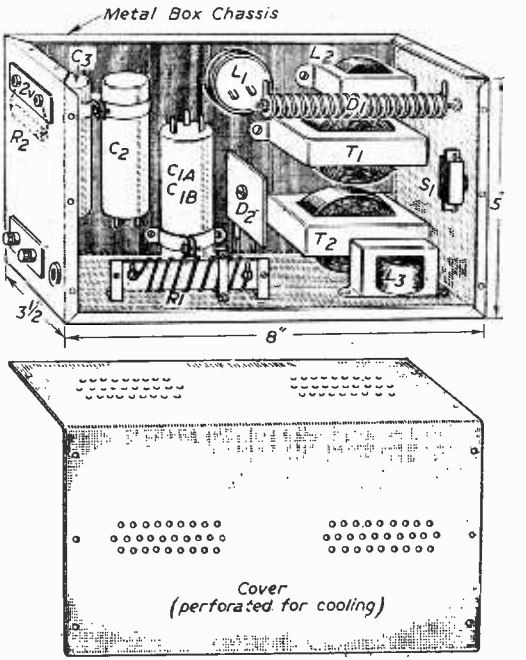


Fig. 3.—Layout of the receiver and its cover. Note that terminals or sockets may be used for the outputs and L.T. may be at the top or bottom as desired.

Welsh Industries Fair

HER Majesty the Queen hopes to visit the Welsh Industries Fair at Cardiff on 18th July.

Under the ægis of the National Industrial Development Council of Wales and Monmouth, Cardiff R.S.G.B. members will have a stand at the Fair. (The Pavilion, Sophia Gardens, Cardiff —4th to 18th July.) The stand will carry an exhibition of amateur-built equipment, and an amateur station will be operated from the Fair throughout the event.

Mr. Eric Martin, G6MN, has kindly provided the station log book and a supply of specially designed QSL cards which will be used to confirm all contacts made from the Fair station, and by courtesy of Messrs. Thermionic Products and Messrs. Modern Electrics, Ltd., Soundmirror tape recording equipment will be available for use and demonstration.

Cardiff R.S.G.B. members will meet for an informal "ragchew" at "The British Volunteer," The Hayes, Cardiff, 7.30 p.m., on Monday, 9th July. Visiting amateurs are cordially invited to attend.

A Stabilised Power Supply

250 Volts at Any Load from 15mA to 150mA

By R. KENDAL

AN efficient stabilised power pack is a very useful piece of equipment for the man who is in the habit of constructing, testing and using electronic circuits including, of course, those of radio and television. Most commercial radio laboratories are equipped with stabilised H.T. supplies as standard items and it will be found frequently that such units are permanently wired to terminals on the laboratory benches.

The power pack described in this article is capable of delivering a stabilised output of 250 volts at any load between 15 mA. and 150 mA.: within these current limits the output voltage will be found to remain constant within approximately 2 volts. Variation of mains input voltage over quite wide limits will also produce no appreciable variation of output voltage. The actual value of output voltage may be varied at will over a range of approximately ±25 volts, but when set to any value it will remain constant irrespective of input mains fluctuations and D.C. load current changes.

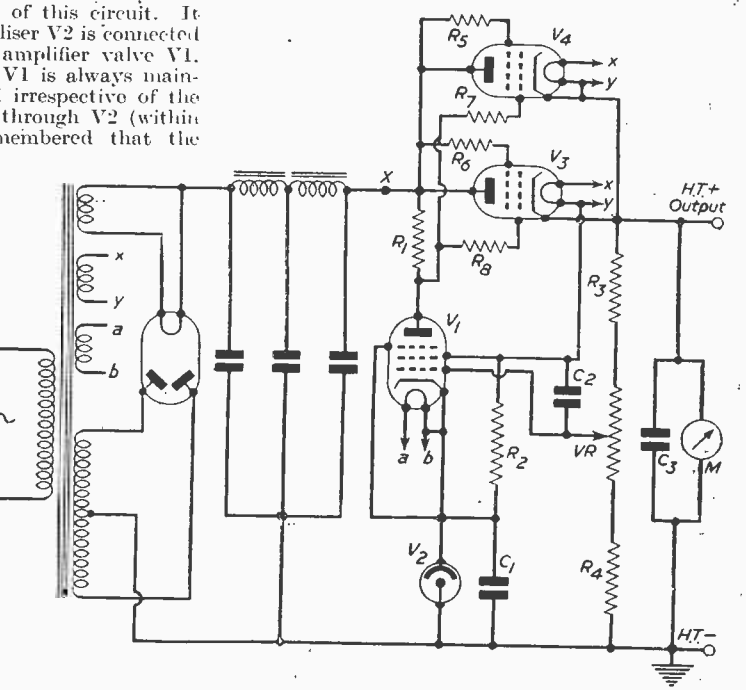
Operation of the Unit

If the circuit is analysed it will be seen that the valves V3 and V4 are, in effect, parallel cathode followers with the power pack output load as the cathode load of the valves. The output impedance of a cathode follower is, of course, extremely low, hence the excellent regulation of this circuit. It will be seen that the neon stabiliser V2 is connected in the cathode circuit of the amplifier valve V1, thus the cathode potential of V1 is always maintained at a constant potential irrespective of the current flowing through it or through V2 (within wide limits). It will be remembered that the property of a neon stabiliser is that the voltage drop across the electrodes remains constant whatever the current flowing through it. The bleed resistor, R2, is included in order to maintain sufficient current through the neon tube for it to remain struck at all times.

The grid of V1 is connected directly to the slider of the potentiometer VR which is connected across the output H.T. line, and the values of R3, VR and R4 are chosen so that V1 operates on its normal grid base even though the cathode is held at about 120 volts above earth by the neon tube. The position of VR thus controls the grid bias of V1 and hence also its anode current and potential. The anode of V1 is D.C. connected to the control grids of the series stabilising valves V3 and V4. Variation of bias on V3 and V4 varies their effective resistance, of course, and so controls the output voltage of the stabiliser. It will be seen, therefore, that variation of the position of VR alters the output voltage of the circuit and thus acts as the voltage adjustment of the unit.

Consider now the effect of variation of load currents on the unit. If the load is increased, the output voltage will tend to decrease, the voltage at the slider of VR (i.e., grid of V1) will also decrease, and this will reduce the anode current of V1. Its anode potential will rise, so raising also the grid potential of V3 and V4. The internal resistance of these valves is thereby reduced and the output voltage rises. In this way the tendency for a reduced output voltage due to increased load is immediately counterbalanced by an increase in voltage due to the action of the series valves.

The condenser C2 by-passes the resistances R3 and VR so that any A.C. ripple remaining on the output of the stabiliser is fed to the grid of V1 at full amplitude. V1, V3 and V4 operate at ripple frequencies exactly as they do for changes of D.C. operating conditions, so that the ripple on the final output is reduced to an exceedingly low level. Variation of A.C. mains input is also stabilised; since any increase in supply voltage will tend to



Circuit of Mr. Kendal's power unit described above.

increase the output voltage, V1, V3 and V4 will react as before and thus maintain a constant output.

Practical Details

In order for the stabiliser to operate correctly it is necessary for at least 130 volts to be dropped across the valves V3 and V4, thus, if the final output voltage is required to be 250 volts, at least 380 volts D.C. (and preferably more) must be available at the point X in the circuit and the transformer, chokes and rectifier drawn to the left of X must have suitable ratings to ensure this. The double section smoothing filter shown is not by any means essential, but it was designed by the writer for use in a power unit with the very best possible performance. The transformer delivered 485-0-485 volts, the smoothing condensers were 4, 8 and 8 μF, respectively, the chokes were 12 henries each and their ohmic resistance was 500 ohms the pair. The valve used was a 5U4G and the D.C. voltage measured at the point X was approximately 400 volts with the full current drain of 150 mA on the unit. The component values specified are suitable for a stabilised output of approximately 250 volts with a plus and minus 25 volts variation available by adjustment of VR.

LIST OF COMPONENTS

R1, 270 kΩ 1 watt 20 per cent. carbon.
R2, 6.8 kΩ 5 watt wire wound.
R3, 68 kΩ, 1 watt 10 per cent. carbon.
R4, 68 kΩ 1 watt 10 per cent. carbon.
R5, 100 Ω 20 per cent. ½ watt carbon.
R6, 100 Ω 20 per cent. ½ watt carbon.
R7, 100 Ω 20 per cent. ½ watt carbon.
R8, 100 Ω 20 per cent. ½ watt carbon.
C1, 4 μF. 250 v. working.
C2, 0.1 μF. 350 v. working.
C3, 8 μF. 350 v. working.
VR, 25 KΩ wire wound potentiometer.
V1, EF50.
V2, S130.
V3 and V4, 6L6G.
M, 0-300 voltmeter (optional).
Note : For greatest possible long term stability R3 and R4 should be wire wound resistors.

It will be noted that the cathodes of the series valves V3 and V4 are operated at about 250 volts positive to earth, and since the heater/cathode insulation is only rated for 100 volts it is necessary for the heaters to be fed from a separate winding on the transformer, one side of the winding being connected to the valve cathodes as shown in the circuit diagram. The EF50, V1, has about 120 volts on its cathode and it should, strictly, have its filament fed from a separate L.T. winding connected to the cathode to prevent excessive heater/cathode voltage. In fact, the rated heater/cathode voltage is so little exceeded that, unless a separate winding is readily available, the filament of V1 could be run from a normal earthy heater supply without much risk of valve failure.

The resistors R5, R6, R7 and R8, are for the purpose of preventing the possibility of parasitic oscillation, they are quarter watt carbon types and should be mounted very close to their respective valveholders. in fact, the screen resistors should be slung directly from screen to anode pins, and the grid stoppers should be slung from the grid pins to the spare pins on the valveholders, the latter being used merely as stand-off insulators.

Apart from the points mentioned the general layout of the components is of little consequence and no special precautions have to be taken with the wiring.

Although the component values given will be found correct for the voltages and valves specified, any number of variations of input and output voltages or valve types is permissible. If changes are made it is merely necessary to adjust R2 so that the neon takes its specified current and to ensure that V1 operates on its characteristic by suitable choice of values for R3, VR and R4.

It will be found that a power pack of this type is a very valuable possession and amply repays the trouble in constructing it. Many of the components will be available from the usual surplus equipment sources.

TRADE NOTES

The New EKCO "Stroller"

E. K. COLE announce a new version of the popular "Stroller" four-valve, plus rectifier, medium- and long-wave superhet portable receiver, operating on A.C./D.C. mains or from all-dry batteries; with highly efficient in-built frame aerials. Housed in a cabinet styled on modern lines and finished in grey birds-eye leather cloth, with handle, speaker grille and hinged scale cover in rich maroon moulded plastic, this model costs £23 10s. including P.T. but excluding batteries.

Valve Data in Handy Form

A NEW and completely revised edition of the popular Mullard Pocket Valve Data Booklet is now available. Not only is this new booklet extremely useful in the service department, but it provides, in a compact form, a handy valve reference for the outside service engineer.

In addition to containing abridged data on all current Mullard receiving valves and television picture tubes, the new edition contains essential information on the latest ranges of Mullard photocells and photographic flash tubes.

The "Testoscope"

WITH reference to advertisements which have recently appeared concerning the Runbaken Testoscopes, we are asked to point out that the Popular Model, at 12s. 6d., referred to in our June issue has not been withdrawn from production. Particulars of other models may be obtained from Runbaken, Manchester.

Change in "Osram Valve Bases"

THE General Electric Co., Ltd., is increasing the diameter of the bases of the following types of Osram valves from 30 millimetres to 34 millimetres: types X61M, W61, DH63, Z63, H63, L63 and W63. Some types have already been changed and others are being changed in the near future but the increased size should be borne in mind in connection with screening cans.

The new design will prevent bases becoming loose.

TR9 Transmitter/receivers

Details of a Popular ex-R.A.F. Unit

By A. W. MANN

THE purpose of this article is not to describe fully the TR9 range of battery-operated ex-R.A.F. transmitter/receivers, but to give prospective purchasers who are interested some idea as to the general design, and to those who already have such apparatus to hand sufficient information and some assistance in, as it were, sorting things out.

There may be some QRP enthusiasts who are using this apparatus after adapting it to their requirements, and others who intend to do so. I should be interested to hear of the results obtained.

The Transmitter

It is of course understood that transmitting apparatus can only be used by licensed transmitting amateurs, and that it must conform to the terms of the amateur transmitting licence.

While a certain amount of information concerning the receivers has been published, little has appeared concerning the various types of transmitter.

TR9 Models

These transmitter/receivers are of compact design and exceptionally well made. There are several variants of the original model, as for example, TR9 D, F, G, H, J, K and L.

TX, RX Combinations

TR9D—Receiver R1120, transmitter T1119.
TR9F—Receiver R1139, transmitter T1138.
TR9G—Receiver R1395, transmitter T1394.
TR9H—Receiver R1139, transmitter T1396.
TR9J—Receiver R1398, transmitter T1397.
TR9K—Receiver R1400, transmitter T1399.

The model G is a variant of model D, while H, J and K are variants of model F.

Special Note

Quite apart from the internal modifications, there is an important difference between certain models, which has made the internal modifications necessary in order to meet service requirements.

While models D and K utilise the L.F. amplifier stages of the receiver to amplify the output of the microphone transformer, the F model requires the A1134 L.F. amplifier with separate H.T. and L.T. supplies.

TR9D

We will, however, confine our remarks to the TR9D. A carbon type microphone can be used without any alteration to the primary circuit. The only alteration necessary being to remove the link wire which shorts out a fixed condenser between the grid of the first L.F. amplifier valve and the secondary winding of the microphone transformer.

Readers who are interested in this series of transmitter/receivers, and have examined illustrations of them, may find the following information of use when such apparatus comes to hand. The meters mounted on the transmitter panel are a 0-30 mA. on the left, and on the right a 0-0.5 amp. thermo-coupled type.

The aerial coil used in these transmitters is of the well-known and efficient sliding contact type, which enables the coil to be tapped at any desired point throughout its length.

The control dial for carrying out this operation is directly below the meters. A very useful feature of this control is that it incorporates a turns indicator, and in addition a graduated degrees scale. By this means not only can the number of complete turns tapped off be logged, but fractions of a turn also.

To the right of the main dial is a smaller knob for the setting of the second tapping. In service use, the transmitter was set up on two frequencies, known as the normal and special frequency respectively. Slightly above the smaller knob, and to the right, is an aluminium slotted control knob. This is the send-receive control.

The hinged covers mounted on the panel give access to the modulator valve (right), while the left-hand one enables the crystals and power amplifying valve to be examined, or changed when required. Some of these transmitters are fitted with a send-receive switch, mounted between the two hinged covers. Others are fitted with a socket. The socket just above the earth terminal, however, is for remote contactor cable connection. This is fitted with a red-topped shorting plug, for tuning-up purposes.

The Receiver

The receiver section of the TR9 series is already well known to readers. This consists of two H.F. stages, triode detector, two L.F. stages and a pentode or power output stage.

On test these receivers provide good output volume on the loudspeaker, but are very poor so far as selectivity is concerned. The tuning range is very restricted, and the H.F. regeneration is rather tricky to work. The correct procedure in this case is to back down one turn from the point of regeneration.

The reason for the poor selectivity is the fact that they are designed in common with the transmitter to use a common aerial tuning stage, this being part of the transmitter section.

It may help if I mention here that the three-pin socket mounted on the top of the receiver is for the plug of the remote volume control. The correct component here is a variable potentiometer of 50,000 ohms. Another point relative to the R1120, but not to all types, is that when using the receiver alone, REC, H.T. Plus and INT. H.T. Plus should be coupled together.

Useful Data

Reverting to the transmitter section, the following data may be of interest to QRP licensed amateurs who must perforce use battery-powered apparatus,

(*Continued on page 374*)

A Car Radio

A 4-valve Receiver Using Standard Parts and

By F. G. RAY

AFTER trying a variety of circuits, aerials and power-supply arrangements, the receiver described herewith was made up. It is a 4-valve straight circuit with rotary transformer to provide H.T., employed with an aerial fixed on insulating pillars along the full length of the vehicle roof. (The latter provided the best signal pick-up of the aerials tried, besides proving very easy to make.) The whole installation proved satisfactory in operation while the total cost is quite low.

The circuit of the receiver itself is shown in Fig. 1. Mains type valves are used, wired so that heater current is taken directly from the vehicle accumulator. There are two 12.6 volt valves (the R.F. and output—a 12K7 and 12A6 respectively). The other two are 6.3 volt types, wired in series (the 6K7 and 6J5, used for detection and 1st L.F. respectively). Many different valves for 6.3 and 12.6 volt operation are readily obtainable and the circuit was found in no way critical. No difference was noted with either a 6K7 or 6C6, triode connected, used as L.F. amplifier, and other output valves proved equally satisfactory. However, if other valves are used two points must be watched. First, the bias resistors (given as 4,000 ohms and 350 ohms in Fig. 1 for the 6J5 and 12A6) may need to be modified in value. The correct values for different valves can be found in a valve reference book. Secondly, the heaters must, of course, be wired for 12 volt operation. This will normally present no difficulties, various series and parallel arrangements being easily arrived at.

Power Supply Circuit

This is shown in Fig. 2. Various types of ex-service rotary transformer are readily obtainable and the receiver was found to work well over a wide range of operating voltages. The output is D.C., which simplifies construction, and no smoothing except for the single 8 μF condenser was found necessary. One type available has an input of 11.5 volts, giving an output of 250 volts, 125 mA. This output is more than ample and can be reduced by slightly under-running the input side by connecting a spiral of 20 S.W.G. or similar resistance-wire in series with one brush lead. Some rotary transformers have an output section providing 13 volts, and it is quite in order to use this as the input winding as long as the current indicated on the transformer is not exceeded.

A maximum H.T. voltage of 150 was found ample. Some rotaries provide an output of 350 volts or more, but figures such as this are not required. The H.T. voltage can be reduced by including a resistor in series with the positive lead from transformer to receiver, but more economical operation (and quieter running) will be obtained by reducing the input voltage as mentioned.

The switch shown in Fig. 2 switches on both transformer and receiver. The full H.T. output will be obtained in a few seconds, but the valve heaters will require 30 seconds or so to attain full operating temperature. Though this means that no H.T. current will be taken during "warming up" it was found that the H.T. voltage does not

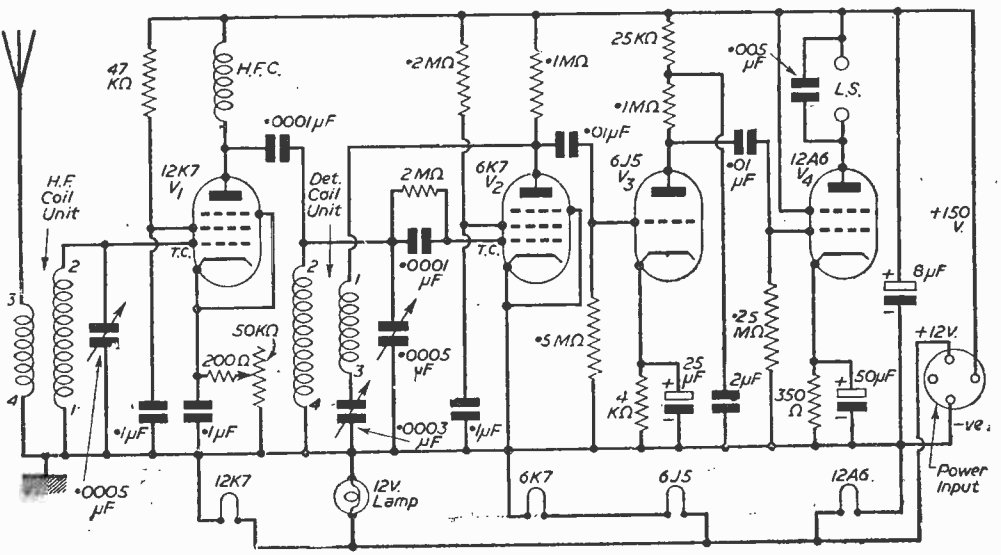
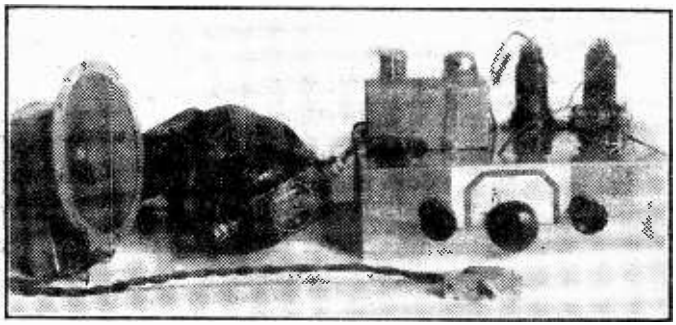


Fig. 1.—Theoretical circuit of the receiver.

Installation

...wered by a Rotary Transformer



A view of the receiver, speaker and rotary transformer.

rise appreciably during this period and no difficulty in this direction was experienced.

It is essential that the transformer be connected in the correct "sense" (polarity), and a valve-base or other suitable plug is used to take the power supplies (including heater current) to the receiver. Brushes and commutator should be absolutely

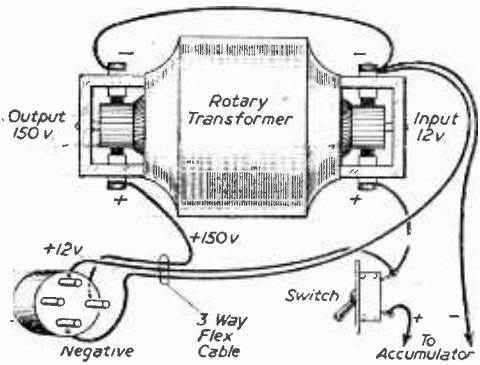


Fig. 2.—Power supply circuit.

clean and free from oil or grease or much sparking may arise and the output may fall considerably. The armature bearings themselves should receive a little lubrication, and with attention to these points the rotary transformer obtained should give a long period of useful service.

Receiver Construction

The receiver is built on a chassis 8¼in. by 5¼in. by 2½in. deep, bent up from a piece of aluminium 8¼in. by 10¼in. Full wiring diagrams are shown in Figs. 3 and 4. The 2½in. by 8¼in. front runner acts as panel, the tuning condenser being below the chassis. If it is desired to have the tuning condenser above the chassis, this can be arranged without difficulty, a lead being taken down through a small hole to form the connection for the rear section of the condenser plates.

The receiver tunes over the medium waveband only, this giving all that was personally required, but dual-range coils could be used instead of those specified. Ample sensitivity was obtained. Refinements such as A.V.C. were not considered necessary, and in any case would not be very practicable with a circuit of this kind.

The coil connections shown are for the coils listed, but coils such as the Wearite PA2 are equally suitable. With such a circuit, any pair of coils

COMPONENT LIST

.0005 μF tuning condenser with ction, scale and knob.
μF reaction condenser with knob.
ohm volume control with knob.
valveholders. 4 valves : 12K7, 6K7, 12A6 (see text).
m-wave aerial coil ; ditto for detector reaction. (" Supacoils," etc.)
condensers : two .0001 μF ; .005 two .01 μF (preferably mica) ; .1 μF ; 2 μF ; 25 μF, 25 v. working; F, 50 v. working; 8 μF, 250 v. working.
rs : 200 ohm ; 350 ohm (see ; 4,000 ohm ; 25,000 ohm ; 47,000 ; two .1 megohm ; .2 megohm ; megohm ; .5 megohm ; .2 megohm.
oke for R.F. coupling.
d socket for power supplies (3-way).
amp and holder.
M.C. speaker with transformer.
switch.
transformer (see text).

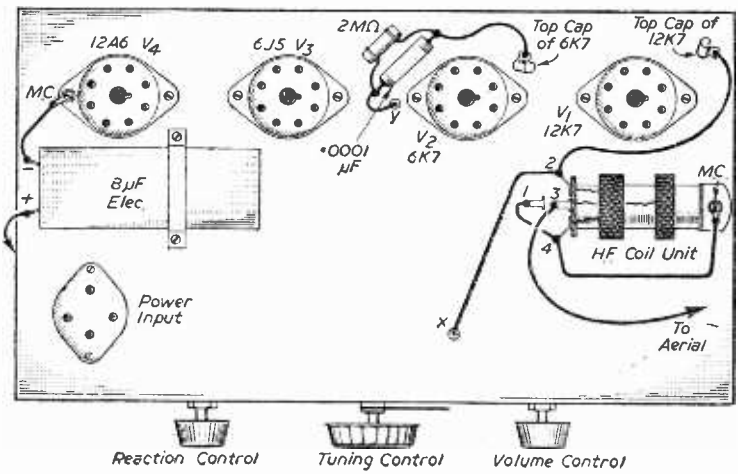


Fig. 3.—Top of chassis layout.

with reaction can be used. If no reaction can be obtained, reverse the leads to the reaction winding.

Power supplies are taken from a socket suitable for the plug mentioned: this simplifies wiring and installation. All points marked "M.C." are connected to the receiver chassis. The .005 μF condenser shown in Fig. 1 is soldered across the tags of the primary of the speaker transformer and will not be found in Figs. 3 and 4. The type of tuning dial and reduction drive used depends on personal preference; a small epicyclic drive is perhaps the easiest to fit and takes up little space.

The on-off switch, which is connected to a few feet of fairly stout twin flex, was not mounted on the receiver itself. It could be so located, if desired, though this would make necessary two extra leads to the receiver chassis.

If the vehicle has the positive terminal of the accumulator connected to the vehicle chassis (and this is usual), a short-circuit will arise if the receiver chassis comes into contact with any metal part of the vehicle. Any dangers in this direction can be avoided by making a small wooden cabinet for the receiver. It will afterwards be possible to bolt this cabinet in the required position, thus effectively insulating receiver from vehicle.

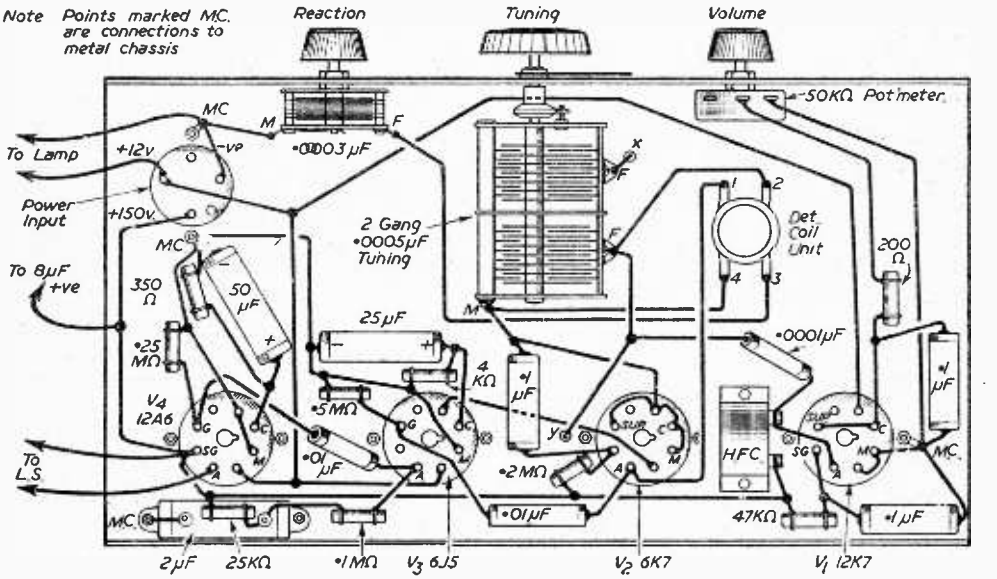


Fig. 4.—Wiring and components below chassis.

Self-acting Broadcasting Transmitters

LOW-POWER broadcasting transmitters, which can be left to operate unattended, are among the latest Marconi developments to be ordered by foreign broadcasting authorities. Orders for ten and seven 2 kW. models have been received from Italy and Sweden, respectively, as well as from Tanganyika.

This latest technique fills a long-felt want in eliminating the need for highly skilled engineers to be constantly in attendance at transmitter sites; such personnel can now be released to perform more important duties.

It Tests Itself!

These transmitters are made up of units which are themselves complete transmitters each having an output power of between 500 and 660 watts. Three or four units in parallel are used to form a 2 kW. installation, and such is the efficiency of the design that should a fault develop in any unit the transmitter switches itself off, tests itself, finds the unit which contains the fault, and switches the good units on again while isolating the faulty unit. This complete cycle takes only two to five seconds.

Remote control is achieved by the use of one pair of high quality lines.

Each of the units measures only 2ft. 6in. x 2ft. 6in. x 7ft., and has no rotating mechanism or oil-immersed components. They use a minimum of valve types and the output valves can withstand long periods of 100 per cent. modulation.

Any one unit can be serviced while the others remain in operation, and the circuits are divided on to chassis which can be withdrawn and easily carried by one man. They can also be rack-mounted in a maintenance van.

High Stability

A day-to-day stability of one in ten million is maintained and two crystal drives are provided—one as a spare which is automatically switched into circuit should the working drive fail.

For the Transmitter

Crystal Oscillators

A Study of the Initial Principles of Transmitter Design

By O. J. RUSSELL, B.Sc. (G3BHJ)

IN considering the design factors of amateur transmitters, it is logical to commence with the actual generator of R.F. oscillations, and for a start the crystal oscillator itself should be considered. The problems arising from the use of a variable-frequency oscillator can be most readily appreciated from a little preliminary experience with crystal oscillator circuits.

The crystal oscillator can best be studied by a selection of circuits. In this connection the use of some simple means of identifying frequency and checking oscillation conditions is highly advisable, especially as such devices are virtually essential in checking later stages of a transmitter to guard against the emission of radiations outside the recognised amateur bands. It is now possible to buy at low cost a range of absorption wavemeters covering the more normal amateur bands, while the simple absorption wavemeter of Fig. 1 can readily be constructed with suitable commercial coils and condenser to cover the frequencies in which one is interested. With a 160 pF. maximum tuning condenser and a selection of cheap plug-in short-wave coils, a useful adjunct to the amateur shack can be quickly made. The indicating bulb is loosely coupled by a two- or three-turn coil to the actual tuned circuit, and this two-turn winding can either be incorporated on the coil former to replace the existing "aerial coupling" or "reaction winding," or can be a permanent fixture to the socket in which the tuning coil is plugged by making it large enough so that it encircles the commercial plug-in tuning coil. In use the coil of the absorption wavemeter is coupled as loosely as possible to the tank coil of the stage under test, so that as little "pulling" as possible occurs. Resonance will be indicated by a glow in the indicating bulb. Loose coupling is made easier if a low-consumption bulb, such as the 60 milliamp "fuse bulb," or one of the special low-current bulbs used in some cycle dynamo lighting systems, is fitted.

Calibration

The absorption wavemeter is best calibrated with the assistance of some known source of at least a few watts of R.F. power, and a fellow amateur transmitter is often helpful here. Such considerations may seem very obvious and even unnecessary, but unless a methodical checking of every stage is made it is fatally easy to radiate unwittingly upon a frequency not permitted for amateur use. Under present conditions it is very advisable to be certain of correct operation, as inspection and monitoring by the Post Office is now very thorough. The use of a communication receiver for checking a harmonic frequency is not be be recommended. On a sensitive receiver a large number of harmonics can be picked up at apparently the same strength, while due to harmonic beat effects strong signals may be received at points on the tuning dial at which there is no actual radiation of energy. If the correct harmonic is tuned in it is certainly possible to identify it by observing the increase in strength as the generator is tuned up on the harmonic setting, but the same effect could be noticed if the apparent harmonic setting was actually due to a receiver oscillator harmonic beating with a higher order harmonic of the R.F. generator. In connection with the checking of oscillators and transmitters generally, it is assumed that the familiar "loop bulb," consisting of a low-consumption bulb with a pick-up loop wired across the contacts, will be available also for checking the presence of R.F. A neon lamp, while useful for testing buffer and doubler stages, is not always suitable for checking a small crystal oscillator, as the output may not be enough to strike the neon.

Crystal Types

Before considering crystal oscillator circuits as such, it is as well to consider the crystal itself. In the past the X-cut crystal was the most popular,

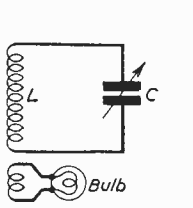


Fig. 1

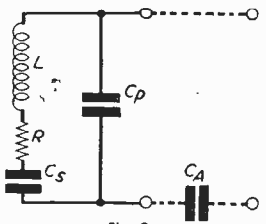


Fig. 2

Fig. 1.—Simple absorption wavemeter. The loosely coupled bulb circuit does not damp the tuned circuit as much as when the bulb is directly included in the tuned circuit. The values of L and C are chosen so as to allow of resonance at the frequency of interest.

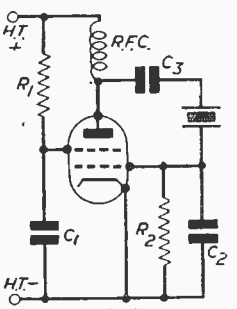
Fig. 2.—Equivalent circuit of crystal plate. If desired, the effect of an air gap is represented by the capacity CA, for a mounted crystal.

especially as these crystals were relatively robust and were reasonably resistant to overloading. The disadvantage of a high temperature coefficient, causing an appreciable shift of frequency as the crystal warmed up in use, was overcome by the introduction of the AT cut crystal. To-day, more especially due to the ubiquitous war-surplus crystals, there are a number of crystals in use which may be of the newer low-temperature coefficient cuts. Many of the modern crystals, both war-surplus and manufactured, are of smaller area than the inch-square or inch diameter circular crystal plates. The user should be careful in using crystals of unknown cut or origin, as these may not be so robust as the sturdy X-cut, and while they will

give excellent, and in fact improved, service if correctly used, care should be taken not to overload them. In the case of crystals purchased new, the makers' recommendations should be carefully followed, as a temporary overload will almost certainly ruin the crystal. Low-temperature coefficient crystals are not intended to be run at a loading so that the crystal becomes hot, even though the frequency does not shift greatly. The amateur who decides to regrind a crystal, unless certain of his techniques, must face the possibility of obtaining an inferior performance with respect to frequency jumps or uncertain operation. It should be clearly realised that even a crystal is not an infallible method of obtaining a stable signal. Apart from the drift with heating, a crystal oscillator, if run at an excessive power level, may not be satisfactory. With a 7 Mc/s crystal, and a final output of 28 Mc/s, drift during a transmission due to overheating may be 5 to 10 Kc/s. A more insidious phenomenon due to overheating, in crystal holders with inaccurate electrode plates, is the occurrence of frequency jump, which may be several kilocycles even at the fundamental frequency. Overrunning of crystal oscillators, particularly of the Tritet type, may introduce a noticeable degree of chirp if the final radiated frequency is high. A Tritet 7 Mc/s crystal oscillator multiplied up to 28 Mc/s can produce a note with a "char-chip" reminiscent of a wobbly unstabilised oscillator.

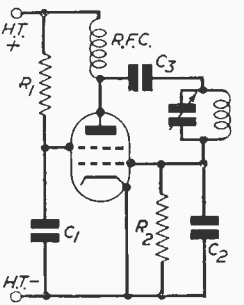
Stability

The crystal is valuable as a stable control element of an oscillator. Mechanically it is stable material of low expansion, so that viewed as a mechanically vibrating device it is inherently stable. From an electrical viewpoint the crystal represents a tuned circuit of very high L.C. ratio, with a high Q. The equivalent circuit of a crystal and holder shown in Fig. 2 is of interest, for it shows that a crystal may behave either as a series or a parallel resonant circuit. In the series resonant condition the circuit of interest is the equivalent inductance L in series with the series capacitance Cs. As L may be of the order of a henry or so while Cs may be of the order of .01 pF., the effective Q is high. As the effective resistance term corresponding to mechanical as well as electrical losses may be quite high, the practical values of Q obtained may be only three or four times those of achievable tuned circuits. In the case of ordinary quartz oscillator plates the value of Q may be anything from about a thousand upwards. In the parallel resonant condition the effective tuned circuit is formed by L tuned by the capacities Cs and Cp across it. As Cp is generally several times greater than Cs, the external circuit is effectively only very loosely coupled to the tuned circuit, so that the oscillation frequency is largely unaffected by the external circuit. A further capacity CA in series with the output terminals of the crystal may be included to represent the effect of any series airgap in the crystal holder. As the effective parallel combination of Cs and Cp will be very slightly less than Cs alone, the frequency of parallel resonance will be slightly higher than for the series resonant condition. The majority of popular circuits in use by amateurs employ the parallel resonant condition, and are mostly derived from orthodox oscillators by replacing a tuned circuit by a crystal. There are now a number of circuits employing the series resonant properties of the crystal, and these can well be studied after the usual parallel examples.



(a)

Fig. 3 (a).—Pierce oscillator.



(b)

Fig. 3 (b).—Colpitts oscillator.

The circuit of Fig. 3(a), commonly called the Pierce oscillator, although Pierce originated the circuit of Fig. 4 as well, may be regarded as derived from the modified Colpitts oscillator of Fig 3 (b).

C_1—.001μF.	R_1—*To suit valve usually*
C_2—*See Text.*	10,000 *to* 50,000Ω
C_3—.01 μF.	R_2—100,000Ω *is a convenient value.*

R.F.C.—Small receiving type of short-wave choke.

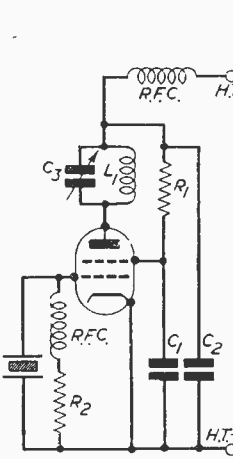


Fig. 4

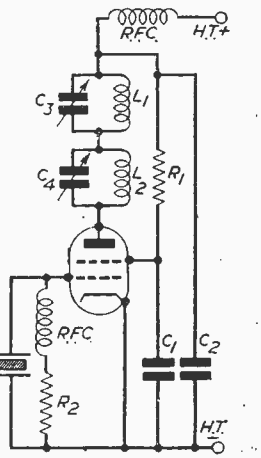


Fig. 5

A crystal replaces the T.G. circuit here, and in Fig. 5 an additional tuned circuit (L_2C_4), resonated to the second harmonic enables the oscillator of Fig. 4 to give a useful second harmonic output, although the Tritet has now superseded this arrangement.

C_1 *and* C_2 .001μF.
L_1 *and* C_3 *resonate at crystal frequency.*
V_1, R_1, R_2, *and R.F.C. as for Fig. 3.*

Crystal oscillator circuits employing the parallel resonant mode are best represented by the "simplest possible" crystal circuit of Fig. 3(a), in which the parallel resonant circuit of the simplified Colpitts circuit of Fig. 3(b) is replaced by a crystal. Providing that the R.F. choke is of adequate inductance effectively to isolate the anode circuit, the oscillator is often used where the complication of a tuning control for the crystal stage is unwanted. There is one point to be noted, however, in this simple circuit. The condenser C_2 functions as an excitation control, and may very well be a fixed condenser of .0001 to .00005 μF. If desired a variable of 100pF. maximum capacity can be used. The condenser is sometimes omitted from representations of the circuit, but it is in fact necessary to give a suitable fraction of R.F. voltage on the grid of the oscillator valve. As in this circuit the crystal provides the full R.F. output of the stage, it is under rather severe operating conditions, and the total anode voltage should be limited to a maximum of about 250 for safety.

T.A.T.G.

The well-known circuit of Fig. 4 may be regarded as derived from the "tuned-anode tuned-grid" oscillator circuit, with the grid circuit replaced by a crystal functioning as a parallel resonant circuit. The anode circuit must be capable of resonating at the crystal frequency, that is the frequency band of the fundamental crystal frequency. In point of fact adjusting the anode tuning circuit has an almost negligible effect on the frequency of output. The effect is most marked if a triode is employed. The superior isolation of pentodes and tetrodes greatly reduces this slight shift effect. It is a proof, however, that a crystal is not an absolutely invariable source of R.F., for a distinct pulling effect upon the note can be detected by monitoring a high harmonic of the crystal. The value of tuning condenser commonly employed for operation on the bands from 1.7 Mc/s to 7 Mc/s is 160pF., with a coil designed to give comfortable resonance. Considerations of L.C. ratio are not of great importance here, although generally one would tend to choose a coil resonating at nearly full capacity for, say, 1.7 Mc/s, while for 7 Mc/s one would preferably arrange for resonance with the tuning condenser about one third in mesh. In tuning with the condenser initially at a lower capacity than the resonance position, oscillation commences as the capacity is increased, and the oscillations rapidly increase in strength as the capacity is further increased, until a point is reached at which a further capacity increase causes oscillation to cease abruptly. For chirp-free keying, the best operating position is with the anode condenser set a little away from the point at which output is greatest.

Harmonics

The output of the tuned plate crystal oscillator of Fig. 4 is upon the crystal fundamental, so that little difficulty with spurious emissions is likely. Where second harmonic output is required, one artifice used has been the connection of a circuit tuned to the second harmonic between the fundamental tank circuit and the anode of the oscillator valve. The oscillator runs under class C conditions, and so an appreciable amount of second harmonic can be extracted from the distorted output from the valve. The second harmonic circuit offers a low impedance to the fundamental frequency, particularly if arranged to be of fairly high C, so that the normal functioning of the oscillator is not greatly affected. The arrangement is shown in Fig. 5. For these oscillator circuits a pentode or tetrode valve has advantages over small triodes such as the 6J5 or 6C6. In general the higher sensitivity of tetrodes and pentodes enables a higher output to be obtained for the same R.F. excitation of the crystal, while the lower grid-anode capacitance is also helpful. In the case of circuits of the type of Fig. 4, if a well-shielded

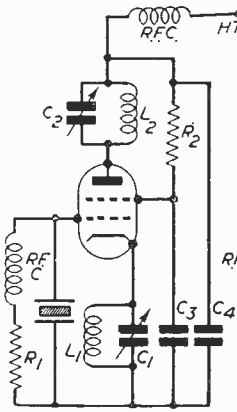


Fig. 6.

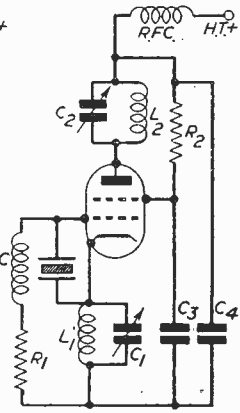


Fig. 7.

Two forms of the Tritet type of oscillator.

L_1C_1 resonate at a frequency slightly higher than the crystal frequency. (See text.)
L_2C_2 resonate at the desired harmonic.
C_3, C_4, R.F.C., R_1, R_2 as before.

tetrode such as the 807 is employed it may be necessary to add a very small external grid to anode capacity of one or two pF. in order to secure oscillation. In general any small pentode or tetrode such as the QV04/7, KT66, 6V6, 6L6, 6F6, 807, etc., may be employed. In the operation of these crystal oscillators, a fuse bulb of the 60mA type or a small R.F. thermal ammeter may be connected in series with the crystal in order to indicate the R.F. current taken by the crystal. This should not exceed the maker's recommended figure. It should be recalled that the use of a fuse bulb is in no sense a protective device, for in the event of an excessive burst of R.F. current the crystal will almost certainly fracture before the bulb blows.

The danger of crystal fracture is often stressed in connection with the Tritet circuit shown in two alternative forms in Fig. 6 and Fig. 7. These circuits are popular when harmonic output is required, for the second harmonic output is almost as great as that of a straight crystal oscillator on its fundamental, while the third harmonic output is also good. It is possible, but not usually satisfactory, to extract a fair output on the fourth harmonic.

(To be continued)

Gramophone Needle Wear

Some Interesting Facts Concerning Diamond Needles

THE subject of using diamonds to play gramophone records has been discussed repeatedly in articles published in this and other journals. Since most of these articles have appeared in technical publications, there is still a wide-spread lack of knowledge among the average users of gramophone equipment. The claims made for many needles have done nothing to enlighten the buying public. Such statements as "5,000 perfect playings" appear regularly in advertising literature. Because of these claims, most needle buyers are misled and do not realise the irreparable damage to which their records are subjected by using inferior stylus material. (Stylus is the technical term for the tip of the gramophone needle.)

The following details (published in America) and accompanying reproductions of a few photomicrographs, may prove of interest to readers.

Fig. 1 is a photograph of three styli, all of which were played only fifteen times on 12in. Vinylite long-playing records. The stylus on the left is diamond, the centre is sapphire, the right is osmium. Pick-up weight for all three styli was the same: 8 grams.

These three materials are the most common in use to-day, with osmium the most popular, by far.

Why Wear?

Why should so much wear be visible in an osmium or sapphire stylus, after such a short playing time, with only eight grams weight? One of the most important factors causing this wear is the tremendous pressure at the point of contact between the record surface and the stylus. Although the overall weight of the cartridge is small (8 grams), this weight is concentrated on a very small surface, i.e., the area where the stylus touches the record. The pressure on this surface may be equivalent to several thousand kilos per square centimetre! It is this great pressure, combined with the speed of the record groove past the stylus, which wears away the stylus material.

From the photomicrographs of Fig. 1, it is obvious that materials such as steel, cactus, etc., *which are not as wear-resistant as osmium* will quickly damage the records on which they are used. Once a stylus is badly worn, it will begin to destroy the record groove. Often pieces of the stylus material will flake off and bed themselves in the record, where they will cause sharp clicks and other noises.

Even osmium, the stylus material which is used in the great majority of cartridges manufactured to-day, wears quickly, and if not replaced will damage records.

Fig. 2 shows another set of photomicrographs of three styli, after 1,000 playings on 10in. Vinylite records, at 78 r.p.m., with a 1½ oz. (38 grams) pick-up. A brief study of this photograph should

(*continued on page* 370)

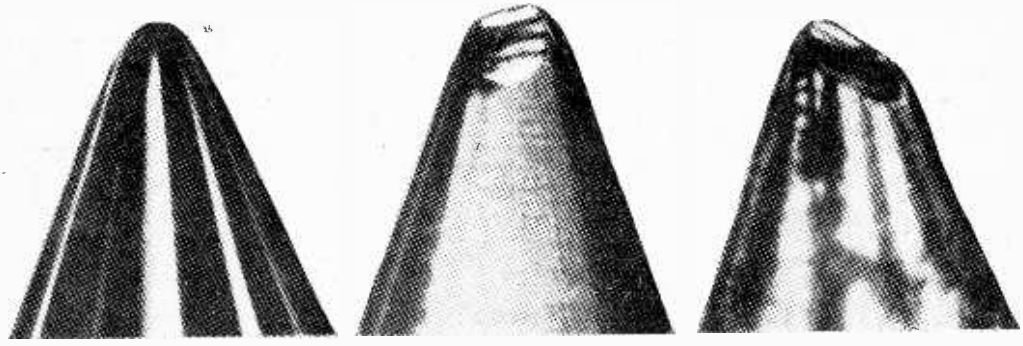
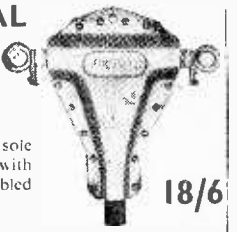


Fig. 1.—Three 1.0 mil. styli after 15 playings on 12in. Vinylite records with an 8 gram pick-up.

Fig. 2.—Three 2.5 mil. styli after 1,000 playings on 10in. Vinylite records with a 1½ ounce pick-up. From left to right: diamond, sapphire, osmium.

AERIAL CO-AXIAL CONNECTOR



The "BURGOYNE" development for efficient watertight co-axial cable connections for which we are sole distributors. Made of aluminium with Steatite insulation. Weight of assembled connector only 1,2 ozs. **18/6**

MOTOR ALTERNATORS.—A super Admiralty equipment in grey steel cabinet. With a D.C. input of 24v., a fully regulated output of 230v. 50 c/s A.C. is obtained. The equipment incorporates a starter switch, and the output is metered by means of an A.C. volt-meter. A control switch and fuses in both A.C. and D.C. circuits are also incorporated. Rating, 80 watts. BRAND NEW **£4**

ROTARY POWER UNITS.—These units give a 110v., 400 c/s output at a rating of 45 watts, when used on 24v. D.C. For those having gear which employs a 110v., 400 c/s power unit this alternator will provide the solution to unmodified operation BRAND NEW **£4**

BOSTIK CEMENT.—Handy pocket-size tubes. The ideal waterproof sealing compound. Will stick or seal almost anything. Single tubes **1/-**. Six tubes for **5/-**. (Please add postage.)

HEADSET ADAPTORS.—Convert those low resistance phones to high resistance by means of this adaptor. Contains matching transformer. AS NEW. **2/-** each plus **6d.** post. and pkg.

MINIATURE AC/DC POWER PACKS.—A very small power supply for use on any voltage between 97-250 volts, A.C. or D.C. mains. Size 8¼ x 3¼ x 2¼in. Complete with mains tapping block and lead. Off load D.C. voltage output approx. 250 volts. On normal load for small superhet approximate output 100-120 volts. (Carriage and packing **2/6.**) **29/6**

R3515.—21-valve radar units with six stage 14 mc/s IF Strip. Sufficient space on chassis to construct complete TV receiver (excel. EHT). Valves: one EA50, ten SP61, five EF36, three EBC33, one EF39, one EB34. BRAND NEW IN TRANSIT CASES. (Carr. paid.) **£3/10/0**

2-VALVE MORSE OSCILLATOR.—A morse oscillator of high quality. A five-position switch selects the desired note and a control the output level. A jack is provided for superimposing interference over the CW note. Complete **15/-**. Carr., pkg. **1/6** extra

TAPE & WIRE RECORDER MOTORS by B.S.R.—A small induction motor specially designed for magnetic tape and wire recorders. Absolutely silent in operation and virtually free from vibration. Minimum stray magnetic field. For A.C. mains 100-250 volts, 50 cycles. Type FP10 **38/-**

EKCO PENCIL IRONS.—For those who have to do soldering in confined spaces, this iron provides the solution to easy scorch-free soldering. It is light in weight and having very low consumption will appeal to those who are tired of clumsy, heavy irons and exasperating electricity bills. For 6 or 12v. operation. Please state voltage when ordering. BRAND NEW IN MAKER'S CARTONS. **£1/1/0** (postage **1/6**).

SIEMENS SOLDERING IRONS Each **14/-**
60 watts for 220-230v. A.C./D.C. (Post., packing 10d.)

M.O.S

MAIL ORDER SUPPLY
(Dept. P.W.8)
33, Tottenham Court Road,
London, W.1.

SHORTAGE OF RADIO & T/V ENGINEERS

The demand of Industry for our trained students is still far greater than we can supply—and is likely to remain so for many years.

We offer:

FULL TIME DAY COURSE

1 year Course in Principles and Practice of Radio and Television.

Next Course commences 27th August

Write for FREE BROCHURES giving details of the above, of our 3-year course and of others.

E.M.I. INSTITUTES—the only college which is part of a great industry.

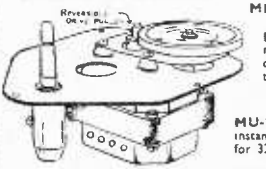
E.M.I. INSTITUTES

Dept. 32, 10, Pembridge Sq., Notting Hill Gate, London, W.2. Bayswater 5131/2

Associated with "H.M.V." MARCONIPHONE COLUMBIA ETC.

1.27

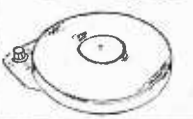
GRAM MOTORS & PICK-UPS for MICROGROOVE RECORDS



B.S.R. MU-10 motors for 33 & 78 r.p.m. Speed change by reversing drive pulley. 10in turntable. 100-250v **£3.15s.**

MU-14 de luxe model with ROTACAM instant speed change for 33 45 & 78 r.p.m. **£7. 3. 4.**

ACOS GP-20 pickups, standard **£3.11.5**
GP-19 LP microgroove head only **£3.3.4**



Frith RADIOCRAFT Ltd.
60-71 CHURCH GATE · LEICESTER
PHONE 58927

SPARKS' DATA SHEETS

Recognised as the Safest, the Simplest and the finest Radio Constructional Sheets. All my Designs are Tested and FULLY GUARANTEED.

THE POCKET PAK. The finest little self-contained Pocket Portable one-valver obtainable. Med. waves. Good 'phone sigs. Most widely used and always praised. All-dry Batteries. **3/-**
THE CRUISER. A three-valve T.R.F. High-gain Set. Specially designed for use with a short aerial. Ideal for Caravans, Camping, Yachts, etc. M/L waves. All-dry Batteries. **3/-**
THE "UNIVERSAL FOUR." A 3-valve plus Rect. M/L wave T.R.F. Circuit giving 4 watts output. A.C./D.C. operation. **3/-**
THE "CUB." A.C./D.C. 2-valve plus Rect. Power and Quality on the "local" stations. A fine little set on M/L waves **3/-**
THE CORVETTE. A compact all-wave Superhet. Good results anywhere with "hook-up" aerial, or a good Portable with self-contained aerial. Chassis 5½ x 4½ x 2in. All-dry Batteries. **3/-**

The above are only a few of my designs.
SEND STAMP FOR COMPLETE LIST.
COMPONENTS SUPPLIED.

L. ORMOND SPARKS (M)
48A, HIGH STREET, SWANAGE, DORSET

IMPROVISATIONS

Temporary Workable Expedients for Experimental Use or as Servicing Aids

By W. J. DELANEY (G2FMY)

THERE are certain components in radio and television receivers which never seem to give trouble, whilst others are continually breaking down. Usually it is found that the latter components are those which, when they develop trouble, result in a complete cessation of signals, and often this is just at a moment when a particular programme is required. In many cases it is not necessary to dismantle the receiver and put it out of commission for a long period, and the following hints will give some ideas which will enable a temporary repair to be made, whilst at the same time the schemes may be applied for experimental use, and all are practical and the result of experiences gained with various types of apparatus.

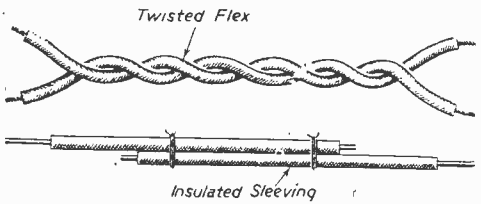


Fig. 1.—Temporary small value condensers may be made up on these lines.

Capacitors

Probably the most troublesome component is the capacitor. Usually its failure takes the form of severe leakage or completely open-circuit. Depending upon its position in a circuit its effect can result in all sorts of conditions including complete cut-off of signals. Although most experimenters carry a good stock of condensers, it is usually found that the very value which is required is the one which is missing from the stock. It is worth while remembering that *small* capacities may easily be made up from twisted flex or straight lengths of wire run through insulated sleeving and laid parallel. Fig. 1 illustrates the idea broadly, but it should be remembered that the two "sides" of the capacity so formed should not be permitted to come into contact either with each other or any other object, and both are adjustable over fairly wide limits. With the flex the degree of twist and the length of the two pieces of flex will govern the total capacity, whilst with the parallel wire arrangement the thickness of the wires and of the insulated sleeving, as well as the amount of overlap, will be the governing factors. Large values such as are found in A.F. circuits cannot be made up in this way, but quite a large capacity may quickly be rigged up by stacking pennies on a piece of insulating material (in the case of a metal chassis) and allowing the bottom of the pile to rest on one bare wire, with pieces of paper interleaved between each successive coin, and clamping the remaining lead under the topmost coin. Here the number of coins and the thickness of the interleaving paper are the controlling factors.

Resistors

It should hardly be necessary to point out that odd values of good condensers may be connected in series or parallel, but we are dealing with makeshift ideas rather than the use of normal components. The same remarks apply to resistors, although one idea which must not be overlooked is that where a resistor burns out due to it being of too low a wattage rating. Another may not be handy, but several lower values and ratings may be joined in series to make up a total near that of the required value, and this will reduce the wattage distribution across each separate section and thus enable quite a big load to be carried temporarily. In fact, such an idea is often worth carrying out on the grounds of expense, as several low-wattage resistors are often cheaper than a single one of the required rating. Where a resistor up to 1 watt rating has broken down, it may be replaced by the simple expedient of using a carbon track, in other words a track drawn with lead pencil. The pencil should preferably be of the B or BB type, so that a good deposit can quickly be made by suitable pressure, and the length of the line or track and its thickness are the controlling factors. Contact with the ends of the line may be made with washers held down by nuts and bolts or by means of a coin and bare wire end as mentioned above under capacitors. Variation of a value for experimental purposes or to obtain a given result in a faulty receiver or piece of equipment may be obtained by sliding the wire at one end along the track. If for any reason it is desired to retain such a component for use over a period it is best protected by *spraying* with shellac, as it will be found to be hygroscopic and to change its value according to the dryness of the atmosphere.

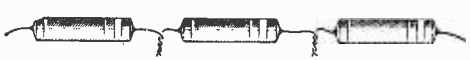


Fig. 3 (above).—Low value resistors may be joined in series to replace a single high-rating unit.

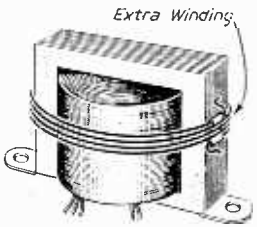


Fig. 4 (right).—A temporary winding may be placed on an unscreened mains transformer, as shown here.

High wattage resistances such as are found in mains receivers may be quickly made up by using wire of the type sold in spiral form for use in electric fires. An odd piece of this may be handy and a meter is, of course, necessary with resistors of this type to check values.

Mains Apparatus

Most of the above ideas may be applied to either battery or mains receivers, but the latter call for especial care, not only in view of the damage which can be done with the high voltage which is usually present, but on the grounds of personal safety. No liberties should be taken with any form of mains apparatus and on no account should alterations or modifications be carried out without first switching it off *and disconnecting the mains plug.* In some apparatus one side of the mains may be actually connected to the apparatus and thus,

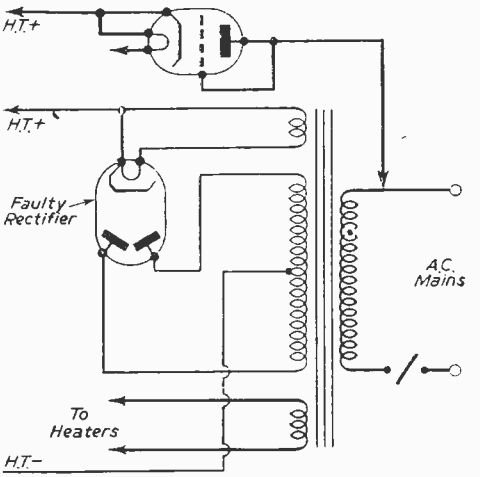


Fig. 5.—Using a power valve as a temporary half-wave rectifier. It may be joined to one half of the secondary winding—but not *the primary.*

although switched off, it will be possible to receive a serious if not a fatal shock, merely by attempting to loosen a grub screw in a control knob.

Apart from the components mentioned, there is probably only one other item which can lend itself to a temporary repair and that is the mains transformer or rectifying valve. When the reservoir smoothing condenser breaks down it usually develops a short-circuit, and as a result the overload damages the rectifier, in some cases destroying it completely. The first step in such a case is obviously to remove or disconnect the condenser, and a receiver may be operated without the condenser for a short period—to hear some special item for instance. A replacement can consist of any condenser of suitable voltage rating from 2 μF upwards, remembering that a higher value tends to produce a larger output voltage. If the valve has been destroyed and another suitable rectifier is not available a power valve may be used temporarily by strapping grid and anode and using it as a half-wave rectifier, but this can only be done where the original receiver had a mains transformer with a 250-0-250 volt secondary. A higher rating will probably not function with the makeshift rectifier. One half of the secondary should be used to feed the valve and it does not matter which half. Hum might be troublesome, but this is a temporary expedient to enable a particular item to be heard. It has been suggested that if the H.T. secondary breaks down, too, the use of a valve of the type mentioned could be adopted by connecting it direct to the mains as shown in Fig. 5. This is not recommended, however, and may be very dangerous, as the other side of the mains must be joined to the H.T. negative line, and this in most cases corresponds to the chassis control spindles, etc., and gives rise to the risks above-mentioned. If the H.T. secondary has gone, no makeshift repair is advised and it is necessary to wait for a replacement transformer to be fitted.

If, however, for some reason a low-voltage secondary has gone, or a temporary low-voltage winding is required, this may be provided in the case of an unscreened transformer by overwinding the wire round the transformer as shown in Fig. 4. It should be wound in the same direction as the other windings and a meter will be necessary to check the voltage produced, and turns added or removed until the desired output is obtained. Again, this will load the primary, and care must be taken not to overload this as the transformer will run hot and a breakdown of insulation may occur, leading to more serious trouble later.

NEEDLE WEAR

(*continued from page* 366)

enable you to judge such claims as "5,000 perfect playings" for any other stylus material except diamond.

From the photographs, it is apparent that diamond is the only material which will withstand the high abrasion which occurs at the contact area of stylus and record groove.

The above extract and illustrations are, as already mentioned, taken from an American Trade publication (Auri-News), and we understand from certain British manufacturers that it does not necessarily give results which would be obtained over here, due to the use of different materials for the discs. Furthermore, it is claimed that the English sapphires would not probably show such wear as is illustrated on our own discs, but the general information is informative as showing how a needle point wears after a number of playings and does show that the harder the needle material the less the wear and consequently the less the risk of damaging a record due to the use of a needle which has been used to play a large number of records and as a result has developed a "chisel" edge.

Programme Pointers

This Month MAURICE REEVE Deals with Some More Recent Programmes

THE atmosphere of complete unreality and artificiality created by the studio audience was never more forcibly brought home than in a recent instance—one of many, no doubt—of a well-known variety artist appearing in a Saturday evening variety programme. In spite of the fact that we heard her received with the usual fanfaronade of applause whipped up on such occasions, I had read on the previous Tuesday that she had sailed that day for the United States!

Stage Successes

There have been many first-class productions this month of famous stage theatrical successes. And, by the way, all the better for being presented free of the "applause blight," as are most of the best features.

Granville Barker's "The Voysey Inheritance" was one of the most powerful productions of the Edwardian era. Its author, and his famous wife, Lillah McCarthy, were famed for their great Shakespearian and Shavian productions at the Court Theatre. Consequently he was of the very stuff that goes to make fine drama. The story of how the younger Voysey refuses to use his father's money when he hears how it was "made," was excellently done by Clive Morton, Felix Felton, Joan Hart and others.

Drama producers should be careful when casting Miss Hart. Her rich, deep contralto voice is so characteristic that, as with many film stars, it tends to swamp the character she is playing. Its timbre is so quickly recognisable that St. Joan or Honor Voysey, etc., all tend to be Joan Hart in the end. "Watch the Wall, My Darling"—not a great stage success—was another Miss Hart part that emphasised this point.

Wilde's "The Importance of Being Earnest," that ever-flowing stream of brilliant late nineteenth century wisecracks, sparkled with lustre, which was not surprising considering it was done by Dame Edith Evans, Ronald Ward, John Gielgud, Gwen Ffrangcon-Davies, etc. The men were perhaps the best, and the "Bunberrying" of John and Algy seemed as brilliant and as fresh as the day it first took London by storm.

So did Shaw's "Pygmalion," with Joan Hart again. Terence de Marney as 'Enery' Iggins, and Angela Baddeley as a very good Eliza. As different, maybe, from "The Importance" as can well be—except in the common nationality of their authors, an all important factor—its ebbulience is just as gushing, whilst the classic "not bloody likely," even in this most profane age, brings the roof down as completely as ever. I expect it always will.

Coward's "Private Lives" was fairly obviously foaled in the Wilde stable, but is a brilliantly, satirical comedy none the less. The whispered jokes about the Albert Hall and "The good old ninth" are vintage Wilde. Googie Withers, Denise Bryer, Hugh Sinclair and Neil Tuson kept the fun going on the required sophisticated level. Middle-aged playgoers will well remember the author and Gertrude Lawrence in the original production, also John Clements and Kay Hammond more recently.

Plays of such vintages as these are like great music, essential for a wholly satisfactory presentation. Radio drama attains three times its normal stature when it is given then.

Radio Play

Two productions of a different type were enormously interesting: "The Fire in the Snow" and "The Ultimate Mountain." The former is the story of Captain Scott and his companions, written specially for and first produced by Australian Radio by Douglas Stewart. The five heroes were excellently played by John Mills as Scott, Peter Coke as Oates, Peter Finch as Wilson, Peter Bathurst as Bowers—"a very gallant gentleman"—and Arthur Hambling as Evans. Patricia Brent was a sincere and feeling narrator, and Tyrone Guthrie the effective producer.

The production moved me intensely. The great story was reverently told with poetic feeling for its deathless character, and the incredible tragedy of their finding themselves forestalled by a couple of weeks (where no man had ever trodden before!) poignantly brought home.

"The Ultimate Mountain" told the story of the attempt on Everest in 1924 by Mallory, Norton and others; an attempt which may have succeeded, but which is recorded as not having done so because those who made the final dash did not return. This was not on quite such a high plane as "The Fire in the Snow," in fact it very nearly came to grief at the hands of a little boy who seemed to step right out of Cowleaze Farm in Children's Hour to plague us with the most incredibly naïve questions and remarks. His intervention was a great mistake.

Music

Music, too, has been well served. The "Trout" Quintet was beautifully played by Dennis Matthews and colleagues. What an extraordinary piano part this is! The two hands play in unison for at least two-thirds of the score; there is hardly any technical or pianistic inventiveness, yet we are completely enchanted throughout.

Verdi's Requiem was scintillatingly performed by the Hallé under Barbirolli. What a masterpiece this is! Whole pages of it might have been torn out of Aïda and have come straight over from Covent Garden. Yet the religious "mystique" is never absent.

The French musical genius seems to reach its apogee in Ravel, and the L.P.O. and choir, under de Sabata, gave a glorious concert of the master's works. He and Debussy crowned an era which would add lustre to any nation's fame.

I can see "We Beg to Differ" going the way of "The Brains Trust," and for the same reason. The standard of question they are confronted with gets sillier and sillier, and their own particular type of sex war thinner and thinner. Its demise would be a pity: it was originally very amusing.

News from the Clubs

WARRINGTON AND DISTRICT RADIO SOCIETY

Press Officer : Mr. Frank E. Loxham, "Fulwood," Heath Road, Penketh, Near Warrington, Lancashire.

WELL attended meetings of the society continue. A series of four lecturettes by G2FCV, on 144 meg. band and operation, have been commenced.

One member entered for the 1951 R.A. examination. Meetings are held at the headquarters, 30, Queen's Avenue, Warrington, on Mondays at 7.30 p.m. All local enthusiasts will be welcomed.

BRIGHTON AND DISTRICT RADIO CLUB

Hon. Sec.: R. T. Parsons, 14, Carlyle Avenue, Brighton, 7.

HAVING participated in NFD and had the usual "inquest" on the day's events, the club settles down to a full programme of talks and demonstrations. Visitors to the locality during the summer months will be most welcome. Club headquarters is Eagle Inn, Gloucester Road, Brighton. Club nights, Tuesdays.

Programme for July.—10th: Audio freq.: transformer design. 17th: Hunts capacitors. 24th: Junk sale. 31st: Tape recording by G5ZQ.

THE MIDLAND AMATEUR RADIO SOCIETY

Publicity Representative : B. H. T. Olver (G3DJQ), Cleeve Lodge, Nether Whitacre, Nr. Coleshill, War.

AT the regular meeting held on Thursday, April 19th, a most interesting talk was given by Mr. E. Shackleton, M.B.E. (G6SN), on radio communication from a P.o.W. camp in Germany. Examples of the improvised radio gear built by the lecturer and his fellow prisoners were shown, and the account of the adventurers connected with its use were most exciting.

At the May meeting held on the 22nd Messrs. C. H. Banks and J. Hickman lectured on High Fidelity Tape Recording and demonstrated the excellent results given by their equipment. The lecture was extremely interesting to both those members who were already working on tape recorders and those about to make a start.

GILLINGHAM TELECOMMUNICATIONS SOCIETY

Secretary : C. E. Pellatt (G2FAQ), 101, Boundary Road, Chatham, Kent.

THE members of the society organised and operated the Medway "A" Station during N.F.D. A very pleasant and successful week-end was enjoyed—157 contacts were made, worth 429 points. The transmitter was VFO-PA, and the receiver AR88. Power was from a petrol-driven alternator, and the station enjoyed the luxury of fluorescent lighting! The call-sign used was G2CM/P.

Meetings, alternate Tuesdays, 7.30 p.m. Medway Technical College, Gardiner Street, Gillingham. New members welcome. During school holidays, meetings will be held elsewhere. Details from secretary at the time.

READING RADIO SOCIETY

Hon. Sec.: L. A. Hensford (G2BHS), 30, Boston Avenue, Reading, Berks.

AT the meeting held on Saturday, May 26th, a recorded lecture was given by G3BML, of Basingstoke, on "Tape Recording." Several demonstrations were given which included bird songs (recorded in a wood), dance-band music and Ham QSO's.

G3BML was in attendance and answered all questions on his home-constructed equipment; several recordings were made by local members, great amusement was found by playing these back.

Further activities at the moment consist of an exhibition stand at the "Hobbies Exhibition" being held at Reading.

Instructional meetings are held every second Saturday of the month.

STOURBRIDGE AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: W. A. Higgins, 28, Kingsley Road, Kingswinford, Nr. Brierley Hill, Staffs.

THE A.G.M. was held on Tuesday, March 6th. Officers for 1951 are—president, G6OI; chairman, G4MI; vice-chairman, G6WF; treasurer, G2CLS; and secretary, G8GF. A comprehensive discussion on future policy and activities was held, and a prospect of increased support for outside activities was very evident.

On Tuesday, April 3rd, a much improved attendance enjoyed a talk by Clarry McLean, G2CLS, describing his transmitter-receiver for top band. The whole unit was contained in a TU5B case. Following this members described apparatus entered for the J. Timbrell Junior Trophy. This was won by John Hogg, G2OG.

On Tuesday, May 1st, a quiz was held, which proved very popular and instructive to members.

The informal meetings continue to be well supported.

WATERLOO RADIO SOCIETY

Hon Sec.: J. C. Henderson, 47, Maple Street, Cheetham, Manchester, 8.

THE above newly-formed club held its first meeting on April 16th, 1951. Mr. B. H. Knowles was elected chairman, and Mr. J. C. Henderson was elected hon. secretary. Meetings are held weekly on Tuesdays at 7 p.m. at St. Albans Schoolrooms, Waterloo Road, Manchester, 8. It is intended to promote a well-balanced interest in all aspects of radio. There are workshop facilities at the club room. A slow morse class is held weekly. One of the members has loaned a B.C.348 and power unit, and this will be on the air when the installation of the aerial has been completed. The aerial facilities are 300ft. east/west—300ft. north/south. One of the members has been giving a series of lectures up to date. New members are arriving at each meeting. Intending members should contact the hon. secretary or just roll up at club headquarters on Tuesdays.

TR9 Transmitter/receivers

(*Continued from page* 359)

The rated air-to-ground range is estimated as at least 35 miles. With the exploits of certain QRP amateurs in mind, it would appear that under amateur conditions on the ground some surprising results might be achieved, in conjunction with a really good aerial.

Valves

Oscillator, VT20.
Modulator, VT51.
Power Amplifier, VT51.

The VT51 H.T. voltage is 150; maximum dissipation 3 watts continuously.

Anode Current 9mA. Screen 2.5 mA. Filament 0.2 Amps.

VT 50. Max. H.T. 150. Filament, 0.1 Amps.

Capable of 1 watt continuous Dissipation.

This transmitter is operated on the fundamental crystal frequency, and the range covered is 4.3 Mc/s to 6.6 Mc/s. Modulation percentage, 90.

The above refers to the TR9D, which incorporates the T 1119 transmitter, and R1120 receiver. The output impedance of the latter, by the way, is 20,000 ohms.

Among the transmitter receivers available are some which have suffered somewhat from storage. The first job, in such instances, is to clean up each unit and remove all traces of oxidation. This applies to the outside clips and, in some cases, to soldered joints.

The receiver, of course, can be tried out as a separate unit. Licensed amateurs who wish to adapt the transmitter to suit their own requirements, should check the wooden screw used in conjunction with the second slider arm. This works in conjunction with a wooden, threaded nut, and it may be found that the latter is locked due to the swelling of the screw. A drop of oil should help here, and once eased the wooden screw should be treated with graphite and carefully and by degrees adjusted, until it has travelled the full length of adjustment.

The relay action can be tested by coupling up a two-volt accumulator, fitting the shorting plug in its associated socket to left of name plate, and, with slotted switch knob to "send," the relays should be heard to operate.

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).

Correspondent Wanted

SIR,—May I take this opportunity of congratulating you on a very efficient and interesting periodical. As a newcomer to radio I have found this magazine very helpful. It has guided me through my lessons, and I can safely say that my practical training was done with the pages of PRACTICAL WIRELESS. And now I proudly display my A.M.I.E.T.(Lond.) Diploma in radio servicing and look towards PRACTICAL WIRELESS with a warm and thankful feeling. I am still a student and am now studying for the Grad. Brit.I.R.E. examination.

I would like to correspond with any reader of PRACTICAL WIRELESS who will be willing to help me with diagrams and parts that I cannot get here.

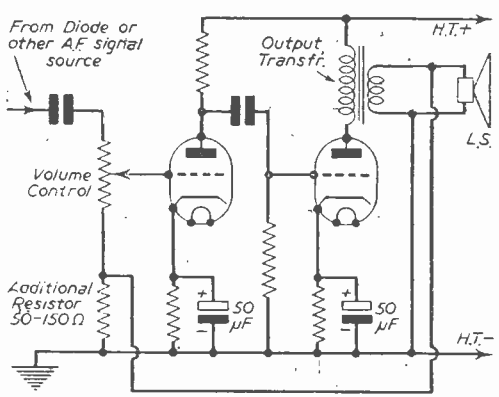
I am 34 years old and I will welcome letters from anybody in any part of the world. I am at present interested in wire recorders and short-wave receivers.—C. L. KENNY (No. 17, Atul Grove Road, New Delhi, India).

Negative Feedback

SIR,—The use of negative feedback in A.F. amplifiers will be well known to most readers and is invariably incorporated in any amplifier with pretensions to quality reproduction.

The need for high initial gain in such amplifiers has probably deterred the builders of small radio sets from employing a negative feedback circuit, for although the set may be used most of the time on strong signals, there are occasions when a distant programme is sought and all available signal strength is needed.

Faced with such a problem I evolved the circuit shown below on the left. It will be evident that the negative feedback is dependent on the setting of the volume control: with the control at maximum volume the feedback is negligible, but as the control setting is reduced, feedback is progressively applied.



Circuit of the idea suggested by Mr. Briddon.

It should be noted that since the feedback is not applied via a cathode resistor the circuit can be used on a battery operated set; the only requisite is that the volume control operates on the penultimate valve, and as this seems to be the practice followed in 90 per cent. of receivers, the circuit should have wide applications.

Wishing continued success to your journal and its readers.—GEORGE E. BRIDDON (S.W.3).

Alternative I.F. Couplings

SIR,—As a very interested follower of your excellent magazine, I do feel that there is one item I cannot let go unchallenged. In the interesting article on "Alternative I.F. Couplings," the author gives a suggested circuit for the three-valve superhet, but on examination I can see no reason for connecting an intermediate frequency of 460 kc/s merely to be followed by a detector stage. Surely one of the major considerations in a superhet circuit is to obtain amplification at the intermediate frequency: as it is I cannot help but feel that a T.R.F. circuit would be far superior.—C. BROADBENT (Huddersfield).

Hum Problems

SIR,—I read the July article on "Hum Problems" with great interest. I had experienced such trouble some time ago with a "low power but high gain" amplifier. The cure which I found effective was much simpler than finding a source of D.C.

Instead of the usual heater circuits with one side to ground, I isolated *both* leads from chassis and made the *only* earth connection at the centre of a small rheostat taken directly to the 6SJ7 heater pins via screened lead.

Here is another tip for hum reduction which will improve a poor H.T. filter. As well as the usual electrolytics, I placed a small condenser in parallel with the choke. The value of this is critical as it

must resonate the choke at 100 c/s. In my case, the choke was 20 henries and, therefore, the condenser had to be .1 μF. The connection of this condenser produced a marked reduction in hum level, whereas a condenser of wrong value either way caused an increase.

I hope this may help someone, or at least provide food for thought.—M. K. DUNN (Nr. Wakefield).

Ex-Service Components

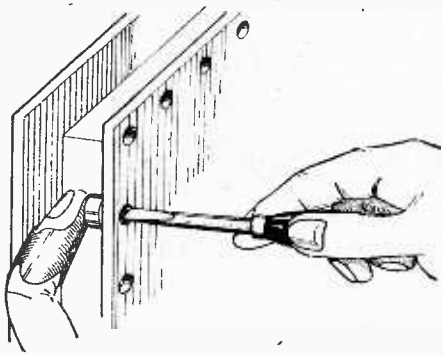
SIR,—I have often seen remarks about not using ex-Government components, especially condensers, and should like to point out the following experience. A friend and I both decided we would build the Transportable Four, described in the January issue. We got together and after finding various items in our spares boxes we went on a shopping expedition for the remaining items. We got mostly ex-Service parts in view of expense and bought a number of items "double" to suit both of us. We constructed the two sets together in my own "den" and when completed we tried them out. My receiver worked very well and after one or two preliminary adjustments I have nothing but praise for the performance. My friend was very excited and we disconnected my set and connected his up. It hardly gave out a sound and we checked wiring, etc., and could find nothing wrong. As mine was all right, and in view of the various remarks we have read from time to time we decided to substitute items one by one from my set (we have no meters as we are only poor amateurs). We started with the .1 μF. condensers and soon found that C8 was the trouble and presume from what it does that it is nearly shorted out. The resistor in series with it was quite warm and this is what gave the clue. So we agree there is a risk if you haven't the gear to test items like these.—G. WATTS (N.W.9).

Service Engineers

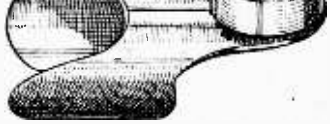
SIR,—I have been interested in the recent correspondence on the above, but would like to point out another aspect which does not appear to have been taken into account. In an endeavour to keep out "dabblers" one or two firms to my knowledge refuse to issue service sheets except to their authorised dealers. The motive may be good. How many dealers are "fully qualified"? There is no standard, as such, and provided a dealer has been on a "course" run by the manufacturer he appears to be "qualified." On the other hand, there are many "dabblers" like myself, who happened to have been through the R.A.F. Signals course, which provided a fairly sound theory grounding in addition to its practical line, and who have made a hobby of radio during the pursuit of which we have made up signal generators and other test gear much of which is not found in the average dealer's workshop. Furthermore, as we handle for friends and "customers" all makes and types of receiver, our general knowledge is very much wider than that of the dealer who only handles one or two makes for which he is "the approved local dealer." In addition many like myself have gone to the trouble of sitting for various degrees from time to time during our study of the hobby and a few letters after our name do tend to show that we know a bit about radio and its associated subjects. Therefore, you cannot generalise, and just as there are "dabblers" who earn the condemnation of the recognised trader, so by the same argument there are plenty of recognised traders who earn the condemnation of the really qualified amateur whom they term a "dabbler" because he has other occupations and merely services equipment as a hobby or part-time employment.—G. W. WALDE (N.W.).

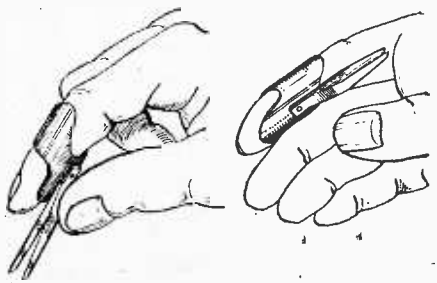
Acru Finger Tools

CONSTRUCTORS will find the range of tools illustrated of great use in chassis construction and assembly. These tools are available as "box" tools to hold nuts (0 to 6 B.A.) in position whilst the bolts are "started," or as screwdriver ends to hold screws in position, or as tweezers. The latter swing round inside the finger when not required, and all these tools may be left on the fingers if desired without hindrance to normal operations. A set of box tools in chrome costs 7s. 6d. and a set of two screwdriver ends and one thimble is 3s. 6d. Tweezers on thimble, with sharp point, flat nose or round nose, are 2s. 10d., and a full set of the above in durable metal case costs 22s.



The useful Acru Finger Tools





Tweezers in use When not in use

0-20 amp. Moving Coil Meters. 7/6. Bond Tester, 0 to .1 ohm, 4in. scale, can be easily converted into ohmmeter or megger. 12/6. Vacuum Gauges. 0-30in.. mercury, 6in. scale, 10/-. Centre Zero Voltmeter, 0-3 and 0-30 volt, 10/-. A.C. Voltmeter, 0-150 volt with 12 k. resistor, will read 300 volts. 7/6. Special Offer. 100 to 124 Mc/s Transmitter in four channels (BC950-A400), less valves, 17/6, plus 1/6 post. Metal Rectifiers, 12 volts ½ amp., 4/6. 6-way on off press button switches, a really beautiful job, 3/6. Moving Coil Mikes (hand type), 6/6. Carbon Hand Mikes, 4/6. Fully Shrouded Mike Transformer, 4/6. 8 mfd. conden-sers, 500 v., screw mounting, 2/6. 8 mfd. 600 volt, 4/-. 4 mfd. 600 volts, paper, 2/6. 10 mfd., paper, 600 volts, 6/-. 32 mfd. 500 volt (larger size with clip), 5/-. 25 mfd. 25 volt, 1/-. 50 mfd. 12 volt, 1/6. 12 mfd. 50 volts, 1/-. 8 x 8 x 8 mfd. 450 v., 5/-. .5 mfd. 500 volt, paper, 9d. .1 mfd. 2.5 Kv., 2/6. Miniature Speaker Cabinets to suit 3½in. speaker in very attractive colours, 7/6. 200 to 250 volt motors, A.C. D.C., with three-speed gear-box, 19/6. ML4, 5/-. VR137, 7/6. 12C8, 8/-. 12SL7, 8/6. NCT1 Thyraton, 6/-. Battery output pen, 6/-. EL3, 10/-. ECH3, 10/-. HVR2A, 7KV. EHT Rectifier, 6/-. E.K32 6.3 volt, .2 Frequency Changer, 6/-. MS Pen, 6/6. VP4B, 7/6. 12A6 output Pen., 6/-. 4-Pin Barfeter .2 amp., 5/-. 1G6 1.4 v. (twin triode), 10/-. KTZ41, 7/6. 4 Gang Tuning Cond., .0005, 3/6. 100 P.F. Double-spaced Butterfly Condenser, 2/6. Anti-interference radio mains suppressors, 7/6. 3 to 6 meter Transmitter receiver, works from 6 volt Vibrator Pack, price £7/10/0. Metal Rectifier, 12 volt at 1 amp., price 4/6. 5in. enerkised speaker suitable for car radio, 15/-. 15 amp. Slidelock fuse, 2/-. 230 v. Bridge type megger less resistance box, £5. G.E.C. and Ediswan Germanium crystal diodes, price 5/6.
Superhet Chassis suitable for radiogram, 5-valve A.C. Complete with dial and speaker by well-known makers. We have a very comprehensive stock of all Radio, Electrical and TV Spares. Write, call or 'phone. All enquiries answered.

SOLIDAS LTD.

4 PRAED ST., LONDON, W.2.
AMBASSADOR 4670

Best Buy at Britain's

Receiver type 21. A battery-operated superhet covering 4.2-7.5 Mc/s. and 19-31 Mc/s. Operates as a double superhet on the 10 metre band. Offered complete with nine 2 v. valves and circuit diagram, 45/- carriage paid. NEW CONDITION, 6 v. Vibrator Pack. Suitable for use with the 21 set. Output 150 v. at 40 mA, fully smoothed and rectified. Circuit diagram included. Only 17/6 post paid.
Portable Test Instruments. These Multimeters are perfect, brand new and contained in original box. The instrument is a moving coil volt-ohm-milliameter, complete in an attractive carrying case with handle. The dial is calibrated for readings of 0-1.5 v., 0-3 v., 0-60 mA. and 0-5,000 ohms. Further ranges can be added as desired. A range switch is incorporated and the basic movement is 6 mA. 250 ohms resistance. Our price: 15/-, plus 1/6 post.
Potentiometers. Heavy duty twin wire-wound, 10 K. and 100 K. 5/- each post free.
Electrolytic Condensers. 8 mfd. 600 v. wkg. 700 v. surge, 3 for 10/- post paid. 16 mfd. 500 v. wkg. 600 v. surge, 3 for 11/6 post paid. Tall can-type single hole fixing.
Multiple Block Condenser. Electrolytic. 8 x 16 x 4 x 4 x 6 mfd., all for 450 v. wkg., 4/9 each, plus 9d. post, or 2 for 10/- post paid. A real snip!
8.1. Block Condensers. Electrolytic. 8 mfd. 500 v. wkg. 3 for 9/- post paid.

CHARLES BRITAIN (RADIO) LTD.

11, Upper Saint Martin's Lane, London, W.C.2. TEM. 0545
Shop hours, 9–5 p.m. (9-1 p.m. Thursday)
OPEN ALL DAY SATURDAY

The "Fluxite Quins" at Work

"All the wiring's FLUXITED inside,
The trouble's not there," Ol cried.
"Just look out here
The reason is clear,
Why our picture has gone all cock-eyed!"

See that **FLUXITE** is always by you—in the house—garage—workshop—wherever speedy soldering is needed. Used for over 40 years in Government works and by leading engineers and manufacturers. Of all ironmongers—in tins, from 1/- upwards.
The **FLUXITE GUN** puts **FLUXITE** where you want it by a simple pressure. Price 2/6, or filled 3/6.

FLUXITE

SIMPLIFIES *ALL* SOLDERING

Write for Book on the Art of "SOFT" Soldering and for Leaflets on CASE-HARDENING STEEL and TEMPERING TOOLS with **FLUXITE.** Price 1d. *each.*
FLUXITE Ltd., Dept. W.P.
Bermondsey Street, London, S.E.1.

RADIOLECTRON

22, Frances Street, Scunthorpe, Lincs
NEW GOODS ONLY
CONDENSERS.—450 V.W. 1 mfd. 2/9; 2, 3/3; 4, 3/2; 8, 3/4; 16, 4/6; 8-8, 6/8; 8-16, 7/6; 16-16, 10/6; 500 V.W. 8 mfd. 4/-; 16, 6/6; 8-8, 6/6; 8-16, 8/6; 16-16, 10/6; 25 x 25v., 2/3; 25 x 50v., 2/3; 50 x 12v., 2/3; 50 x 50v., 2/6. Tubulars, 500 V.W. up to .01, 1½d.; to .1, 1/3; .25, 1/9; .5, 2/10. Moulded Mica, up to .0003, 10d.; to .003, 1/-; to .01, 1/6; Sil. Mica, up to 80 pf., 9d.; to 8K pf., 1/-.
VOLUME CONTROLS.—Long Spdls., all values, 4/6; with SW, 6/6; D.P. SW, 8/-; Midg. Type, ½, ¾, 1, 2 meg., 5/-; with SW, 7/-; D.P. SW, 8/-; Wire Wound, 1 K. to 80 K., 6/6; 100 K., 7/9.
RESISTORS.—All values, ½ to ½ w., 6d.; ½ to 1 w., 8d.; 1 to 2 w., 10d.; 2 to 3 w., 1/3; Wire Wound, 5 w. to 2 K., 2/-; 3 K.. to 50 K., 2/6; 10 w. to 2 K., 2/6; 20 w. to 2 K., 4/-; Mains Droppers, 2 adj. taps, .2 A., 5/-; .3 A., 5/4; Linecord, 3-way, .2 A. or .3 A., 2/3 yd.
Terms.—Orders up to 10/- post 4d.; over free. List 4d. Business closed July 13th to 28th.

RADIO UNLIMITED

ELM ROAD, LONDON, E.17 (Key 4813)

NEW BOXED VALVES
6K7GT/G, 7/6. 6K6GT, 8/6. 6V6G, 12/6. 6Q7G/GT, 11/6. 6F6G, 8/6. 6L6, 12/6. 9D2, 5/-. VR92, 4/-. 6X5, 9/-. KTW61, 8/-. 5U4, 10/6. 6J5, 6/-. EF39, 6/6. EF36, 6/6. EBC33, 8/6. SP61, 7/6. SP41, 6/-. 25Z6, 12/6. 25A6, 12/6. 1T4, 10/-. 1S4, 10/-. 1S5, 11/-. 1R5, 11/-.
NEW, BOXED P.M. SPEAKERS.—2½in., 15 ohm, 13/6; 3½in., 2/3 ohm, 14/6; 5in., 2/3 ohm, 14/6; 6in., 2/3 ohm, 13/6; 8in., 2/3 ohm, 16/-; Elliptical, 22/6.
This Month only:—
MAINS TRANSFORMER
By World Famous Manufacturer. 350-0-350, 6v., 5v., 100 m.a. Guaranteed Brand New. 25/- carr. paid.

RADIO SUPPLY CO.

34, Hanover St. Park Lane, Leeds

BRAND NEW GUARANTEED GOODS
TERMS.—C.W.O., or C.O.D. over £1 postage 1/2 extra on orders under £2.
R.S.C. MAINS TRANSFORMERS
Fully interleaved and impregnated.
Primaries 200-230-250 v. 50 c/s. Screened..
HALF SHROUDED DROP THROUGH
250-0-250 v. 70 m.a., 6.3 v. 2 a., 5 v. 2 a. 12/11
350-0-350 v. 70 m.a., 6.3 v. 2 a., 5 v. 2 a. 14/11
350-0-350 v. 90 m.a., 6.3 v. 3 a., 5 v. 2 a. 19/9
250-0-250 v. 100 m.a., 6.3 v. 6 a., 5 v. 3 a. For R1355 Conversion 25/9
350-0-350 v. 100 m.a., 6.3 v.-4 v. 3 a., C.T., 0-4-5 v. 3 a. 21/11
350-0-350 v. 150 m.a., 6.3 v. 4 a., 5 v. 3 a. 27/11
FULLY SHROUDED UPRIGHT
250-0-250 v. 60 m.a., 6.3 v. 2 a., 5 v. 2 a., Midget type 2½-3in. 16/11
350-0-350 v. 70 m.a., 6.3 v. 2 a., 5 v. 2 a. 18/9
250-0-250 v. 100 m.a., 6.3 v.-4 v. 3 a., C.T., 0-4-5 v. 3 a. 23/9
250-0-250 v. 100 m.a., 6.3 v., 6 a., 5 v. 3 a. For R1355 Conversion 26/9
350-0-350 v. 100 m.a., 6.3 v.-4 v. 3 a., C.T., 0-4-5 v. 3 a. 23/9
350-0-350 v. 150 m.a., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a. 31/-
425-0-425 v. 200 m.a., 6.3 v.-4 v. 4 a., C.T., 6.3 v.-4 v. 4 a., C.T., 0-4-5 v. 3 a. Suitable Williamson Amplifier 47/9
OUTPUT TRANSFORMERS, Push Pull 10-12 watt to match 6V6, 6L6, PX4, etc., to 3-5-8 or 15 ohm Speaker ... 15/11
15-18 watt for 6V6, 6L6, etc., to 3 or 15 ohms 21/9
Williamson type exact to author's spec. 72/-
FILAMENT TRANSFORMERS. Primaries 200-250 v. Secs. 6.3 v. 2 a., 7/6; 0-4-6.3 v. 2 a., 7/9; 12 v. 1 a., 7/11; 12 v. 3 a. or 24 v. 1.5 a., 16/9.
SMOOTHING CHOKES.—80 m.a., 12 h. 350 ohms, 5/6; 90 m.a. 10 h. 100 ohms, 6/6; 100 m.a. 10 h. 100 ohms, 7/6; 50 m.a. 50 h. 1,500 ohms. Suit Williamson Amp. 9/6.
TRANS. 230 v. input. Output 320 v. 70 m.a. auto, 6.3 v. 3 a., 7/6.
FULL LIST 4d. SPECIAL LIST FOR TRADE 4d. FOR EX-GOVT. ITEMS SEE CLASSIFIED ADVT.

LYONS RADIO LTD.

3, GOLDHAWK ROAD, Dept. M.P., SHEPHERDS BUSH, LONDON, W.12

Telephone: SHEpherds Bush 1729

RECEPTION SETS AEW.1.—These are five valve superhet receivers with a frequency range, in 4 switched bands, covering medium wave band (188-545 metres) and short wave 50-12 metres. Power pack is incorporated, requiring 6 v. D.C. for operation. Loudspeaker is housed separately in its own case. Supplied complete with valves, speaker, instruction manual, including circuit diagram. Condition as new and unused and in working order. PRICE £11 10s. 0d., carriage 9/6.
BENDIX TRANSMITTERS, TYPE 1.—For modifying as a 20, 40 and 80 metre Tx. In varying conditions, from 30/-. For callers only.
POWER UNITS, TYPE 229.—Contain rotary converter for 24 v. D.C. input with D.C. outputs of 12 v. at 2A. and 300 v. at 70 mA., 2 stabilisers CV45, carbon pile voltage regulator, wire-wound pot. and resistors, 8 mfd. electrolytics, etc. Overall size 10½ x 8½ x 7in. PRICE 22/6, carriage 3/6.
AERIAL MASTS.—Consists of 4 sections of stout all-weather resisting paxolin tubing, each section approx. 7ft. long. Max. diam. 3½in., Min. diam. 1¼in. by 3/16in. wall. Each section fits together with metal ferrules, forming a mast 28ft. high. Very light weight and can easily be raised by one man. Guy ropes, etc., are not supplied. PRICE 42/-, carriage 4/-. Top two sections only to form a mast 14ft. high, PRICE 18/6, carriage 2/6.
MODULATOR UNITS, TYPE 169.—Contains 1 each of VR91, 5U4, CV67 (Klystron) CV85, 2 Selenium rectifiers, 230 v, 30 mA., tuning motor high voltage condenser, etc. Built on metal chassis and housed in case 18 x 9 x 7½in. Brand new and unused. PRICE 29/6, carriage 5/6.

Impressions on the Wax

Review of the Latest Gramophone Records

THE recent arrival in Great Britain of Leopold Stokowski, at the invitation of Sir Thomas Beecham, whose Royal Philharmonic Orchestra he will conduct in a series of concerts in London and the provinces, is an event of some importance to music-lovers. For his latest recording he has chosen "Symphony No. 1 in E Minor, Op. 39," by Sibelius. The symphony orchestra which was assembled for this set of four 12in. records—*H.M.V. DB*21264-7—is composed of picked musicians under Stokowski's supervision. There is some interesting writing for strings and woodwind, notably clarinets and considerable novelty in the use of pizzicato chords to end the work.

It was while studying in Florence that Berlioz read Shakespeare's "King Lear" and begun an overture on the subject. The result was one of the composer's best works. Critics have long compared it with Beethoven's "Coriolan." The "King Lear" Overture is this month recorded by Sir Thomas Beecham conducting the Royal Philharmonic Orchestra on *H.M.V. DB*9614-5 and it is considered one of the finest recordings yet made.

The noted French pianist and composer, Robert Casadesus, has for many years wielded considerable influence in the two fields of teaching and concert playing. For his latest recording he has chosen to play the solo part of Cesar Franck's "Symphonic Variations," on *Columbia LX*8800-1 (automatic couplings only). He is accompanied by the Philharmonia Orchestra conducted by George Weldon.

The recordings made by Constant Lambert of Waldteufel waltzes have the mark of authenticity. As a leading ballet conductor, Lambert knows the precise weight of emphasis to place in the phrasing of a danceable melody. His happy flair for waltz tunes is heard to advantage in his recording of Waldteufel's "Sur la plage," by the Philharmonia Orchestra, on *Columbia DX*1755.

Leon Goossens is considered to be the greatest living exponent of the oboe and for his latest record he plays the solo part of Albini's "Concerto in D, Op. 7, No. 6," on *Columbia DX*1753, with the strings of the Philharmonia Orchestra under the able baton of Walter Susskind.

Festival Recordings

A sound picture of Great Britain is supplied by *H.M.V. C*7850-1, which consists of a recorded sequence of national, musical and sporting events taken from the archives of the B.B.C. and The Gramophone Company Limited. The commentary on these two records is by David Lloyd James.

Vocal

For his third film, M.G.M.'s sensational young operatic star, Mario Lanza, has been given his most exacting rôle so far—that of portraying the life story of the greatest tenor of the last 100 years—Enrico Caruso. Two of the songs featured in the film, "The Loveliest Night of the Year" and "La Donna E Mobile," have been chosen by Lanza for his latest English recording on *H.M.V. DA*1978.

Recently back from her triumphant stay in America, Kirsten Flagstad has been making appearances in London, singing Leider at the Royal Albert Hall and opera at Covent Garden. For her recording on *H.M.V. DA*1933 the great Norwegian soprano has chosen the beautiful "Geistliches Wiegenlied," which Brahms set for soprano with viola and piano accompaniment. The viola is played by Herbert Downes and Gerald Moore is at the piano.

The fourth recording in the series of excerpts from Mozart's ensemble opera "Cosi fan Tutte," by the principals of the Glyndebourne Opera Company, is as delightful as the previous items already issued on H.M.V. The first act, with which this record, *H.M.V. DB*21115, is concerned, features Richard Lewis (tenor), Erich Kunz (baritone) and Mario Borriello (baritone).

Variety

Steve Conway sings the continental hit "Mairy Rose" coupled with "All Alone with my Heart," on *Columbia DB*2875. He is supported with the Peter Knight Singers and orchestra directed by Norrie Paramor.

Irish tenor Josef Locke has chosen for his latest release a pair of ballads that are suited to his robust voice. They are "Take a Pair of Sparkling Eyes" and "Nirvana"—*Columbia DX*1752.

Geraldo and his Orchestra add to their laurels by being the first dance band to play at the Royal Festival Hall. He chooses "Mariandl, Andl, Andl" and "Across the Wide Missouri" for his recording on *Parlophone F*2464.

Harry Davidson and his Orchestra continue their Old Time Dance Series with "The Sauntering Serenade" and "Starlight Waltz," on *Columbia DX*1751, Victor Silvester and his Ballroom Orchestra place dance tempo versions of "Tea for Two" and "The Lady is a Tramp," on *Columbia FB*3608, and Ivor Moreton and Dave Kaye, the "Tin Pan Alley" duettists, present a group of contemporary tunes that make pleasant, easy listening on *Parlophone F*2461.

Editorial and Advertisement Offices:
"Practical Wireless," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. 'Phone: Temple Bar 4363.
Telegrams: Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

BOOKS

BRITISH SHORT WAVE LEAGUE is devoted to the interests of amateur radio enthusiasts. Publishes 12-page "BSWL Review," monthly (members only). Offers many services and activity departments. World wide membership. Founded 1935. Apply for details to: BRITISH SHORT WAVE LEAGUE, 55, Victoria St., London, S.W.1. (Abbey 2384.)

THERE IS STILL TIME to have personal radio on your holiday at budget-beating cost. Get "Personal Portables." **2/8**, post paid. from BRADBOOKS, Sennen, Penzance, Cornwall.

R.S.G.B. "Amateur Radio" publications: Transmitting Licence, 32pp., **1/-**; Service Valve Equivalents, 32pp., **1/3**; Transmitter Interference, 32pp., **1/6**; Simple Transmitting Equipment, 52pp., **2/3**; Microwave Technique, 68 pp., **2/3**; Receivers, 96pp., **3/9**; Valve Technique, 104pp., **3/9**; V.H.F. Technique, 96pp., **3/9**; R.S.G.B. Bulletin, current issue, **1/6**. Five recent issues, **2/6**. Prices include postage. RADIO SOCIETY OF GREAT BRITAIN, 28, Little Russell St., London, W.C.1.

ALIGNMENT PEAKS. Second edition. 5,000 superheterodyne alignment peaking frequencies, **4/9** post free. The Practical Radio Engineer, quarterly publication of the Institute, sample copy **2/-** post free. Membership and examination data **1/-** post free. Secretary, I.P.R.E., **20**, Fairfield Road, London, N.8.

RECEIVERS & COMPONENTS

TR9 COMPLETE SETS with 9 valves, not guaranteed **16/-**. Yaxley 2-way Switches, **1/9**. 50 new, 50 used Resistors, ½ to 5w.; our selection, **6/6**. Unselected Nuts and Bolts, **1/9** lb. 50 Wire-end Electrolytic Condensers Asstd., including 2 and 4 mfd. 350, 500v.; knock-out price, **10/6**. 8 mfd. 600v. Cans, damaged, **1/3**. All post paid. Indicators, 6a. complete in maker's crate, **75/-**. AUTOREX MOTORS, New Whittington, Chesterfield.

EVERYTHING for Radio constructors. Condensers, Coils, Valves, Resistors, etc. Send stamp for list. SMITH, 98, West End Road, Morecambe. Quick service.

WILTON RADIO presents the "Wilton" D.X.5 Battery T.R.F. short-wave chassis receiver with Eddystone slow-motion dial. For constructors, 16 gauge Al. Panels, 16in. x 12in., 12in. x 9in., 12in. x 6in., 13in. x 10in., 10in. x 9in. Send s.a.e. WILTON RADIO, Giants Grave Road, Neath.

SMALL CHOKE, 300 ohms, 50ma, **1/6**. Intervalve Trans., **2/6**. M R Spkr. Trans., **2/6**. Midget Components, List 2½d. CARTER'S, 67, Bell Lane, Marston Green, Birmingham.

RF UNITS TYPE 24, and 24 mod. 27 at **12/6** ea., plus 1/3 carr.; R1124, with 6 universal valves. OK for TV sound, **21/-** ea. We have large stocks of ex. Gov. Radio, Electrical and Optical goods. S.A.E. will bring you complete lists. H. ENGLISH, Rayleigh Rd., Hutton, Brentwood, Essex.

12 VOLT VIBRATOR Packs with OZ4A valve, smoothing, etc., **15/6**. Miniature M.C. Speakers, 1½in. cone, **3/9**. Battery Amplifier Chassis, containing mike, intervalve, and output transformers, valve holders, DP. DT. telephone-type switch, resistances, condensers, etc., sold for parts only, **4/-**, all ex-Government. Post free 10 page list 6d. SALLIS, 93, North Road, Brighton, Sussex.

RATES: 4/- per line or part thereof, average five words to line, minimum 2 lines. Box No. 6d. extra. Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Wireless," Tower House, Southampton St., Strand, London, W.C.2.

SOUTHERN RADIO'S Wireless Bargains.—Walkie-Talkie (Transmitter Receiver) type 38, Mark II, complete with 5 valves, throat microphone, headphones and aerial. 7 mc/s amateur band suitable for field use, powerful superhet receiver, modulated transmitter, guaranteed ready for the air, less batteries, **£3/10/-**. R.3515 Television Units, complete with 21 valves, 6 stage 14 mc/s I.F. strip, ideal for T.V. conversion, brand new in original wooden cases, **£3/10/-**. R.1355 Receivers, brand new, as specified in Inexpensive Television, **£3/5/-**. Receivers, B.C. 454 (49-100 metres), B.C. 455 (39-49 metres), brand new, complete with 6 valves, black crackle finish, **£3/10/-**. Command Receivers, type CCT-461-04 (1.5 mc/s to 3 mc/s), complete with 6 valves, 28 volts Dynamotor, brand new, black crackle finish, **£4**. Lufbra Hole Cutters, adjustable from ⅜in. to 3¼in. for use on wood, metal, plastic, etc., **5/9**; Lufbra Fly Cutters, **14/6**. Lionel "Bug" Keys, genuine U.S.A. automatic Morse key, type J-36, few only, **£3/7/6**. Throat Microphones, magnetic type, complete with long lead and plug, **4/6**. Control Cables for Command receivers, B.C.453/4/5, 14ft., with adaptors, **9/6**. Radio Compass Indicators, with internal Salsyn motor, type T-82a, 3in. dial, **13/6**; 5in. dial, **15/6**. Hand Generators, 6 volts at 5 amps, with crank, **21/-**. Speakers, Celestion 2½in., P.M. moving coil, 3 to 5 ohms, **17/6**. Meters, D.C., moving coil, 2in., brand new, 0-2 ma, 0-5 ma, 0-30 ma, 0-20 volts, **9/6** each. Plastic Transparent Map Cases, 14in. by 10¼in., ideal for maps, charts, display, photographs, etc., **5/6**. Star Identifiers, with hydrographic office modifications A-N, type 1, complete in case, **5/6**. Condensers, 100 assorted tubular and mica, all useful sizes up to 2 mfd, **15/-** per 100. Westectors, type WX6, and W112, **1/-** each, **11/-** doz. Full list of radio publications, 2½d. SOUTHERN RADIO SUPPLY, LTD., 11, Little Newport St., London, W.C.2. (Gerrard 6653.)

CONDENSERS, 32/32 mfd., 350vw, tub., **2/6**; .1-2.5kV, **2/6**; .01-4kV, **1/3**. Perm. Mag Dynamotors, 24v. to 250v., 60 ma. and 6v/3a, **5/6**; 12v. input, **7/6**; smoothed, R3084 type Chassis with Tx section, **20/-**; TV 6049 pre-amps., with 2xEF50, **17/6**; Valves, 1R5, 1T4, 1S5, 1S4, each **9/-**; VU111, VU120, 2X2, CV6, 7193, EA50, EB34, 12H6, 954, 9004, 9006, VR66, VR65, VR65A, each **3/6**. Lists available 1½d. s.a.e. Post paid over 10/-. W. A. BENSON, 308, Rathbone Rd., Liverpool, 13.

DECCA Three-speed Elec. Gram. Motors with turntable, **£7/3/9**, post 2/6. Decca Lightweight Pickups with 2 push-in high-fidelity Acos crystal heads with permanent sapphires for Standard and L.P., **84/6**, post 1/6. Ex-Collaro Standard Microgram Cases with uncut motor board, **50/-**. G.P. 20 Pick-up Heads, standard or L.P., **43/4**, post 1/-. Send 2½d. now for new list of these and other bargains, including Full Constructional Manuals how to build wireless sets, amplifiers, tuners, bass reflex cabinets, etc., for half normal cost. NORTHERN RADIO SERVICES, 16, Kings College Road, London, N.W.3. (Primrose 8314.)

MAKE THESE Receivers—complete with Cabinet and Valves: TRF 2WB, **£5/10/-**; MSS S'het., **£6**; LMS S'het., **£6/5/-**. Concise Books of instructions, **1/6** each. Thousands of Components available—TRF Coils, **5/3** pr.; .01 x 1,000v Tub, **3/6** dz.; .1 x 350v Tub, **2/9** dz.; Dial Drum, 2½in., **6d.**; Microphones, **1/6**; Sleeving, 1, 1½ 2 or 3 m/m, **1/-** dz. yds.; ex-RAF 40:1 Trans., **6d.**; etc., etc. 3d. stamp for latest list. SUSSEX ELECTRONICS, LTD., Princes St., Brighton.

ALL-WAVER, 1,000-mile range, modern detector circuit, needs no batteries or mains, plans and text **2/6**. For Ultra-Midget Set, **2/-**. List 1½d. ALEXTONE, Hillworth, Longdon, Glos.

RADIO SUPPLY CO., 34, Hanover St., Park Lane, Leeds. All goods guaranteed. Ex-Gov. Valves (new), D1 **1/3**, 954, 956 **2/9**, EA50 **2/6**, 9D2, SP4 (MS/PEN), VU133 **3/9**, EF36, KT2, 6C4 **4/9**, 12A6Met **5/9**, KT2 **4/11**, 6J5GT **5/3**, 6C6, 6D6, 6B8Met **6/6**, 42, 57, 6F7 **7/11**, 6K7G **6/11**, 6J7Met **7/6**, KT66 **8/9**. Volume Controls less SW, long spindle, 100K, 200K, **1/3**. P.M. Speakers, new, boxed, 2-3 ohm, 5in. **14/9**, 6in. **15/6**, 8in. **17/6**. Mains Trans., 230v input, 320v 60ma, 6.3v 3a output **7/6**. Ex-Gov. Unit with 4 EF50, 2 EF39, 1 EBC33, 1 EL32, and many useful components (valves do not carry our usual guarantee), **37/6** plus 2/6 carr. R1124 Units, less valves, **11/9**, carr. 2/-. Ex-Gov. Smoothing Chokes, 100ma 10h 100 ohms Trop., **4/3**. 8 mfd 500v Can Electrolytics, **1/8** ea. C.W.O. or C.O.D. over £1. Post 1/2 extra under £2. Full list 4d. RADIO SUPPLY CO., 34, Hanover St., Park Lane, Leeds.

TRANSMITTER - RECEIVERS, ex-R.A.F. T.R.9s 9-valve Battery Sets, not guaranteed owing to storage corrosion effects, but all valves checked. Complete with transit case, P.O. for **25/-** to "ELECTROMART," 14, Broad Pavement, Chesterfield, Derbyshire.

MIDDLESBROUGH.—Denco and Viewmaster TV Kits, C.R. Tubes, Coil Packs, Valves, etc.; send for free lists to PALMERS, 114, Waterloo Road. (Phone: 3096.)

HANNEY OF BATH offers: Eddystone 740 Receiver . . . we always have a reasonable number of these on order, get into touch with us about delivery. At the time of going to press we have two for immediate delivery . . . current price **£35/10/-**. W.B. Stentorian Speakers (which are in very short supply). We have good stocks of the following, all 2-3 ohm Speech Coil: 2½in. **17/3**, 5in. **17/6** (old price), 6in. and 7in. **23/6**, 8in. **24/-** (old price), 9in. **33/-**, 10in. **41/9**. Also a few 10in. Whafedale Golden at the pre-increase price of **£4** (2-3 ohm coil only). ACOS GP20 Pick-ups, **£3/11/5**, inc. tax.; LP Heads for same, **£2/3/4**. Summer All-dry Portable: Coil **5/-**, .0005 Variables **4/6**, 3-1 Audio Trans. **7/6**, Midget OP Trans. **4/6**, list available. Wearite "P" Coils, **3/-** each: Denco "C" type TRF Coils, **6/6** pair; Atkins Coils, **3/6** each: 465 Kc. IF's, **12/-** pr. Huge stocks of 1% Silver Mica Condensers of the finest quality, **1/3** each; 30,000 Erie ½-watt Resistors in stock (please note revised price of **8d.** each). Televisors: We have most components in stock for the following designs—P.W., P.T., E.E., W.W., Viewmaster. Send 3d. stamp for lists which contain information on almost everything you require. We supply quality components only and do not stock Government surplus. L. F. HANNEY, 77, Lower Bristol Rd., Bath. (Tel.: 3811.)

SYNCHRONOUS MOTORS, 200-250v. A.C., 50 cycles, clock type, **12/6** each, **1/-** postage; suitable for model engineers. UNIVERSAL ELECTRICAL, 217a, City Rd., London, E.C.1.

FLEX, super quality. Acro intercom leads containing 4 lengths, approx. 24ft. 2 screened, 2/- each, 5 for **10/-**, post free. L.T.S., LTD., "Bromyhurst," Barton Rd., Urmston.

ELECTRONIC ORGAN Construction Data. Component values, practical layout, etc. Further details C & S., 10a, Duke St., Darlington.

OUTSTANDING, owners complete kit incl. 3in. C.R.T. P.W. 1945-49. W.W. 1942-49. P.M. 1944-47. lot **50/-**. WILKINSON, 154, Eccleshall Rd., Stafford.

ROTARY-BEAM Antenna Indication. Magslip Transmitters, from **10/-** (listed £16). Stamp for circuits and full details. ENGINEERING FACILITIES, LTD., 29, Rea St., Birmingham, 5.

WALNUT RADIOGRAM CABINETS; sample designs; few only; stamp details. SHAW, 69, Fairlop Rd., E.11.

CABINETS.—Why buy one when you can make a first-class veneered or hardwood cabinet yourself at a fraction of the cost? We supply detailed drawings and instructions of easily constructed, well-designed cabinets. Send for illustrated catalogue to CHAFFEY-CONSOLE, 6, Selton Rd., Petts Wood, Kent.

WALNUT Radiogram Cabinets, stamp details. E. WISKER, 501, Hale End Road, Highams Park, E.4.

SERVICE SHEETS for hire. Reasonable terms. S.A.E. for particulars to W. J. HERBERT, 118, Gelli Rd., Gelli Pentre, Rhondda, Glam.

CRYSTALS, Aerials. P'buttons, .23/450, .1/800, .001, .01/1kv, **3d.**; SW Coils, 50 12, Pye pcs., **6d.**; Mikes, 1355 IFT, 64 150, **1/-**; Rect. Units, Mike Trans., VCR97 Holders, **1/6**; 8/450, 7193, 1 9; 40 50, **9d.**; 954, **2/6**; 2B6, 2A6, Phones, **3/6**, SAE lists. ANNAKIN, 25, Ashfield Place, Otley, Yorks.

EX-STOCK!! Amplion Multirange Testmeter, **£4/7/6**; Goodmans Audiom 60, **£8/12/6**; 2p6w Yax.sw, **2/3** ea.; Waxed Tubular Conds. .5 mfd.-.01 mfd., 350-1,000v wkg., **2/9** doz., 3 doz. **6/9**; Mica .002 mfd 5Kv wkg, **2/-** ea. ANGLIN, 106, Cleethorpe Rd., Grimsby.

TAPE RECORDINGS, ETC.

MAGNETIC SOUND Recording Wire, stainless steel, temporary wooden spools, approx. 1¼ hours' running time at 2ft. per sec.; **14/-** per spool. A. SMART, 40, Grange Rd., Halesowen, Worcs.

MAGNETIC RECORDING.—Stainless Steel Wire, .0036in. diam.; 8oz. spools; 14,000ft.; playing time, 2 hours; **15/-**, post free. H. WILSON, 17, Berwood Farm Rd., Sutton Coldfield.

TAPE RECORDING. Complete Line-A-Tone Recording Panels, speeds 7½ and 15in. per sec., or 3¾ and 7½in. per sec., **£20.** The Line-A-Tone Recording Unit, in attractive walnut cabinet, complete with tape, microphone, etc., **£68.** Recording Heads, Oscillator Coils, and all accessories. Send for price list. MORECAMBE SOUND SERVICE, Sealand Works, Cross Cop, Morecambe.

HIGH GRADE V/controls. 50K and ½ meg semi-midget, 1/spindle, 1/sw, **2/9**; ½, 1 and 2 meg. 1/spindle, w/sw, **4/6**; Condensers, 8/450, **2/9**; 16/450, **3/6**; 8 x 16/450, **3/9**; 16/16/450, **4/3**. All fresh stock. 3½in. Spkrs., **12/6**; O/trans. Pentode, **3/6**; heavy duty, tapped, **5/9**; 0-500 Microampmeters, **7/6**; Crystal Diodes, wire-ends, **3/6**; complete X/tal kit, with phone, **13/6**. Special clearance of useful oddments, **5/-** parcel. RAEMOS (mail order), 52, Pendlestone Rd., Walthamstow, E.17.

RAYTHEON or Western Electric 725A Valves with proprietary transformer, removed from brand new equip., **85/-** each unit, p. and p., 3/6. Same unit in original alum. chassis, **95/-**, carr. pass. train. 5 6. 4E27 Valves, **36/-** each, post free. V/h, **1/6**. List (2½d. stamp) will bring hundreds of items, including IFFs .6005 twin gang Condensers, Close Tolerance Resistances and Condensers, etc. C.W.O. RADIO SERVICES, St. Elizabeth's, Lr. Bullingham, Hereford.

REPAIRS AND REWINDS

ELECTRICAL TEST METERS, all makes single or multi-range repaired and standardised. THE ELECTRICAL INSTRUMENT REPAIR SERVICE, 329, Kilburn Lane, London, W.9. (Tel.: Lad. 4168.)

LOUDSPEAKERS repaired promptly. MODEL LOUDSPEAKER SERVICE, 34a Billingdon Road, Oxford.

VACUUM CLEANERS and Gram. Motors, repairs our speciality. Armature rewinds, new bearings and commutators fitted, also transformers rewound, speakers repaired. Competitive prices. Trade enquiries invited. 2 to 5 days c.o.d. service. Send s.a.e. for price lists to: A.D.S. Co. (V.E.M. Dept.), 261-3, Lichfield Rd, Aston, Birmingham, 6. Est. 1935.

CAR-RADIO, 5-valve superhet; long wave only; medium wave easily added; 6-volt input, size 5 x 4 x 4in., complete with vibrator pack and speaker, **£5.** COOK, 136, Basildene Rd., Hounslow, Middx.

SIL. MICA, 20, 50, 100, 200, 230, 1,800, 4,000pf; 3,3 doz. 100pf var., ball race each end, ideal for vfo; **2/6**, 4 for **8/6.** KNIGHT, 28a, Glebe Rd., Letchworth, Herts.

BARGAINS.—S.C.R.522, 19 valve VHF, **£8**; T.1154, **£5**; SBA/466 IF strip, **£2**; R.1155 AE, tested, **£6**. C.W.O. P.P. **10/-**. MILNES, 52, Rushton Hts., nr. Blandford, Dorset.

RADIO EQUIPMENT, all types, constructed to your own specifications; Kits built. Receivers aligned, etc. Write for quotation. Box 204.

COMPLETE COURSE Morse Code on records. New. Enquire, Box 203.

A CAR RADIO for **£7/10/-**, Inst. 3 a. drgs. **2/6** post. 40, Stamshaw Rd., Portsmouth.

SITUATIONS VACANT

APPOINTMENTS IN CIVIL AVIATION.—Radio Mechanics are required at Ministry of Civil Aviation aerodromes and radio stations in various parts of the United Kingdom. If you have had practical experience in the maintenance of radio or radar equipment, call, write or telephone to MINISTRY OF CIVIL AVIATION, Room 310A, 19 29, Woburn Place, London, W.C.1 (telephone: Terminus 3366, extension 4153), or call at any Ministry of Civil Aviation aerodrome for particulars.

EDUCATIONAL

SEE THE WORLD—600 Radio Officers required. Send 2d. stamp for prospectus to Britain's leading college. We train most in shortest period, at lowest cost. WIRELESS COLLEGE, Colwyn Bay.

A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds, etc., on "No Pass—No Fee" terms. Over 95% successes. For details of exams. and courses in all branches of engineering, building, etc., write for 176-page handbook—Free. B.I.E.T. (Dept. 242B), 17, Stratford Place, London, W.1.

MERCHANT NAVY and Air Radio. Here is an opportunity to train as Radio Officer. The big liners are open to you, but you must qualify for the P.M.G. Certificate. Day, Evening and "Radiocerts" postal courses. S.A.E. Prospectus from Director, THE WIRELESS SCHOOL, 21, Manor Gardens, Holloway, London, N.7. (Estd. 30 yrs.) (Phone: ARC 3694.)

THE INSTITUTE of Practical Radio Engineers have available Home Study Courses covering elementary, theoretical, mathematical, practical and laboratory tuition in radio and television engineering; the text is suitable coaching matter for I.P.R.E., Service, entry and progressive exams. Tuitionary fees at pre-war rates are moderate. The Syllabus of Instructional Text may be obtained, post free, from the SECRETARY, Fairfield Road, Crouch End, N.8.

WIRELESS.—Postal Course in theory for Amateur Transmitting Licence, complete with text-book at moderate fee; also instruction at school for P.M.G.'s Certificates to become Radio Officers in Merchant Navy at good salaries. Recognised by Ministry of Education. Apply, B.S.T., LTD., 179, Clapham Road, London, S.W.9. (Estd. 1906.)

Practical Wireless
BLUEPRINT SERVICE

PRACTICAL WIRELESS

No. of Blueprint

CRYSTAL SETS

Blueprints, 1s. each.

1937 Crystal Receiver .. PW71*

The "Junior" Crystal Set PW94*

STRAIGHT SETS

Battery Operated

One-Valve : Blueprints, 2s. each.

The "Pyramid" One-valver (HF Pen) .. PW93*

Two-valve : Blueprints, 2s.

The Signet Two (D & L F) PW76*

Three-valve : Blueprints, 2s. each.

Summit Three (HF Pen, D, Pen) PW37*

The "Rapide" Straight 3 (D, 2 LF (RC & Trans)) PW82*

F. J. Camm's "Sprite" Three (HF, Pen, D, Tet) PW87*

Four-valve : Blueprints, 2s. each.

Fury Four Super (SG, SG, D, Pen) PW34C*

Mains Operated

Two-valve : Blueprints, 2s. each.

Selectone A.C. Radiogram Two (D, Pow) PW19*

Three-valve : Blueprints, 2s. each.

Double - Diode - Triode Three (HF Pen, DDT, Pen) PW23*

Four-valve : Blueprints, 2s. each.

A.C. Fury Four (SG, SG, D, Pen) PW20*

A.C. Hall-Mark (HF Pen, D, Push-Pull) .. PW45*

SUPERHETS

Battery Sets : Blueprints, 2s. each.

F. J. Camm's 2-valve Superhet PW52*

No. of Blueprint

SHORT-WAVE SETS

Battery Operated

One-valve : Blueprint, 2s.

Simple S.W. One-valver PW88*

Two-valve : Blueprints, 2s. each.

Midget Short-wave Two (D, Pen) PW38A*

Three-valve : Blueprints, 2s. each.

Experimenter's Short-wave Three (SG, D, Pow) PW30A*

The Prefect 3 (D, 2 LF (RC and Trans)) .. PW63*

The Band-spread S.W. Three (HF Pen, D (Pen), Pen) PW68*

PORTABLES

Four-valve : Blueprint, 2s.

"Imp" Portable 4 (D, LF, LF, Pen) .. PW86*

MISCELLANEOUS

Blueprint, 2s.

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

AMATEUR WIRELESS AND WIRELESS MAGAZINE

STRAIGHT SETS

Battery Operated

One-valve : Blueprint, 2s.

B.B.C. Special One-valver AW387*

Two-valve : Blueprints, 2s. each.

A modern Two-valver .. WM409*

Mains Operated

Two-valve : Blueprints, 2s. each.

Consoelectric Two (D, Pen), A.C. AW403

SPECIAL NOTICE

THESE blueprints are drawn full size. The issues containing descriptions of these sets are now out of print, but an asterisk beside the blueprint number denotes that constructional details are available, free with the blueprint.

The index letters which precede the Blueprint Number indicate the periodical in which the description appears: Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

No. of Blueprint

SHORT-WAVE SETS

Battery Operated

One-valve : Blueprints, 2s. each.

S.W. One-valver for America AW429*

Two-valve : Blueprints, 2s. each.

Ultra-short Battery Two (SG, det Pen) WM402*

Four-valve : Blueprints, 3s. each.

A.W. Short-Wave World-beater (HF Pen, D, RC, Trans) AW436*

Standard Four-valver Short-waver (SG, D, LF, P) WM383*

Mains Operated

Four-valve : Blueprints, 3s.

Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) WM391*

MISCELLANEOUS

Enthusiast's Power Amplifier (10 Watts) (3/-) WM387*

Listener's 5-watt A.C. Amplifier (3/-) .. WM392*

Harris Electrogram battery amplifier (2/-) WM399*

De Luxe Concert A.C. Electrogram (2/-) .. WM403*

HINTS COUPON

This coupon is available until Aug. 6th, 1951, and must accompany all Practical Hints.

PRACTICAL WIRELESS, AUG., 1951

Published on the 7th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and printed in England by W. SPEAIGHT & SONS, LTD., Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia), LTD. South Africa: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage, for one year: Inland and Abroad 13s. 6d. (Canada 13s.). Registered at the General Post Office for the Canadian Magazine Post.

RECEIVER TYPE 25. The receiver portion of the T.R.1196. Covers 4.6-6.7 Mc/s and makes an ideal basis for an all-wave receiver, as per *Practical Wireless*, August, 1951, issue. Complete with valves type EF36 (2), EF39 (2), EK32 and EBC33. Supplied complete with necessary conversion data for home use. 35/- new condition. Chassis only 8/6.

PLESSEY. 3in. P.M. Speaker with miniature O/Trans., 17/6. W.B. 2½in. P.M. 3 ohms, 1/trans., 15/-.

R.3515 I.F. STRIP. A complete I.F. Unit comprising 6 SP61 I.F. Stages, tuned to 13.5 Mc/s, 1 EA50 diode detector and 1 EF36 or EF39 output or video stage. A few modifications only are required to adapt this unit, which will give pictures of extremely good quality. Price, complete with valves and foolproof modification instructions 18/6, plus 5/- carriage and packing. Limited quantity only.

5CP1 C.R. TUBES. Brand New and Boxed, 25/- carriage paid.

.547 RECEIVERS. Absolutely brand new, in sealed manufacturers' packing cases. Incorporating 13 valves type EF50, 2 of SP61, EF36, EBC33, 3 of EB34. Complete 45 Mc/s I.F. Strip, motor dial and drive, pots, etc., etc., as only, plus 10/- packing and carriage. Whilst they last!

TYPE 25 R.F. UNIT. Brand new, converted from new R.F.24, 19/6 (carriage and packing, 1/6).

This unit can now also be supplied modified to cover R.F.25 frequency (for Midlands T.V.), brand new, at 25/-.

GERMANIUM CRYSTALS complete with circuit diagram, 4/6.

MIDGET .0005 mfd. TWO-GANG TUNING CONDENSER. Size only 2in. x 1½in. x 1½in. Capacity guaranteed, standard length ¼in. spindle, complete with mounting bracket, less trimmers, 6/6, or complete with "built-in" trimmers 7/6. Each plus 6d. post.

MOVING COIL METER RECT., 6/-. W.S. and W., 1/6.

NO. 38 "WALKIE-TALKIE" TRANS-RECEIVER. Complete with throat Mike, 'phones, Junction box and aerial rods in canvas bag. Freq. range 7.4 to 9 mc/s. All units are new and tested before despatch. As supplied to Overseas Police Forces. 24/19/6 carriage 2/6.

RECEIVER R.1355 as specified for "Inexpensive Television." Complete with 8 valves VR65, and 1 ea. 5U4G, VU120, VR92, and a copy of "Inexpensive TV." ONLY 55/- (carriage, etc., 7/6).

RECEIVER TYPE 21. The receiver portion of the W/S 21 operating from 4.2-7.5 Mc/s. Double superhet from 18-30 Mc/s. Incorporating S.F.O., and crash limiter. Valve line-up 7-ARP12 (VP23) and 2-AR8 (HL23DD). Absolutely brand new, complete with circuit. Only 45/- complete. Vibrator power unit for above, brand new, 17/6 only.

Send stamp for current Component List. Probably the most comprehensive in the trade.

CR50 (VP91) BRAND NEW BLO SAVANIAN. 10/- original boxes. British Types boxed, 8/6. Unboxed British Types, 6/-.

I.F. TRANSFORMERS. Manufacturers' surplus. Iron-cored. 465 kc/s. Size 4in. x 1¼in. x 1¼in. Per pair, 3/6, whilst they last.

INDICATOR TYPE 6. These units are brand new, in excellent condition and are all fitted with a VCR97 CRT the tube which many constructors have put to T.V. use. Valves include 4 VR91 (EF50), 2 VR54 (EB34), plus host of potentiometers and H.V. condensers, etc. The complete unit is enclosed in a metal box 8 x 8½ x 7½in. Price only, £3/19/6, post paid.

VIBRATOR POWER UNITS, 2 volt. As for Canadian 58 set. Complete, smoothed, output 1.5v. L.T. and 6½v. and 180v. H.T. at 35 m.a. Complete in grey metal box. Size 8 x 3½ x 4½. 50/- only.

EX-R.A.F. INDICATOR UNIT TYPE 62. Containing VCR97 CRT with mu-metal screen, Crystal Unit and valves 10 VR65 (SP61), 2 VR54 (EB34), 2 VR66 (EA50), etc., etc., two deck chassis in metal case, 18in. x 13in. x 11in. New condition, 67/6 each. Plus 7/6 packing and carriage.

METAL RECTIFIERS. 8/7 C. volts 75 m.a., 6/-. C.3.C., 6 volts 1 amp. 4/-. Westinghouse, 12 volts 2 amp., 12/6. Pencil Type E.H.T., 600 v. 1 m.a., 4/7; 1,000 v., 1 m.a., 6/-; 2,400 v. 3 m., 15/-; J50, 500 v. 2 m.a., 7/6.

FILAMENT TRANSFORMERS. Input 200/50, A.C., 6.3 v., 1.6 amp., 2/6. Input 6.3 v. 2½ amp., 10/-; 6 v. or 12 v. 3 amp., 15/-; 6.3 v. 12 amp., 37/6.

MAINS TRANS. (PARMEKO). 250, 90 m.a., 6.3 v. 3 amp., 6 v. 2 amp. Input, 110 250, 20/-. Min. Mains Trans., 3½ high by 3 by 2½, fully shrouded, 250-0-250, 60 m.a., 6.3 v. 3 amp., 5 v. 2 amp., 21/-.

LASKY'S RADIO

SAFETY FIRST. FUSED TEST PRODS. LASKY'S PRICE, 4/11 per pair (one red, one black). Post 6d. extra.

FOR THE WORKSHOP. PARCEL OF PLIERS. (Soiled.) 6 Pairs, all different. Round and flat nosed, long and short, etc. **LASKY'S PRICE 9/6.** POST FREE. Original cost was well over £1.

RECEIVER UNITS TYPE 25. The receiver section of the TR1196 equipment. Easily converted to an all-wave receiver. 6 Valve superhet. Valve line-up:—2 EF36; 2 EF39; 1 EK32; 1 EBC33. Full details and circuits supplied free with each receiver. Slightly soiled, but unused. **LASKY'S PRICE, 35/-.** Carriage 4/6 extra.

COIL PACKS. BUY NOW AT PRE-BUDGET PRICES.
WEYMOUTH. Long, medium and short. Simple fixing. For use with 465 kc/s I.F. **LASKY'S PRICE 39/6.** Postage 1/6 extra.
OSMOR TYPE "Q" COIL PACKS. Supplied complete with circuit diagrams. Simple single hole fixing. Sheet for 465 kc/s I.F. These coil packs are aligned and tested in actual receivers. All prices include purchase tax. Long, medium, short (LMS), 44/-, with H.F. stage, 62/4. Long, medium and trawler band (LMT), 47/10. Medium, short, short (MSS), 42/10.

MAINS TRANSFORMERS. All primaries 200-250 volts 50 c.p.s.
MBA/3 350-0-350 v. 80 m/A.; 6.3 v. 3 a.; 5 v. 2 a. Both filaments tapped at 4 volts. **LASKY'S PRICE 20/-.** Post 1/6 extra.
MBA 4 270-0-270 v. 70 m/A.; 6.3 v. 3 a.; 5 v. 2 a. Semi-shrouded. **LASKY'S PRICE, 16/11.** Post 1/6 extra.
MBA/5 350-0-350 v. 125 m/A.; 6.3 v. 4 a.; 5 v. 3 a. Fully impregnated. **LASKY'S PRICE, 37/6.** Post 1/6 extra.

V.H.F. RECEIVER UNITS. Contains 8 valves: 4 EF50; 1 EL32; 2 EF39; 1 EBC33. Also many useful components, coils, condensers, resistances, etc. Frequency covers 124 Mc/s. This is a superhet unit with an R.F. stage and three I.F. stages. Dimensions: 10½in. x 7½in. x 6in. **LASKY'S PRICE**, specially selected, 35/-, carriage 5/- extra. Soiled units, 29/6, carriage 5/- extra.

LONG AND MEDIUM WAVE COILS. T.R.F. With reaction. Supplied with circuit. **LASKY'S PRICE**, 6/9 per pair. Post 6d. extra.

LOUDSPEAKERS. All first-quality, moving coil. L/T. 5in. P.M. **LASKY'S PRICE**, 12/6. 3½in. P.M. **LASKY'S PRICE**, 13/11. 8in. P.M. **LASKY'S PRICE 14/11.**
Postage 1/- per speaker extra.

NO SHORTAGE OF RADIO VALVES AT LASKY'S. OUR HUGE STOCKS ARE AT YOUR SERVICE.