A BEGINNER'S GUIDE TO RADIO

1/-

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DECEMBER, 1953

EDITOR:
F.J.CAMM

# PRACTICAL WIRELESS


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AN ECONOMY QUALITY AMPLIFIER
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GRID DRIVE
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Practical Wireless

EVERY MONTH
VOL. XXIX, No. 566, DECEMBER, 1953

Editor F. J. CAMM

22nd YEAR OF ISSUE

COMMENTS OF THE MONTH

By THE EDITOR

# TV Interference with Sound Radio

EVER since the TV service began to develop viewers have complained of interference from the ignition systems of motor-cars, electro-medical apparatus, hair dryers and vacuum-cleaners. Little publicity has been given to the interference with ordinary broadcast reception caused by the timebases of TV receivers. This form of interference is far more widespread than is generally known, because it would appear that listeners are less vocal in their complaints than viewers. Now that there are over 2,500,000 television receivers in operation, the problem has reached proportions of national dimensions and it is not surprising that the Radio Industry Council has appointed an Interference Suppression Sub-committee to deal with the matter. Many readers of this paper also operate television receivers, and they should take care to shield all those parts of TV receivers which are prone to cause trouble in this direction. This does not imply that home-constructed receivers are more likely to cause this form of interference than commercial receivers. On the contrary, all receivers designed in our laboratories and described in our associated journal, "Practical Television," are interference-tested and all parts likely to give rise to interference are adequately shielded.

Readers may be interested to know that in the last issue of the General Post Office Return of Interference Complaints, radiation from television receiver timebases heads the list of offenders, after the normal causes of inefficient aerial and earth systems, interference due to loose wiring in the house, or faulty receivers.

All television receiver designers are now endeavouring to work on the tentative lists of radiated fields which have been proposed by BREMA, and the British Standards Institution have appointed a sub-committee to deal with radio interference susceptibility of receiving equipment, working under the technical committee dealing with radio-interference suppression. We draw attention to this matter because the number of TV receivers is increasing at a rate which will make such interference intolerable to listeners. We hope that every reader of this journal will make quite sure that his receiver is not an offender.

The Editor and Staff Join in Wishing Every Reader a Very Happy Xmas

### *HOME RECORDING—A THREAT*

IN a recent announcement the Musicians Union threatened that unless operators of home-recording apparatus get the permission of an artist to record his or her performance, action would be taken in cases brought to its notice. Strictly, of course, it is breaking the law.

The union has received many complaints from its members, and it intends to take prompt and vigorous action to prevent what it considers to be an infraction of its members' rights.

The secretary has sent a letter to all recording instrument manufacturers asking them to pass on the warning to retailers and customers. It is estimated that there are 30,000 home-recording amateurs in this country whose hobby mainly consists of recording the voices and the instruments of their favourite radio performers, either on wax, tape or disc. There have been instances of amateurs selling recordings of a broadcast by a famous conductor and of the Coronation ceremony. The union, however, is going too far when it says that it opposes the making of records at home, even those which are made for fun. It will never be able to stop it, and if the union threatens action in all the cases brought to its notice it will never be out of the Law Courts. We know that there is a practice of swapping and selling discs and tapes privately recorded from BBC programmes, The law seems to be that, provided such recordings are not performed publicly, they are quite valid legally and the maker is free from risk of action.—F.J.C.

# ROUND the WORLD of WIRELESS

**Broadcast Receiving Licences**

THE following statement shows the approximate number of sound receiving licences issued during the year ended August, 1953. The grand total of sound and television licences was 13,056,689.

| Region | *Number* |
|---|---|
| London Postal ... | 1,709,307 |
| Home Counties ... | 1,459,179 |
| Midland ... ... | 1,308,033 |
| North Eastern ... | 1,697,723 |
| North Western ... | 1,329,989 |
| South Western ... | 1,025,772 |
| Wales and Border ... | 662,488 |
| Total England and Wales ... ... | 9,192,491 |
| Scotland ... ... | 1,111,616 |
| Northern Ireland ... | 213,479 |
| Grand Total ... ... | 10,517,586 |

**Stars on Sound**

THE big names in show business will be found this winter not on TV but sound radio. Although only Jewel and Warriss and Eric Barker have been booked for a television series, the stars due to be heard regularly on sound include Frankie Howerd, Ted Ray and Kitty Bluett, Peter Brough and Archie Andrews, Bernard Braden and Barbara Kelly, the Goons, Vic Oliver with Terry Thomas and the Lyon family, and the ever-popular "Take It From Here."

The main reasons for the apparent shunning of television programmes are time and money. A top-rate variety artist can appear nightly on the stage and record sound programmes on Sunday or during the daytime, but an evening spent on a live TV show plus a whole day's rehearsal time eliminates the possibility of appearing in a regular stage variety bill.

**Royal Military College**

THE Royal Military College of Science, which was established in 1947, at Shrivenham, Berkshire, is the first experiment of its kind in the world. One of its chief objects is the training of young regular officers in the scientific principles on which the weapons of to-morrow will be designed. The big modern laboratories are packed with elaborate and special apparatus giving more opportunity for practical experiments than any other British university.

When students leave the college they are sent to posts in the Army and Ministry of Supply to act as links between the service departments and the back-room scientists.

**B.I.R.E.**

THE following meetings will be held during November:

*London Section.*—Wednesday, November 11th, 6.30 p.m., at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1: "A Symposium of Papers on Vibration Methods of Testing Electronic Components and Equipment."

*North-eastern Section.*—Wednesday, November 11th, 6 p.m., at the Institution of Mining and Mechanical Engineers, Newcastle-upon-Tyne: "Principles of Electronic Computing Machines."—Dr. B. V. Bowden (Manchester College of Technology).

*West Midlands Section.*—Tuesday, November 24th, 7.15 p.m., at the Wolverhampton Technical College, Wulfruna Street, Wolverhampton: "Remote Control Devices and Servo-mechanisms."—A. E. W. Hibbitt (Muirhead, Ltd.).

**Trainee from India**

MR. NRIPESH CHANDRA BAGCHI, M.Sc., A.Inst.P., Assistant Director in charge of the X-ray laboratory of the Government of India's Test House at Alipore, Calcutta, has arrived in the United Kingdom for training made available under the Colombo Plan Technical Co-operation scheme in modern industrial radiographic practice and the use of industrial X-ray plant for testing metal structures which has recently been installed at Alipore.

Mr. Bagchi will spend about five months at various institutions in the United Kingdom.

**R.S.G.B. Exhibition**

THE Seventh Annual Amateur Radio Exhibition organised by the Incorporated Radio Society of Great Britain, will be held at the Royal Hotel, Woburn Place, W.C.1, from Wednesday, November 25th to Saturday, November

*In one of the laboratories at the Shrivenham Military College, Berks, are three radar screens. Across two of them move patterns transmitted by instruments at the other end of the laboratory. The top screen is the face of a "radar clock" whose hands tick off the minutes and seconds, the hands being strips of green light and the works a circuit of radio valves.*

28th. The Exhibition will be opened at noon on the 25th by Mr. Rene Klein, founder-member and vice-president.

As in past years the exhibition will be supported by a number of companies who specialise in the provision of valves, apparatus, equipment and publications for the radio amateur. In addition the Services will be represented. Members of the R.S.G.B. will exhibit a wide range of home constructed equipment of modern design.

### Staff's Support

REPRESENTATIVES of the BBC Staff Association have informed the BBC "that the Association would support any reasonable measures deemed necessary to preserve broadcasting from the adverse effects of sponsoring and commercialism, subject to the preservation of existing standards of efficiency and condition of service."

### Ever Ready, Ltd.

MR. C. G. WHITE has been elected to the Board of the Ever Ready Co. (Great Britain), Ltd.

Mr. White joined the company in 1925 and has been export manager for the last fifteen years.

### Home Service Coverage

AS part of its plan to make local improvements in the coverage of the Home Service, the BBC is building a new low-power transmitting station at Hampstead near Cromer. The new station will have a power of 2 kW. and it is hoped to bring it into service before the end of the year.

For technical reasons it must use the same wavelength as the Northern Home Service, 434 metres (692 kc/s), and it will therefore carry that service. The transmitter will be provided with a directional aerial system designed to give a good service in Sheringham, Cromer, North Walsham, Aylsham and Reepham, without affecting reception of the Moorside Edge transmissions in North-west Norfolk and along the Lincolnshire coast.

### Traffic Control

WHEN the roadway on London Bridge was resurfaced recently, portable radio sets were used by City police to control the traffic. The work took six weeks to complete and was carried out in three stages so that only one third of the width of the bridge was under repair at one time.

### Indian Experts' Visit

WHILE in London for the recent C.C.I.R. Conference, two members of the Indian delegation visited the Southend works of E. K. Cole, Ltd.

One of the visitors was the chairman of the delegation, Mr. B. V. Baliga, M.Sc., who is wireless adviser to the Indian Government and, until a year ago, chief engineer to All India Radio. Mr. Nerurker, B.(Eng.), a research engineer with All India Radio and a member of the C.C.I.R. Indian delegation, accompanied Mr. Baliga on his visit to Southend. C.C.I.R. is the international committee responsible for the allocation of ether for broadcast purposes and for the laying down of standards.

### New Type Aerial

MR. CHARLES BOVILL, 41-year-old inventor of Morden, Surrey, has introduced a new method of receiving radio signals without interference from electrical gadgets such as hair-dryers, sewing machines, electric razors, etc.

In a test demonstration, three radio sets were connected to an indoor aerial while several electrical appliances were switched on. Interference was so great that reception was completely ruined until Mr. Bovill's new aerial, specially concealed in a picture frame, stopped all atmospheric noises immediately. The aerial has been demonstrated at the Radio Show and will cost approximately 37 shillings.

*Two police constables control traffic on London Bridge by portable radio.*

### Propaganda Stations

IT is reported that Russia is planning to construct a group of radio stations round the East European countries under her influence. These stations will be used to counteract propaganda broadcasts from Western nations.

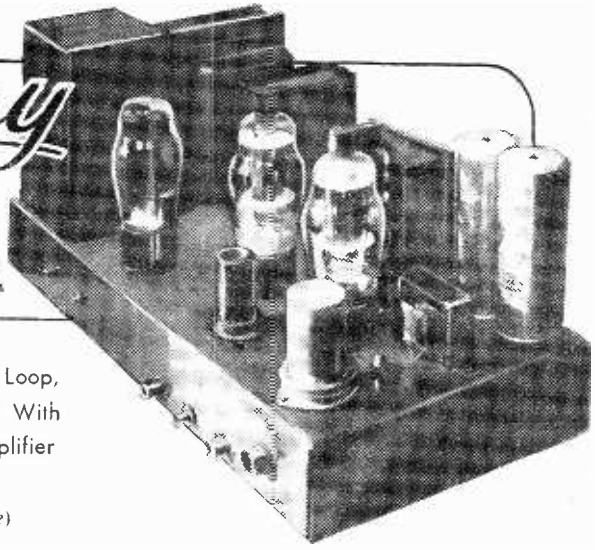
At Koepenick, near Berlin, a 1,000-kilowatt transmitter is being built and seven 300-kilowatt transmitters will be erected on the frontiers of Bulgaria and Greece, Hungary and Yugoslavia; Austria and Yugoslavia, and West Germany and Czechoslovakia.

### Change of Address

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., have announced that the new address of their Glasgow branch is 149/153, North Street, Glasgow, C.3.

These premises are considerably larger than those vacated and general stocking facilities have been greatly improved.

# AN Economy QUALITY AMPLIFIER



A High Gain, Low Cost, Four Feedback Loop, Main Amplifier, 6/8 Watts Output With Negative Feedback Tone Control Preamplifier

By C. J. White. Assoc.Brit.I.R.E.

(*Continued from page* 674, *November issue*)

WHILST being pleased with this result it was at once apparent that still more improvement could be made. The gain of V1 was increased to 520 times: the feedback in the main loop increased to 23db and the input requirement brought down to 0.4 volts R.M.S. for 6 watts output, and it is with these constants that the amplifier is now put forward. The reduction of the input requirement is particularly useful in that whilst maintaining the very high quality it enables the requirements of the pre-amplifier tone control stages to be eased. Though no mention as yet has been made of the associated tone control stage, and actually either can be used independently (apart from power supplies), it has been kept constantly in mind that the main amplifier has to be supplied with a distortionless input and in its turn supply power to such a stage which when connected to the main amplifier will not cause either hum or instability.

*TEST FIGURES*

*Input* 0.4 *R.M.S. v. at* 1,000 *c/s per* 6 *watts output across* 15 *ohms.*

*Hum level* 90*db down* (50 *c/s and* 100 *c/s in proportion of approximately* 3-2).

*Distortion measured on a wave analyser : at* 1,000 *c/s— no detectable harmonic content : at* 50 *c/s less than* .05 *per cent. For* 6 *W. at* 1,000 *c/s distortion* .27 *per cent.* (*R.M.S. value of harmonic components*).

The complete circuit diagram of the main amplifier was given last month. Starting from the output end it will be seen that the output transformer which is especially designed for this amplifier and supplied by the Radio Supply Company, Wellington Street, Leeds, has provision for two output impedances 3-4 and 12-20 ohms, that is the two nominal impedances 3.5 and 15 ohms. If an 8 ohm output impedance is required, a special model is supplied, it being felt that as 3.5 and 15 ohms loudspeakers are in the majority the transformer can be designed with this in mind and the price kept correspondingly low. The transformer has two secondary windings brought out, each of 3.5 ohms so that when connected in parallel the output impedance is 3.5 ohms and when in series 15 ohms. Two jack sockets are wired across two wirewound 15 ohms resistors in the cathode circuits of the output valves, the value of these resistances is not critical, anything from 10 to 25 ohms will be perfectly satisfactory, but they must be matched. They provide a measure of negative feedback but are really provided to enable the output valve currents to be matched by the potentiometer VR2. Connect the jack plug to a voltmeter, preferably with a low reading of 0-1 or at most 0-10 volts, the actual reading with 15 ohm resistances will be of the order of 0.75 volts, then plug in jack 1, and then jack 2, and adjust potentiometer VR2, repeating until both readings are exactly the same. The operation is extremely easy, keeping in mind that a reduction of one will result in an increase of the other. It is possible, of course, that the two valves are so far mis-matched that no position of VR2 will cause the currents to equal each other. Here the best advice is that another valve should be obtained and the best pair of three used. In the writer's experience it is very rare that a complete match cannot be obtained in this way, and it is fortunate that this valve, whilst so good is also so cheap that it enables one to purchase three,

*A square wave at* 2 *kc/s as reproduced on a 'scope through this amplifier.*

the spare one going towards making another pair when the time comes to replace. The cathode end of resistance R19 which provides the bias for the two output valves is also connected to the moving arm of the humdinger across the heater supply to V1 and V2. There are very good reasons for this in that in the first place it relieves the cathode heater PD of V2 by the amount of bias on V3 and V4, and in the second it prevents hum being introduced via the PD between the heater and cathode of V1 and/or the heater/cathode of the preamplifier, i.e., it reverses the sign of the PD caused by the cathode bias without affecting the grid bias.

From V4 and V3 to V2 is straightforward. V2 is the 6J5 concertina phase splitter, with the load in both anode and cathode circuits. Bias is provided automatically by the difference between the cathode/H.T.—volts of V2 and the anode/H.T.—volts of V1. The two resistances R9 and R10 are the only

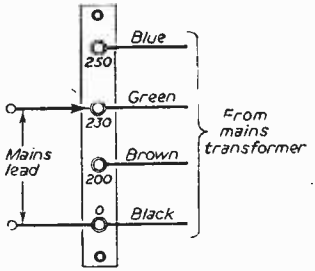



*Fig. 7.—The paxolin tag strip.*

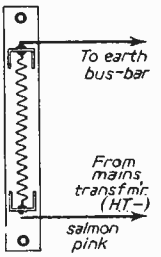



*Fig. 8.—H.T. fuse paxolin holder.*

others where, although the tolerance does not matter, they can be 12 to 20 KΩ without making appreciable difference; they must be matched.

Coming now to the EF54 V1, it will be seen that the anode is taken straight to the grid of V2 without the usual condenser and that the anode load of V1 is also in reality the grid leak of V2. In the preparatory work it was found that in order to get the best of the excellent performance of this circuit it was necessary to use resistances of plus and minus 5 per cent. It was very quickly realised how difficult it is to procure these and additionally the tolerance between different specimens of V1 made it essential that, for the constructor to reproduce the results of the laboratory, some means must be provided whereby the very highest degree of accuracy could be easily controlled by the constructor and yet be flexible enough to cover the largest of tolerances in V1. The answer to this problem was found in the use of a variable potentiometer to feed the screen of V1. In order to prevent the screen being taken to cathode potential a 5 KΩ resistance R7 is inserted in the cathode side of the variable arm VR1 of the potentiometer formed by R6 and VR1. The only instruction in the use of this potentiometer is that it should be rotated until the sound is loudest, this position is also the position of maximum quality; there is no need to touch it further unless a valve is changed or on alterations of a major character. For those who like to adjust critically such controls, it is best done on a tuning note, either BBC or record, and at somewhere close to maximum output. By this very simple means, plus the use of R8, the Ea, Es and Ec of V1 are all corrected and the proper bias automatically supplied to V2. C1 and R5 plus the use of C11 and R22 can be described as stabilisers; they control the stability of the amplifier at very high or supersonic frequencies, particularly when long wires are used for loudspeaker extensions. The adjustment of feedback on changing to either output impedance is semi-automatic, use the tap between the two resistances R21 and R20 for 3.5 ohms or use the free end of R20 for 15 ohms.

**Power Supplies**

Dealing now with power supplies and construction in general it might be as well to say that even though we are constructing an Economy Amplifier the old adage still holds good, that often the cheapest now is not the cheapest in the long run. This factor of

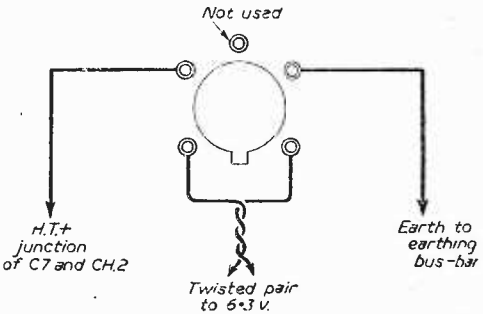



*Fig. 6.—Wiring for the preamp. power socket connection.*

reliability was kept to the forefront in the gathering together of the component parts. The mains transformer used has a safety factor of nearly 200 per cent., that is it can supply nearly twice the power which is actually drawn from it and after a long soak test of 48 hours continuous running in a closely confined space it was still cool to the touch—it was also mechanically quite quiet which if not so can be quite a bugbear in small rooms. The main smoothing choke, a specially selected ex-government type, has an even greater safety factor, with the reservoir condenser, surely the *bête noire* of all

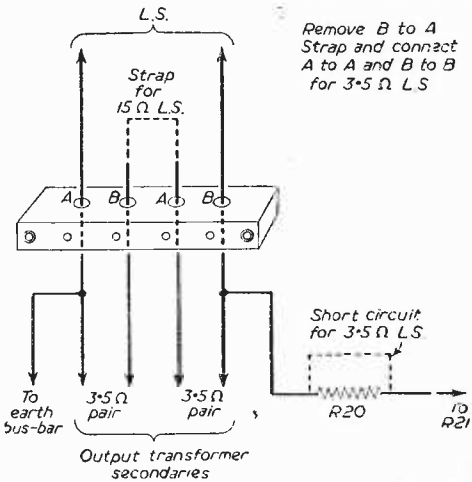
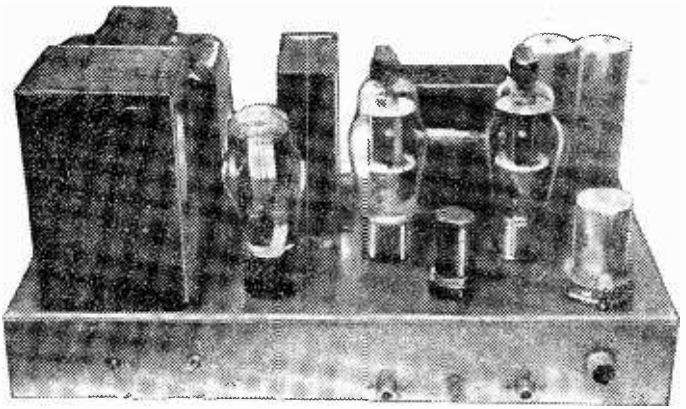



*Fig. 9.—Loudspeaker output terminal block.*

designers, of paper construction the only really reliable type to serve as such. Farther down the H.T. line are the two smoothing condensers C7 and C8 and here it must be categorically stated that no reduction in working voltage or capacity can be tolerated; they are comparatively expensive, but will be found cheap in the long run. One point here which will be surprising to some, is that they should be purchased with insulating washers together with the corresponding large soldering tags and fitted with the metal soldering tag slipped on first, then the insulating washer and then mounted through the chassis with the H.T. negative wire coming up through the chassis to connect to the soldering tags both strapped together. It may seem strange to go to this trouble of isolating the cans from the chassis when the cans are at H.T.— potential, but one of the reasons for the quite negligible hum level is the care taken to avoid multiple earth returns and this is one very easily overlooked point where it takes place. Before leaving the power supply it will be as well to mention the mains transformer, in that accurate centre tapping of the heater windings is secured by the use of humdingers. These are best adjusted when using the pre-amplifier with all gain and bass controls at maximum. In order to cater for the use of the alternative type of output valve, the transformer has two heater windings of 6.3 volt 1 amp. which are to be connected in parallel for the 807 and in series for the 1625.



*Rear view of the complete amplifier.*

*(To be continued)*

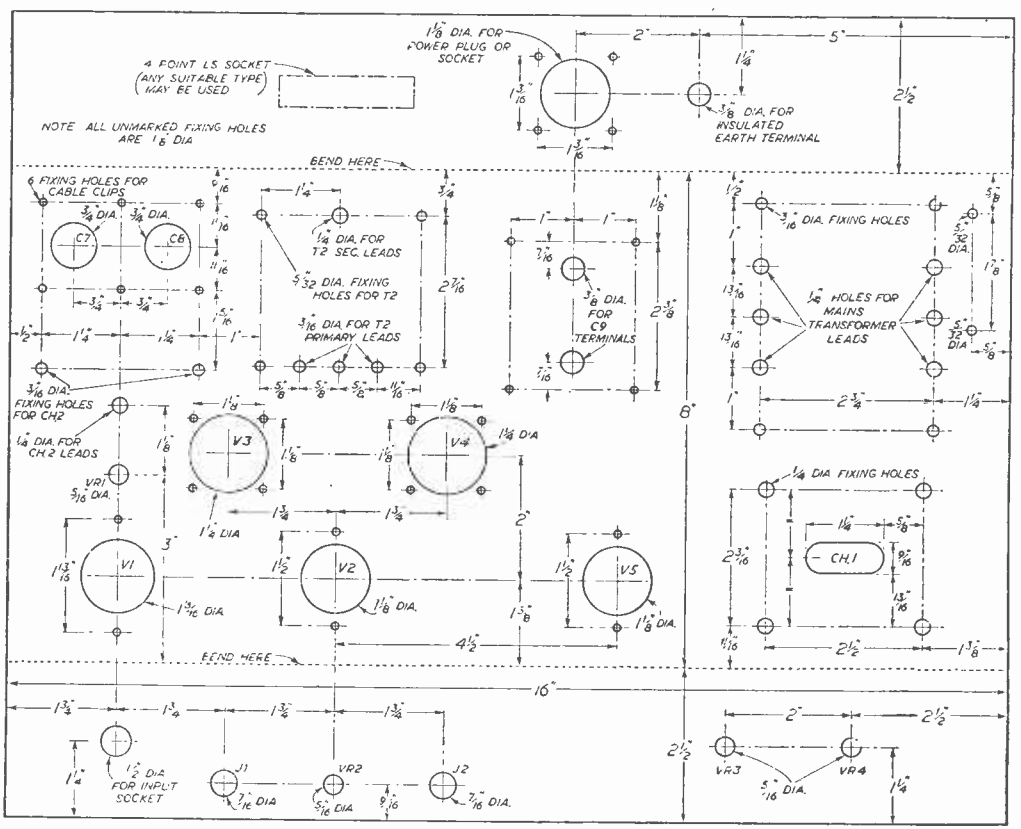



*Fig. 10.—Chassis drilling data.*

# A REMOTE CONTROL UNIT

## OPERATING A RADIO RECEIVER FROM EXTENSION LOUDSPEAKERS

By David Boswell, B.Sc.

THOSE who have extension loudspeakers in the home know the irritation of having to walk into another room to switch the receiver on and off, or change a station. A simple solution to the problem is to make or buy another set. Yet if it is desired to have listening facilities in one or possibly two bedrooms as well as the kitchen, then a set for each room becomes an expensive luxury!

The system of remote control described here enables the operator to effect mains switching in the parent set and gives a choice of two stations, by the use of a single push-button beside the extension loudspeaker. The number of speakers need only be limited by the handling capacity and degree of matching required of the receiver sound output stage.

*Enjoy Your Xmas Listening with the Aid of this Distant Controlling Device.*

It is the relay which makes this possible. The primary operating circuit is shown in Fig. 1 and this is energised so that it triggers a cyclic sequence of three relays with three successive pulses. Fig. 2 shows the chain of events. It will be seen that it is necessary to have a 3-core cable run to each speaker in place of the usual twin lead. The author used a 1/036in. screened twin, but any cable capable of handling 3 amps or more will do. If convenient earthing points are available near the set and the extensions, they can be utilised as a third line, but the secondary of the output transformer must not be earthed if this method is adopted.

The use of a battery obviates the dangers inherent in passing mains voltages through the extension leads, battery drain being negligible owing to the fact that current passes only when the push-button is held depressed.

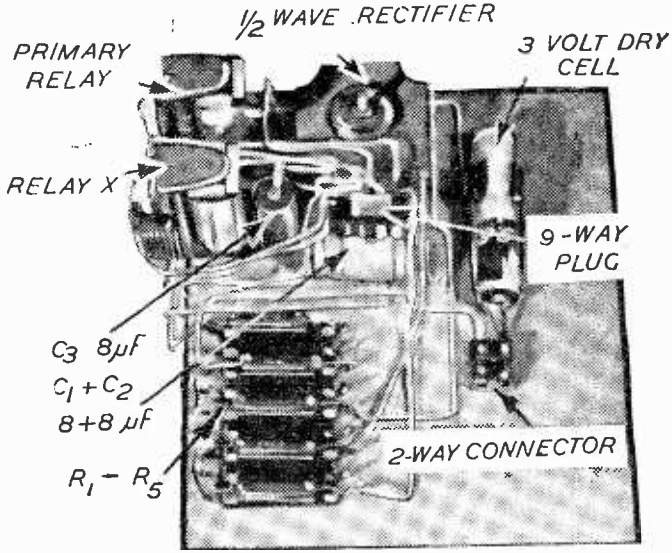
### Operation

A single-pole change-over contact, break before make, is all that is required on the primary relay (Fig. 3). This switch operates high resistance relays X, Y and Z in sequence from a simple power supply consisting of a half-wave rectifier, three smoothing condensers and a resistance chain to suit the type of relay available. Post Office type 3,000 of resistance 10,000 ohms, were fitted successfully without any heating, buzzing or contact troubles. It should be mentioned that 8$\mu$F proved satisfactory for the particular relays used. In general, these condensers should be of sufficient value to give adequate smoothing and enable the relay to stay energised while its power source is being altered by change-over contacts on another relay, yet not so large that they upset the sequencing.

When a remote push-button is depressed for the first time, relay X energises through $Z_2$, $Z_3$ and $X_4$, holding on through $X_2$ and $Z_4$. When the button is released Relay Y energises through $X_1$ and holds on via $X_3$, $Y_1$ and $Y_3$. In addition to those contacts required for the sequence operations, Relay Y carries a single pole make and two single-pole change-over contacts. The single pole is connected across the mains switch in the set, while the change-overs alter the tuning circuits from manual to pre-set. See Figs. 3 and 4.

Pressing the remote push-button a second time energises Relay Z through $Y_2$ and $Z_2$; $Z_1$ and $Z_3$ are its hold on contacts. Relay Z alters Relay X's hold-on circuit so that when the push-button is released, X is de-energised. Relay Y still holds on due to the position of the changeover switch on the primary relay, while two extra pairs of make contacts on Relay Z are used to switch further pre-set capacities into the tuning circuits of the receiver.

The final part of the sequence occurs when the push-button is pressed a third time. Relay Y cannot now hold on as Relay X is already released and immediately the primary relay is operated, it falls out. This prevents Relay Z from holding on through $Y_4$. Upon release of the button, Z de-energises




*Details of the complete unit.*

and the whole circuit is dead, but ready for recycling.

**Modifications to the Receiver**

The position and mounting of components must, of course, vary with circumstances, but it is advisable to adhere to the block diagram in Fig. 4 when grouping them. Relays Y and Z must be as close as possible to the receiver tuning condenser—in many sets the space immediately above it is free and suitable. The operating relay, power supply and Relay X, may be mounted on a sub-chassis and supported in the set, or alternatively fitted into a separate box. In the latter case, an 11-way lead is required to connect them to Relays Y, Z and the loudspeaker, in the set.

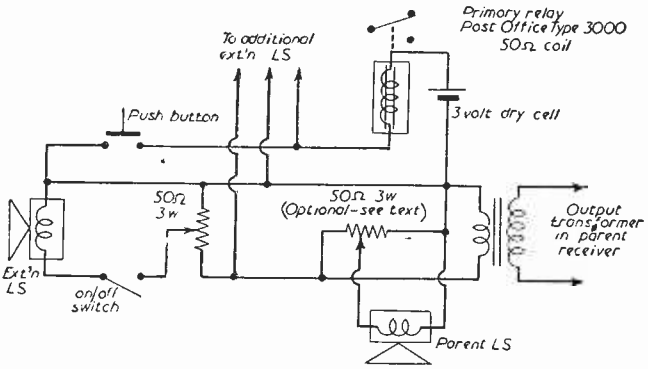



*Fig. 1.—Primary operating circuit.*

In most receivers the volume control carries the mains switch, and when the latter is off the control is in its minimum sound position. When the remote control is functioning some means of gaining full volume must be found, so that it can be regulated entirely by the local potentiometer on the extension speaker. The simplest way is to interchange the two outer leads on the volume control so that when the mains switch approaches the off position, maximum sound is obtained. The momentary surge of sound that may occur when switching off at the set, can be avoided, if so desired, by first manually detuning away from the station in use.

A further method of overcoming this problem would be to unsolder the centre lead from the volume control and connect it to the non-earthed outer. This will deliver full volume to the sound ouptut stage of the receiver, and control can then be effected through a low resistance potentiometer in the parent loudspeaker coil circuit (Fig. 1), as with the extensions. If, when using the set in the normal way, one or both of the stations selected for remote control suffer bad sound distortion at full volume, it is advisable to insert the stopper resistance, $R_s$ in Fig. 5. This attenuates the signal applied to the grid of $V_1$ under remote control operation only. Its value can be determined by a simple experiment in local conditions, and will probably be above 47 KΩ.

Unless a separate switch is fitted to the parent loudspeaker, it will perform in parallel with any of the extensions that are working, but if the receiver volume control/mains switch is of the single-pole type, a double-pole one in its place can be used to switch both mains and speaker. Should the set already be fitted with a double-pole switch and it is not an A.C./D.C. model where the chassis is live, one of the poles may be used in the previous manner without danger. It is essential, however, to arrange that the mains-switching pole is always in the "LINE," side of the mains and not in the neutral.

Fig. 5 shows the modified circuit of the first two valves of a typical T.R.F. receiver. In the case of a superhet the oscillator grid on the mixer is treated in essentially the same manner as that of $V_2$.

After completing all modifications, the pre-set condensers $C_2$, $C_4$, $C_5$ and $C_6$, should be adjusted to give maximum volume on Light and Home programmes when the appropriate relays are operating. It will probably be necessary to adjust the trimmers on the main two-gang tuning condenser to offset the additional capacity caused by extension of the grid leads to Relays Y and Z. The use of screened leads may be found desirable, although no hum or feed-back occurred in the author's receiver with unscreened P.V.C. insulated wire.

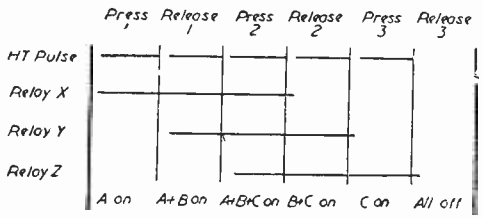



*Fig. 2.—Operation sequence.*

In conclusion it must be said that this article is

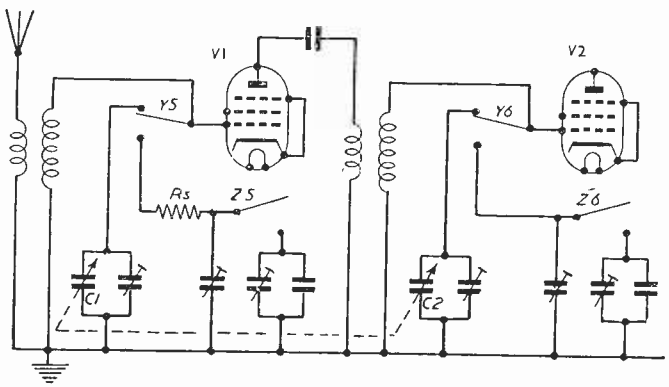



*Fig. 5.—Showing how the relays Y and Z are used to alter tuning from manual (using $C_1$ and $C_2$) to pre-set, for Light and Home programmes.*

intended mainly as a guide and the examples to illustrate one particular solution of the problem. It is certainly possible to achieve similar results using solenoid-operated wafer-type switches, or even multiple bank Post Office Uniselectors, instead of relays. These switches have the advantage that they

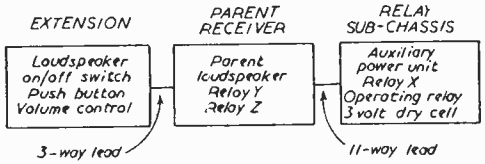



*Fig. 4.—Block diagram of the arrangement.*

do not require continuous energising current from their D.C. supply, but they are expensive, and whereas the relay system uses say 50 mA., while the set is on, a current 12 times as large is needed to operate them This would mean a very much larger power unit.

The ex-W.D. solenoid-operated switch No. 10DB 6338, is a useful basis for this alternative type of system, though it should be borne in mind that the ordinary bakelite wafer is not suitable for handling 240 volt mains.

The relay unit need not cost more than £2 15s. 0d. to build (excluding leads and speakers). If the extensions are used for three hours every day and a three-volt battery purchased once a year, the annual cost of running the system would be less than 2s. 6d., whereas an extra radio, besides its higher initial cost, uses twice as much electricity. For these reasons a remote control can be an economic proposition, but it is also an amusing and instructive exercise in the art of using relays. There is no reason why a unit capable of selecting more than two stations should not be designed.

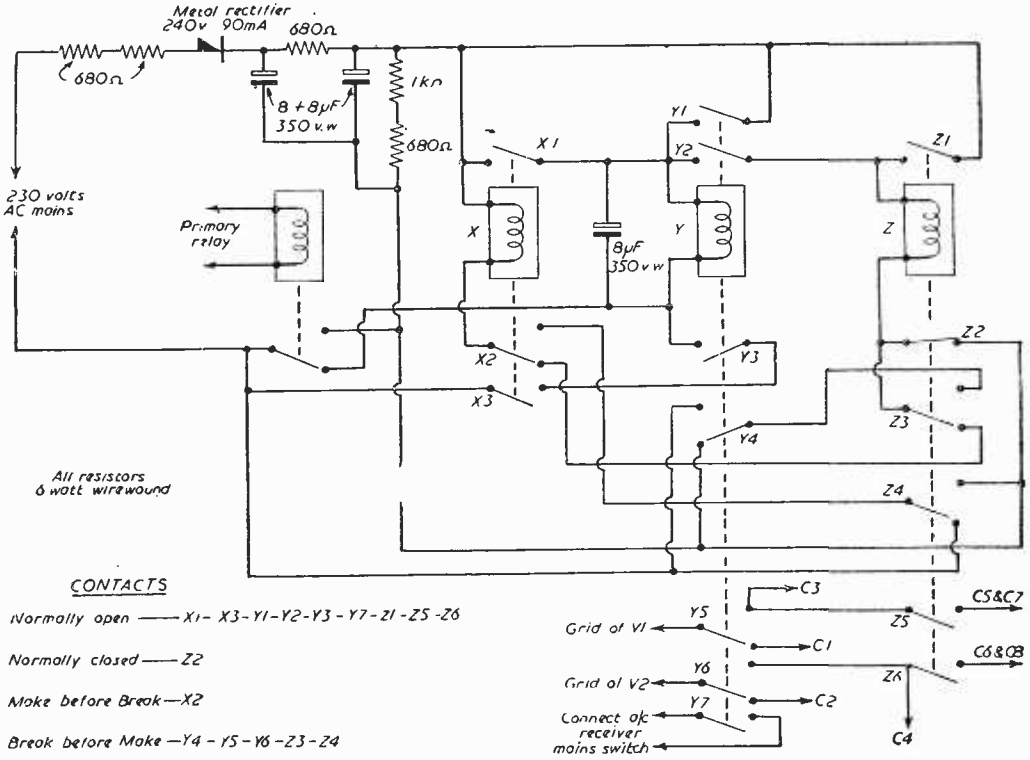


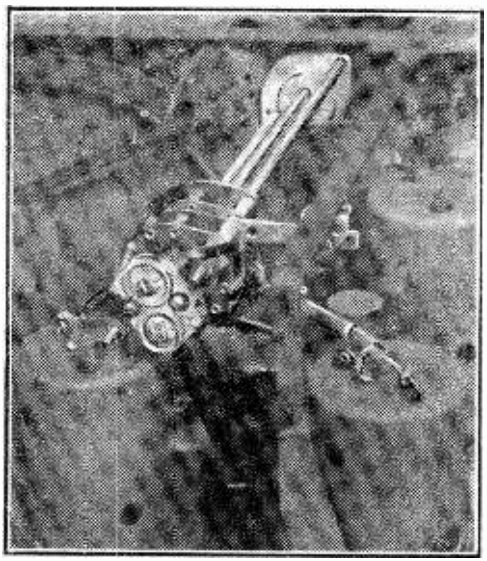

*Fig. 3.—Cycling sequence circuit.*

# A VARIABLE BANDWIDTH FILTER

## A SELECTIVITY MODIFICATION FOR THE R1155 OR ANY RECEIVER OF SIMILAR TYPE

By J. Cook

IT is probable that there are a number of radio enthusiasts who, like the author, own an R1155 or similar communications type receiver and require the receiver to perform the dual function of band searching, perhaps on the "Ham" bands, when the full sensitivity and selectivity is needed, as well as providing day-to-day listening on local or other powerful stations. It may then be found that such a receiver is not wholly satisfactory due to the restriction in bandwidth, not usually necessary in this role, and the consequent loss of quality. The employment of two or more efficient I.F. stages in a receiver usually provides a highly selective (i.e., narrow bandwidth) response curve, the R1155's being in the order of 4 kc/s to 6 kc/s total bandwidth for 6 db. attenuation. Inevitably audio response suffers as the normal bandwidth radiated by broadcast stations is 9 k/cs (double sideband) for the medium waveband, the loss of the higher frequencies being audibly apparent by the lack of brilliance in reproduction. This debasing of quality is particularly objectionable on musical programmes.



*The additional switch and wiring are clearly seen here.*

More advanced communications receivers utilise several methods to obtain variable selectivity—this being the answer to the problem. Quite often some mechanical device is employed to vary the coupling between I.F. coils or an electrical equivalent using tertiary coils or, particularly on American receivers, a frequency selective filter using a special type of

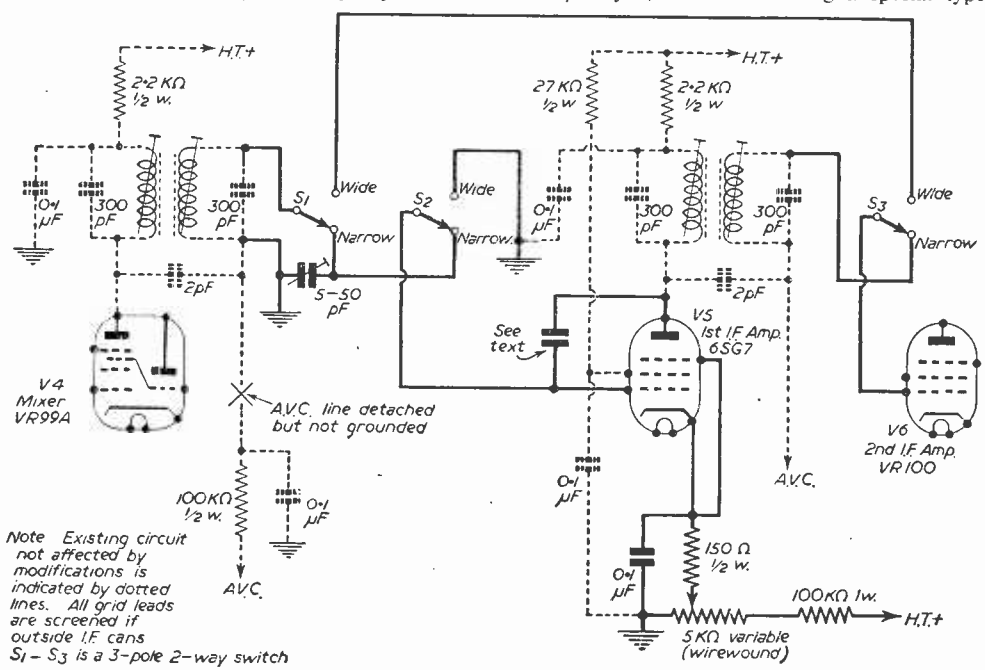



*Fig. 1.—General details of the modification.*

piezo-electric quartz crystal in a "gate" circuit. Sometimes a combination of these methods is used with some complicated switching by the manufacturer; but it is very difficult to incorporate any of these devices once a receiver is manufactured because of the restriction in space imposed by the average chassis layout and lack of room inside I.F. screening cans for extra components—usually all adding up to an impracticable proposition. Besides this the procurement of crystals for a rather odd and peculiar I.F. frequency like the R1155's 560 kc/s is no easy or cheap matter.

The compromise scheme described here has been successfully applied to an R1155 receiver by the author to obtain variable selectivity and is, of course, equally applicable to receivers of a similar type where this facility is required, subject to reasonable mechanical adaptability.

### The Circuit

The circuit illustrated at Fig. 1 offers two means of varying the I.F. response curve to obtain a wide or narrow bandwidth at will. As will be seen, the first I.F. stage can be completely by-passed by a switching arrangement whilst the secondary of the first I.F. transformer may be tuned off peak on to one of the sidebands; the primary cannot be treated likewise (as it should be) because it would affect the narrow band performance. The wide bandwidth so obtained will not be without some loss of gain as one I.F. stage only is now being used—however, this is the characteristic of all variable selectivity systems and is, in any case, unimportant when listening to local stations. The correct sideband must, however, be chosen when tuning in. The second method provides assistance at the other listening extreme when it is found that the 4 kc/s to 6 kc/s bandwidth of the two I.F. stages is insufficient to obtain satisfactory separation of some, usually more distant, transmissions. Both I.F. stages are utilised, the first I.F. being brought back into operation by the selector switch and this stage is made regenerative by deliberately introducing positive feedback between the anode and control grid of the pentode which is now an American metal valve 6SG7, it being more suitable for this application than the original VR100. Regeneration is controlled by a variable gain control in the cathode lead of the 6SG7 and as this gain control is advanced to near oscillation point a sharply peaked I.F. response is obtained, asymmetrically placed about the mid-point, providing substantially single sideband reception remarkably similar to the crystal gate filter characteristic though, unhappily, without the phasing facility of the crystal whereby the best side band may be selected. Nevertheless, carefully used it can be of very great value in rejecting unwanted signals.

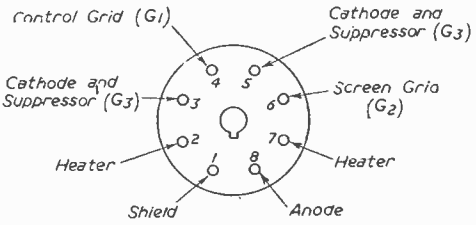
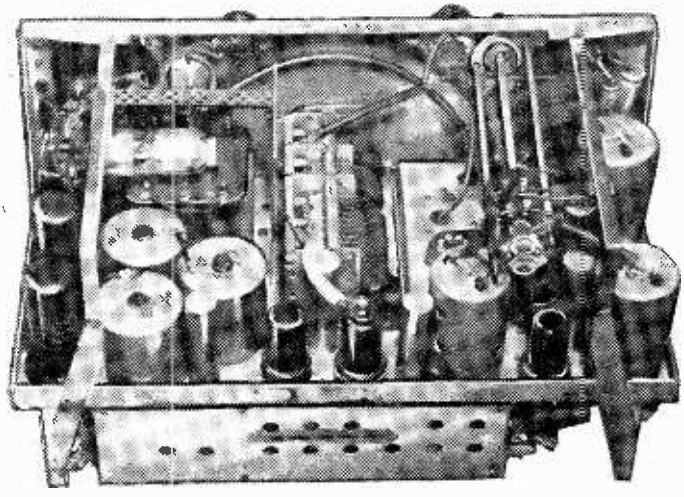



*Fig. 2.—Details of the base connections of the 6SG7.*

### Modification Details

(i) Switching circuit. As indicated the output from the secondary of the first I.F. transformer can be passed through to either the grid of the first or second I.F. amplifier at will by selecting the appropriate switch position. Provision has to be made to ground the grid of the first I.F. amplifier when it is not operating on the wide band position whilst the by-pass lead, which is isolated when both valves are used on the narrow band position, is connected to a small preset condenser so that when used, i.e., in parallel with the first I.F. secondary winding and enables the slightly smaller valve and stray capacities associated with the narrow position to be equalled to the wide position and thus maintain alignment of both circuits. This condenser is a small preset component of the high stability ceramic or Phillips type, variable between about 5 to 50 pF, and is mounted on to the ends of the lateral rods of the switch assembly. A standard long spindle type of wafer wave-change switch is used with the wafers reset to the rear of the switch if necessary in such a manner that they are located immediately above the first and second I.F. cans—it being essential that all wiring is screened, as short as possible and with input and output leads physically removed from each other as far as is practicable to avoid instability, etc. If the switch has more than the two positions required it can, in most cases, be adapted to a two-position movement by appropriate bending of the unused "stop" lugs on the frame of the assembly. The wiring connections are most conveniently made inside the I.F. cans first and leaving



*A general view of the modified receiver 1155.*

the connections to the switch until last. The switch is bolted to the front panel and also braced towards the rear on to the chassis protecting rail. (See Fig. 2.)

(ii) Re-alignment. This is carried out in the first instance with only the second I.F. valve switched in (wide) and the cores of the first I.F. transformer are peaked to the appropriate I.F. using a signal generator if available; otherwise by tuning in a local non-fading station (A.V.C. off!) and peaking the I.F.'s for maximum response as observed on the tuning indicator—always assuming the R1155 oscillator to be correctly aligned before commencement of operations. The secondary of the first I.F. transformer is then detuned slightly from optimum by about 2 kc/s to broaden the response on one of the sidebands. If no signal generator is available or is not accurate enough, the effect is evident audibly by the increase of brilliance in reproduction, especially on a "live" studio broadcast of music; it is, after all, the ear which will be the final judge of the results obtained. Finally, with both I.F.'s working (narrow) the four windings of the first and second I.F. transformers are all peaked for maximum signal, but using only the preset condenser to peak the secondary of the first transformer and not touching the slug core in the transformer. It should be unnecessary to adjust the third I.F. transformer as it is not in any way concerned with these modifications. All alignment operations should be done with a suitable trimming tool—a plastic knitting needle suitably filed served admirably in the author's case.

(iii) Regenerative I.F. stage. This circuit is dealt with last because it is essential that the I.F. amplifiers should be quite stable before this modification is introduced and the wiring to the selectivity switch above is perfectly capable of introducing uncontrolled regeneration if the wiring has not been carefully carried out! If all is well, control of regeneration in the first I.F. stage is effected by dispensing with the present biasing arrangements for that stage and taking the cathode to ground via a variable cathode bias potentiometer; this may be located anywhere convenient on the front panel. In view of this arrangement it is impracticable to use the A.V.C. line of the R1155 which has a standing bias of some three volts or so; the A.V.C. lead is disconnected from the secondary of the first I.F. transformer and the winding is grounded at that end, the redundant A.V.C. components (100,000 ohm resistor and 0.1 $\mu$F condenser) may either be removed or remain "floating." The 6SG7, which is used in place of the VR100, is a single-ended valve and thus it is necessary to rewire the socket, which need not be changed as it is also of the octal-based variety. The valve is made regenerative by soldering a short length of insulated wire—1in. to 1½in.—to the anode pin and placing the free end in close proximity to the grid pin. The position of this wire is adjusted in such a manner that the feedback so introduced just brings the valve to the verge of oscillation when the gain control is advanced to maximum when, besides greatest gain, greatest selectivity—with one sideband partially suppressed—will be obtained. Backing the control off to about mid-point will provide the normal gain and double sideband working associated with the R1155.

In practice these two modifications should enable the user to obtain a much more flexible performance from his receiver allowing reception of many stations which would otherwise be "swamped" whilst being able to listen to interference-free transmissions with high-fidelity reproduction, especially if a good amplifier is employed.

In connection with the latter remark, a note regarding the rather unusual appearance of the R1155 illustrated on page 737 may be appropriate to conclude this article as readers may well be puzzled by this. Besides the selectivity modifications described here the set has been completely remodelled to incorporate two triode connected 6L6's in push-pull, an "S" meter with separate meter amplifier to present an indication irrespective of A.V.C. and also to reverse the current to present conventional left to right presentation instead of the usual reversed action, voltage regulator, variable delay A.V.C., noise-limiter, infinite-impedance detector, R.F. gain control, aerial trimmer and several other new features.

# *BBC Monitoring Service*

THE BBC monitoring service, developed during the war to listen to broadcast transmissions from foreign countries for intelligence purposes, was retained after the conclusion of hostilities as a source of information for BBC news bulletins and Press information, as well as for the benefit of government departments. The main monitoring and office facilities of the service are at Caversham Park, Reading, with a remote engineering interception station 3½ miles to the north at Crowsley Park, in an electrically quiet area where an extensive directional aerial system can be provided. Signals from this station are relayed by landline to Caversham.

The General Electric Co. Ltd., which since the war has already supplied the BBC with 54 communication receivers for both sites, has recently supplied a further 30 receivers of an improved design. Twenty-eight of these have been installed in the main receiving bays at Crowsley Park and two on the new supervisory console table in the main listening room at Caversham. This is the first major installation of the new version of the G.E.C. communication receiver, which incorporates many circuit refinements and additional facilities.

**Technical Details of the New Receiver**

The new receiver (the BRT 400 D) is a 14-valve superheterodyne receiver with a frequency range which has been modified to suit BBC requirements, 150-385 kc/s and 0.51-30.0 Mc/s in six bands. The input impedance is 75 ohms on all bands.

Selectivity has also been adjusted to suit the BBC. There are six switched bandwidths, overall bandwidths for 6 db attenuation being 5.5 kc/s, 9.0 kc/s, 13.0 kc/s for telephony and 0.5 kc/s, 1.0 kc/s and 2.0 kc/s for telegraphy, the last three positions with a crystal filter in circuit between the mixer and I.F. amplifier.

In the new receivers the local oscillator frequency stability has been improved, They were all subject to an extended drift test, the specification requiring that oscillator frequency drift should not exceed 5 kc/s measured at 29 Mc/s, 3 kc/s measured at 19 Mc/s and 2 kc/s measured at 8 and 3 Mc/s. In practice, when the receivers reach a stable operating temperature, drift figures much lower than these are normally obtained.

# On Your Wavelength

## By Thermion

### Birthday Echoes

I CONTINUE to receive belated letters from remote quarters of the earth from readers suffering from nostalgia as a result of reading our Birthday Number. They remind me of something which I did not mention in my brief resumé of my association with the journal. For example, one reader in an isolated shack in New South Wales tells me that he is still using the three free gift spanners which we presented with every copy of this journal in the early '30s. His only drill gauge is one we presented during that same period. He still has the pocket tool kit which we had specially manufactured for readers, and has on file every blueprint from No. 1 to date. He tells me that he has made a profitable business out of manufacturing sets for his friends, drawing most of his components from this country.

Others remind me of controversial topics which I had forgotten. All of them remember my long, sustained attack on jazz when it was first spawned upon the ether. One asks what my views are now. They have not changed but become intensified. After all, in its early years there were only two well-known bands creating their cacophonous shindy on the air. Members of each band, however, soon saw that there was money in it and broke away and themselves formed bands until to-day there are literally dozens of them.

Gilbert Harding, no doubt, could probably express himself on this matter more vociferously than I. I am heartily sick and sated with listening to announcements about somebody "and his band." Evidently the BBC took some note of my campaign which I carried on for a number of years for we have fewer of them now. Unfortunately, this form of radio annoyance has been replaced by something equally irritating. I am referring to the general tendency of the BBC to introduce parlour games into the programmes, such as "Down You Go," "What's My Line?" etc. Sooner or later we shall have musical chairs and charades.

### Gilbert Harding

I FEEL sorry for Gilbert Harding in some ways. I am sure that his endeavour to convince us that rudeness is wit is well-intentioned and that he does not really intend what he says. The venom with which he threw an aspidistra out of the window because he did not like it would be understood, I think, by most men who hate flowers and plants inside the house. I like rump steaks, but I do not want them to decorate my room. However, my dear Gilbert, you must remember where to stop. Radio audiences cannot answer back, but others can. To modify an old saying "a *little* ill humour now and then is welcomed by the wisest men."

### Advance of Tape Recording

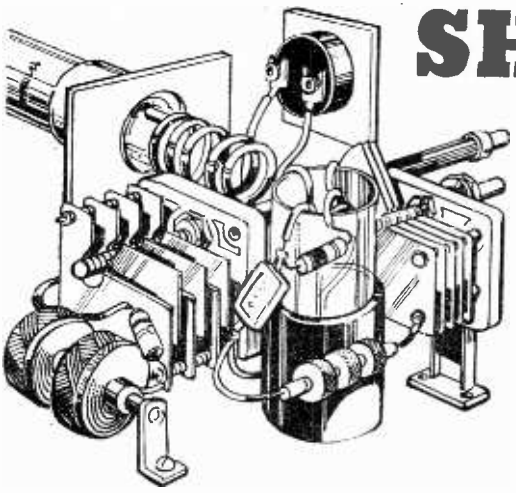
I MUST say that I was very surprised to learn that there are 30,000 amateurs in this country operating home-made tape recorders. I do not know whether the Sound Recording Association would support these figures, but judging from the increasing volume of correspondence we receive on this subject I do not think the estimate is far out. Large numbers of the tape recorder described in our companion journal, "Practical Mechanics," are being built as I know from the manufacturers of some of the components. The number is likely to increase. In view of the copyright position, however, some amendments to the Copyright Law will have to be made or a system of licence fees instituted, although how the latter could be brought about eludes me. Perhaps it could be effected by imposing a levy on each recording head sold.

### Electronic Organs

ANOTHER branch of electronics which is gaining popularity is that concerned with electronic musical instruments and particularly electronic organs. The one made by my colleague, Mr. W. J. Delaney, is a first-class job, and although I spent 11 years learning the piano and the organ and have naturally through lack of practice lost some of the digital dexterity with which I could perform musical acrobatics on the keyboard, I was astonished at the speed with which one could play fast runs on this organ. Unlike the piano or the organ which require some considerable depression of the keys before the note emerges, the slightest touch on an electronic organ is sufficient to produce the note. Of course, such instruments are only suitable for music specially written for the organ, since it is not possible to hold the note as, say, with a piano, by means of the sustenuto pedal. The quality, however, of the instrument to which I have referred is in my opinion equal to that of a professional instrument and I am not surprised that it is being built in large numbers.

### Sponsored Programmes

I LISTENED the other day to a most interesting talk by one most intimately associated with either sponsored or commercial TV. He explained how it would work, but the impression left on my mind was that whoever operated this alternative programme was going to tell the advertiser what he could have in the way of publicity. I can assure him that unless the advertiser can obtain adequate publicity he is not going to pay large fees for programme time in order that the operators can make large profits. The sensible view must be adopted that advertisers must get their money back and that will not happen if they merely get a mention. Of course, some programmes will be mutilated by the interlarding of trade puffs, but in programmes of the variety type where a pause between each item can be regarded as an interval, I see no reason why bunkum pills by boloney should not have their mention.



# SHORT-WAVE SECTION

## MODERN SHORT-WAVE BATTERY RECEIVERS

By T. W. Dresser

AS a direct consequence of various circuits published by the writer in PRACTICAL WIRELESS he has been asked by a number of correspondents for an up-to-date battery receiver. This article, therefore, is in a way a reply to these readers, but it is hoped it will also be of interest to others who may have no mains supply or who, for reasons of their own, prefer battery operation. Before going any further, however, it should be made clear that the writer has no intention of attempting to duplicate, in battery form, the kind of arrangement found in certain receivers advertised as suitable for use on A.C., D.C., and battery operation. The quality of reproduction from many of these sets is, to say the least, appalling, and very few readers of PRACTICAL WIRELESS would tolerate it for long. Nor is it necessary to do so. With the enormous range of good-class components and valves available to-day to battery users both quantity—as regards the number of stations receivable—and the quality, from the audio response viewpoint, are not difficult to achieve.

Without much doubt the best-known battery circuit is that of the three-valve T.R.F., consisting of R.F., detector and output stages, and there have been many variations on this theme, although there is still plenty of scope for experimenting with them. The circuit of such a combination is shown in Fig. 1, and while, basically, it cannot claim any originality there are some points in which it is a departure from the orthodox. For instance, the ganged tuning condenser is split stator type with one section of 380$\mu\mu$F and a much smaller section, on the same rotor shaft, of 10 $\mu\mu$F. In use the large section tunes the medium-waveband only and is switched out on shorts, where the 10 $\mu\mu$F section is used alone. Seven bands are covered, the medium-waveband and six short-wavebands as follows: 3.5 to 4 Mc/s., 6.9 to 7.4, 13.95 to 14.45, 20.5 to 21.9, 27 to 30, and 48 to 55 megacycles or, in wavelengths, 75 to 85.7

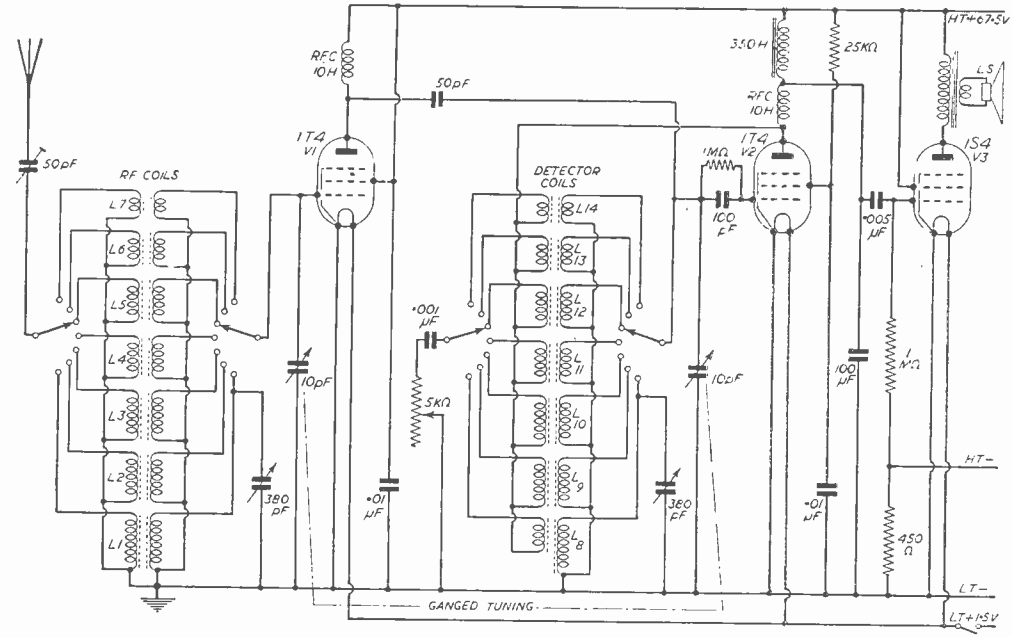



*Fig. 1.—The most reliable general type of circuit for the beginner.*

40.54 to 43.47, 20.7 to 21.5, 13.7 to 14.6, 10 to 11.1 and 5.4 to 6.25 metres. In effect, then one metre or so is extended the full length of the scale, and, as the scale length of the Muirhead dial used on the original receiver is equivalent to approximately twenty-two feet, there is not much need for bandspreading!

As a result of the use of such a small capacity condenser the L/C ratio and the circuit Q are excellent and they are further improved by the iron-dust cored coils. The coverage has been deliberately restricted to the amateur bands as those are what the majority of short-wave listeners are interested in, but by adding trimmers across the 20, 30 and 45 metre coils these can be padded up to cover the broadcast bands of 25, 31 and 49 metres. That, of course, is up to the reader, and for those who prefer general coverage a different tuning circuit with normal coils is shown in Fig. 2, which will cover from 1.4 to 32 megacycles continuously, thus including all the amateur bands from 10 to 160 metres and a small portion of the broadcast band. This arrangement, like the other, has been used in the receiver and puts up an excellent performance when used with a few feet of flex as aerial and no earth, but it means a few changes in the chassis layout as the coil and condenser measurements are not the same.

**LIST OF COMPONENTS**

3 miniature valve holders.
14 Denco iron dust cored coil formers ½in. diam.
1 two-gang variable condenser (bandspread type).
1 Yaxley Switch: 4 pole, 7 way (with grounding ring to earth coils not in use).
1 50 μμF fixed condenser.
2 100 μμF fixed condensers.
2 .01 μF fixed condensers.
1 .001 μF fixed condenser.
1 .005 μF fixed condenser.
2 R F chokes, 10 Henries.
2 1 megohm fixed resistors.
1 450 ohms fixed resistor.
1 variable 50 μμF condenser.
1 25,000 ohm fixed resistor.
1 Audio choke 350 Henry.
2 IT4 valves.
1 IS4 valve.
1 5,000 ohm potentiometer.
1 1.5 volt L.T. battery.
1 67.5 H.T. battery.
Aluminium for chassis.
1 3in. W.B. speaker.

COIL DATA FOR GENERAL COVERAGE COILS

| Frequency | | Turns | | Turns | Reaction Winding |
|---|---|---|---|---|---|
| 1.4 to 2.8 Mc/s | L1 | 65 turns. 32 s.w.g. enamel | L6 | SAME | 20 turns of 32 s.w.g. enamel closewound |
| 2.5 to 5 Mc/s | L2 | 32 turns 32 s.w.g. enamel | L7 | AS PREVIOUS GRID COIL | 10 turns 32 s.w.g. enamel close-wound |
| 5 to 10 Mc/s | L3 | 16 turns 28 s.w.g. enamel | L8 | | 6 turns 32 s.w.g. enamel close-wound |
| 10 to 20 Mc/s | L4 | 8 turns 26 s.w.g. enamel | L9 | | 3 turns 26 s.w.g. enamel close-wound |
| 20 to 32 Mc/s | L5 | 3½ turns 26 s.w.g. enamel spaced wire dia. | L10 | | 4 turns 26 s.w.g. enamel close-wound |

All formers 1in. dia. Reaction windings spaced ⅛in. from grid winding.

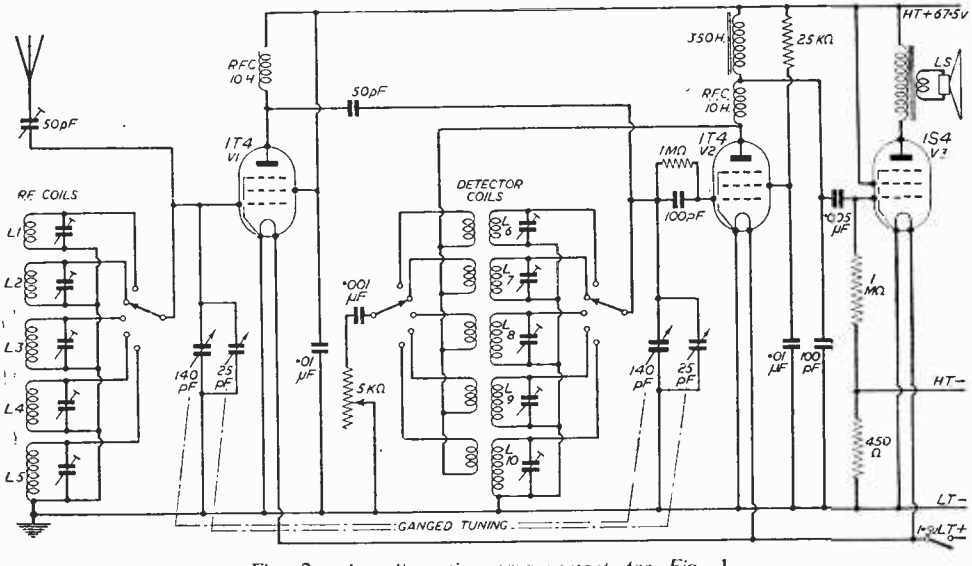



*Fig. 2.—An alternative arrangement for Fig. 1.*

**Layout**

Returning to the original circuit the controls are: main tuning, bandswitch, reaction / on-off switch and aerial tuning. No volume control is necessary as slightly detuning will serve the same purpose. The components, with the exception of the 3in loudspeaker, are all mounted on an aluminium chassis of rather unusual dimensions, 6.5in. x 7.5in. x 2.5in. deep, as shown in Fig. 3. These dimensions have the advantage of keeping the receiver compact and the wiring short as well as assisting in below chassis screening. The bandswitch is placed immediately below the tuning gang and the coils are close up on each side so that the slug screws do not foul the tuning condenser. The screens between the coil banks are extended to one side of the chassis to isolate the R.F. valve wiring from that of the detector and also to act as supports for the reaction control and the aerial trimmer. The latter, incidentally, has one of the moving-plate tips bent so that it may be shorted out when required by fully closing it. The shafts of these two controls are of bakelite rod used with a brass coupling collar.

**Reaction**

The particular reaction circuit in this receiver is extremely quiet in operation and does not affect tuning to any noticeable extent. The parallel-fed coil is in series with a .001$\mu$F fixed condenser and the by-passing effect of the latter is controlled by the 5000 ohm potentiometer, giving very smooth reaction. This is helped considerably by the L.F. coupling, which is an impedance arrangement instead of the usual R.C. or transformer method. The choke required for this purpose should be of not less than 350 Henries, and could be higher with advantage. Such chokes, however, are rare and in their absence an ordinary intervalve transformer with its primary and secondary connected in series will serve as well.

When the coils have been wound and checked they should be coated with polystyrene dope to prevent turns slipping and to keep out humidity.

A rough method of checking the wiring when putting the receiver into service is to touch a finger to the detector grid, when there should be a strong squeal and then to the R.F. valve grid which will result in a pronounced hum from the speaker. Next, turn the reaction control slowly until the usual rushing noise, indicating that the detector is oscillating, is heard. If there is no oscillation when the control is fully advanced the reaction winding should be moved nearer the grid winding, and if this is still insufficient add a turn or two to the reaction winding. It is possible that at the point of oscillation a strong howl will appear. A 50,000 ohm resistor across the L.F. choke will cure the trouble, and all that there remains to be done then is to tune in a station on each band and adjust the coil cores for maximum signal strength.

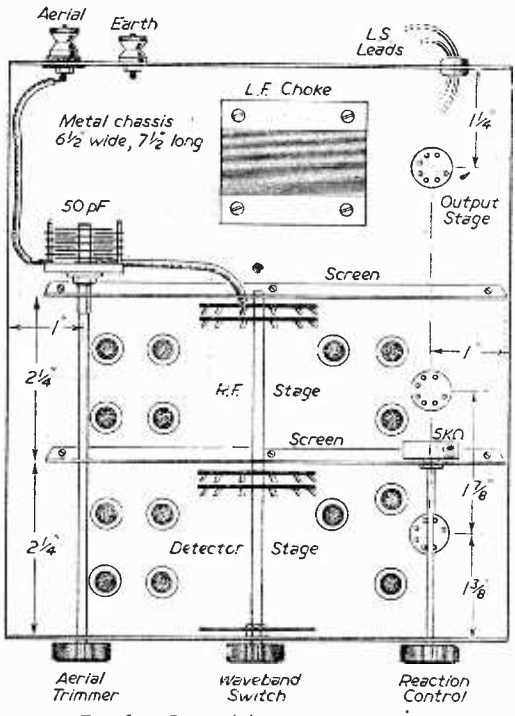



*Fig. 3.—General layout arrangement.*

COIL DATA

| Frequency | | Primary | Secondary | | Grid | Reaction |
|---|---|---|---|---|---|---|
| Broadcast | L1 | 25 | 100* | L8 | 100* | 33* |
| 3.5 to 4 Mc/s | L2 | 7 | 85 close-wound | L9 | 85 c.w. | 28 c.w. |
| 6.9 to 7.4 Mc/s | L3 | 5 | 45 turns spaced to $\frac{3}{8}$in. | L10 | 45 turns spaced to $\frac{3}{8}$in. | 18 c.w. |
| 13.95 to 14.45 Mc/s | L4 | 3 | 22 turns spaced to $\frac{3}{8}$in. | L11 | 22 turns spaced to $\frac{3}{8}$in. | 9 c.w. |
| 20.5 to 21.9 Mc/s | L5 | 3 | 15 turns spaced to $\frac{3}{8}$in. | L12 | 15 turns spaced to $\frac{3}{8}$in. | 6 c.w. |
| 27 to 30 Mc/s | L6 | 2 | 11 turns spaced to $\frac{3}{8}$in. | L13 | 11 turns spaced to $\frac{3}{8}$in. | 5 c.w. |
| 48 to 55 Mc/s | L7 | 1½ | 6 turns spaced to $\frac{3}{8}$in. | L14 | 6 turns spaced to $\frac{3}{8}$in. | 3 c.w. |

* Hank (or wave wound) with 36 enamel S.W.G. All other coils wound with 34 enamel S.W.G. All formers Denco polystyrene dust cored, ½in. diameter.

# TRANSMITTING TOPICS

THIS MONTH THE PROBLEMS OF GRID DRIVE ARE DEALT WITH

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

ONE aspect of amateur transmitter operation is the vexed question of grid drive. All too frequently one hears remarks about "low grid drive," inability to obtain the rated grid milliamps on the more H.F. bands—and, of course, there is always the man who is able to obtain a phenomenal number of milliamps of grid current. Drive problems, like the poor, are always with us, and it is as well to examine this question of grid drive from first principles. A small dash of sound basic principles will be found superior to any amount of confused reasoning. Some of the conflicting matter that has appeared in the past has not served to clarify this matter. The following points are, in fact, presented for the genuine enquirer who is anxious to progress along sound lines to an understanding of how he may obtain the most efficient operation of his apparatus.

Grid drive is usually measured, in amateur practice, by observing the grid current reading of the driven stage. Providing the bias and other voltages are exactly as prescribed by the valve manufacturer, the P.A. stage is then operating under its optimum conditions. However, if one cannot meet exactly the maker's voltage ratings, things may be a little difficult. For example, if the grid bias is too low, a much higher value of grid current results. However, no one imagines that a reduction in bias provides "more drive." True, the R.F. output of the stage may increase, but this is at the expense of efficiency. In extreme cases the anode dissipation of the stage may be exceeded and the valve damaged, even though the total input would be within rating *if* the bias and drive were correct. Clearly correct drive is obtained *only* when the grid current is as specified at the specified bias value. Here again, with modern tetrode and pentode stages there is no merit at all in running with the correct bias, but with increased grid current. Output may actually be reduced, and the valve damaged. With triodes gross over-running is not so serious, but with sensitive multigrid valves, high grid currents are dangerous to valve life. Furthermore, of course, T.V.I. harmonics are intensified by overdrive.

### Grid Drive Power

The point is that grid current is only half the story. The real factor is the R.F. grid driving power. This is obtained only when bias and grid current are as specified by the maker. However, the amateur views the "rated grid drive power" figures quoted by makers with suspicion. His experience is that far more driving power has to be available than the maker claims. Thus, the popular 807 is quoted at some quarter of a watt grid drive for full R.F. output. On this basis it seems that a quite inefficient driver taking less than a watt of power would be more than adequate to drive an 807 to some 60 watts input. However, practical experience soon shows that the driving stage must provide far more R.F. output than the figure listed by the maker for the P.A. stage valve.

Here again, however, it must be firmly understood that the maker's drive figure is a value representing the actual R.F. drive power required *in the absence of any other sources of R.F. loss.* Accordingly, the practical value of drive power which the driver must supply is dependent upon several other conditions. Thus the frequency of operation, bias circuit losses and coupling circuit losses must all be carefully considered. Fortunately for the amateur all these points have been considered ages ago, and the

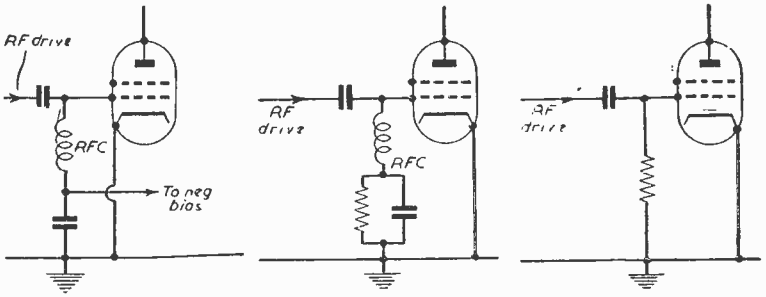



*Fig.* 1 (*left*).—*Fixed bias circuit.* *Fig.* 2 (*centre*).—*By-passed grid-leak bias.* *Fig.* 3 (*right*).—*Un-by-passed grid-leak bias.*

practical conclusions are quite simple. The minimum drive power required at relatively *low* frequencies, as for 1.8 and 3.5 Mc/s operation, should be at least *three* times the maker's quoted drive power figure. However, as the frequency is raised, additional losses must be considered, so that for 7 Mc/s and 14 Mc/s operation *five* times the rated maker's drive figure is required, while on 21 Mc/s and 28 Mc/s the available drive power should be at least *eight* times the rated drive figure. This presupposes that valves capable of efficient operation at these frequencies are used. Most modern valves; such as the 807, satisfy these requirements. When operation is extended to V.H.F. or U.H.F. it may become necessary to provide *twenty* or *thirty* times the nominal drive power from the driver stage. It is, of course, on the higher frequencies that drive becomes difficult, particularly as it is difficult to obtain good output from the driver stage itself on the higher frequencies. It is, in any case, clear that inadequate drive may be due to a too optimistic reliance upon the quoted maker's drive figure as a guide to operation on the short-wave and ultra-short-wave regions of the spectrum. The multiplying factors suggested will be found suitable for the average amateur rig. In fact, a really efficient layout would reduce these factors. A really inefficient layout, of course, is very wasteful of drive power, particularly if stray capacities are high.

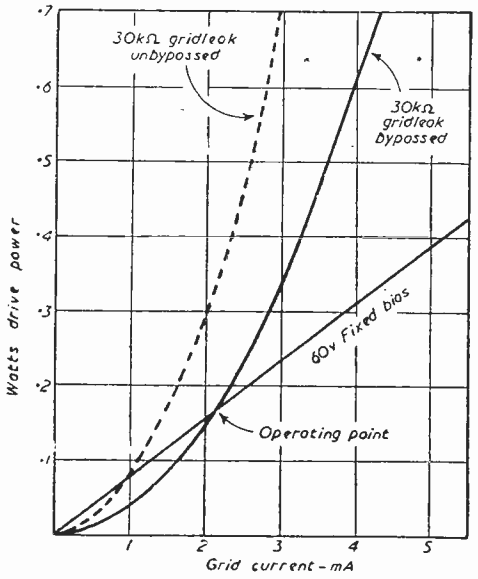



*Fig. 4.—807 grid drive power requirements for the cases of 60 volts fixed bias, by-passed 30,000 ohm grid-leak, and for a 30,000 ohm grid-leak un-by-passed.*

### Grid Bias

A further point to observe is that the grid driving power depends somewhat upon the type of bias arrangement in use to obtain the grid bias. The circuit diagrams illustrate three common methods. These are battery bias, grid-leak bias with the leak by-passed to R.F., and grid-leak bias with the leak not by-passed to R.F. The differing behaviour of these arrangements is shown in the graph, which represents the R.F. grid power of an 807. It is assumed that 2 mA. represents the optimum grid current, and that 60 volts is the required bias. Both in the fixed bias case and the by-passed grid-leak case the R.F. grid drive power is the same at the selected operating point. However, with the grid-leak an increase in drive grid current represents a greater drive power requirement than for fixed bias, while at lower grid currents the grid-leak bias case takes less power than the fixed bias case. It can be seen, therefore, that grid-leak bias is to some extent self-compensating for changes in grid drive power. If more drive is applied, this is opposed by the increased bias developed across the grid-leak, while if the drive falls slightly the bias also falls, and to some extent offsets the loss of drive. This is a useful feature of grid-leak bias, and it is often employed in conjunction with fixed bias. The fixed bias keeps the P.A. from drawing excessive anode current when drive is removed, while when the drive is applied the grid-leak makes up the extra bias required for Class C operation.

### 'Phone Operation

It will be noticed that an un-by-passed grid-leak is wasteful of drive, as the grid-leak is itself a load on the R.F. source, so that R.F. power is wasted in the grid-leak. The use of an un-by-passed grid-leak is quite common in low-level driver stages, but if used for the P.A. stage the extra power loss may unduly reduce drive at the higher frequencies where drive is critical. If drive is a bit difficult, therefore, an improvement may be effected by by-passing the grid-leak to R.F. Furthermore, of course, the grid drive power figures on the graph are equivalent to those quoted by the maker, and under any given conditions they should be multiplied by the factors previously given in order to obtain the actual drive power that should be available. The operating conditions here chosen for the 807 are suitable for C.W. operation at medium inputs. For 'phone operation, or for full-power C.W. working, the operating point of 3 mA. at 60 volts should be chosen. For grid-leak bias this would then require a grid-leak of 20,000 ohms to provide the 60-volt bias at 3 mA. grid current.

# A SUBSTITUTION CHECKER

## A VERSATILE INSTRUMENT FOR THE EXPERIMENTER

By H. R. Singh

VERY often a constructor is confronted with a receiver where a condenser or resistor has become faulty and beyond recognition due to over-heating or some similar contributory cause.

Where no service data is readily available one has to determine its value by trial and error. This is a long process and involves quite an amount of repetition work, together with a great deal of soldering. It is in such cases as this where a "Substitution Checker" is of great help.

The instrument to be described is unique in that, with only 20 resistors and 19 condensers a total of over 1,000 different circuit and component selections are possible. Thus, in the hands of the keen constructor it is a versatile little instrument which can be put to many more uses than that mentioned above.

### Circuit

The circuit of the instrument, which is practically self-explanatory, is shown in Fig. 1. It consists basically of two "selector" switches S1—S2 and S3—S4 (S1 and S2 are ganged together, so are S3—S4) to which are connected a selection of 20 resistors and 19 condensers. The function of these switches, as their name implies, is to select any one of the components one at a time. Two switches, T1 and T2, suitably labelled "Bank 1" and "Bank 2," select either of the main switch banks to which the resistors and condensers are connected. In this way, all the components in either bank can be selected and transferred to their respective sockets indicated in "Red" and "Blue." With suitable coloured leads terminating in crocodile clips and plugs, these socket points can then be coupled to any section of the circuit under investigation.

### Circuit Selection

Circuit selection is an easy matter and is made possible by the use of suitably designed coloured

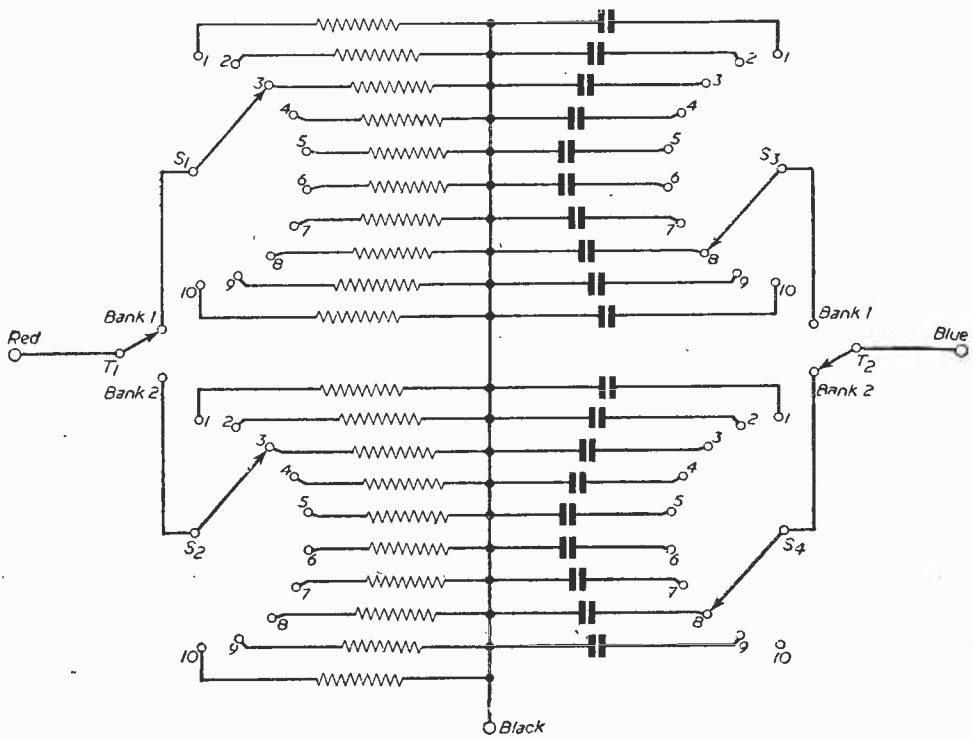



*Fig. 1.—General theoretical circuit of the checker described in this article.*

leads, shown in Fig. 2. The colour of the leads corresponding with the socket colours on the instrument panel.

Three leads should be made up, as shown at "a," one each in "red," "blue" and "black." And one as at "b" which can be any colour. The number of circuit combinations possible is shown in Fig. 3. It will be noted that there are five circuits altogether, and circuits "a," "b," "c" and "d" are selected by plugging in the appropriate coloured leads to Fig. 2 (a). To select the parallel circuit shown

at "e," Fig. 3, the lead of Fig. 2 (b) is required together with the "black" coloured lead which plugs into the black socket.

**Component Selection**

Having selected the circuit, it now remains to choose suitable component values. This can be done by first drawing up a table, as shown, on White Bristol board in Indian ink, and gluing it into position on the bottom of the case, so that it can be seen from a sitting position, when the instrument is resting on its back.

let us arrange a complete switching for the parallel circuit of Fig. 4.

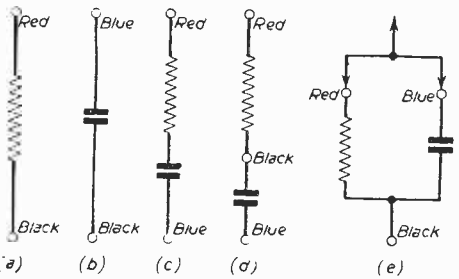
*On the resistor range, set :—*
T1 to Bank 1.
Selector to 4.

*On the condenser range, set :—*
T2 to Bank 2.
Selector to 9.

Use leads "a" (black) and "b" of Fig. 2.

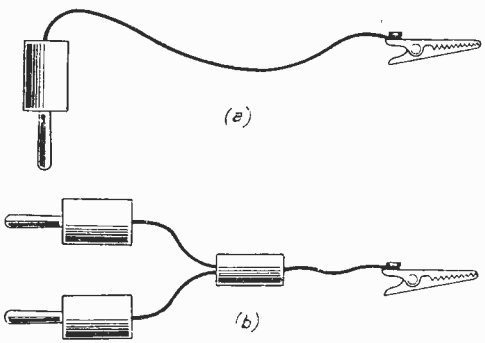
The two crocodile clips can now be connected to the experimental circuit.

| Bank 2 ... | 27 KΩ | 39 KΩ | 50 KΩ | 100 KΩ | 220 KΩ | 330 KΩ | 470 KΩ | 1 MΩ | 2.2 MΩ | 4.7 MΩ |
|---|---|---|---|---|---|---|---|---|---|---|
| Bank 1 ... | 50Ω | 100Ω | 220Ω | 500Ω | 1.5 KΩ | 3.3 KΩ | 5 KΩ | 10 KΩ | 15 KΩ | 20 KΩ |
| Selector Switch | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Bank 1 ... | 50 pF | 100 pF | 200 pF | 300 pF | 500 pF | .001μF | .002μF | .003μF | .005μF | .01μF |
| Bank 2 ... | .02μF | .03μF | .05μF | .1μF | .25μF | .5μF | 2μF | 8μF | 25μF | — |



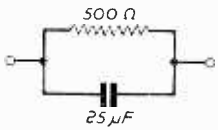

It will be seen that this table gives details of component values with respect to "selector" and "toggle" switch positions. Thus, if a 100 ohm resistor is called for, toggle switch T1 is switched to position marked "Bank 1" and selector switch is set to position "2" on the resistor dial. For a 470 KΩ resistor T1 is set to "Bank 2" and the selector to position "7." Similarly, selections can be made in the condenser range.

To illustrate the system somewhat more clearly,




(a) = 20 selections
(b) = 19 "
(c) = 380 "
(d) = 380 "
(e) = 380 "

Total selections = 1179




*Figs. 2, 3 and 4.—Left, Details of the combinations which may be obtained on the worked example above.*

**COMPONENTS LIST**

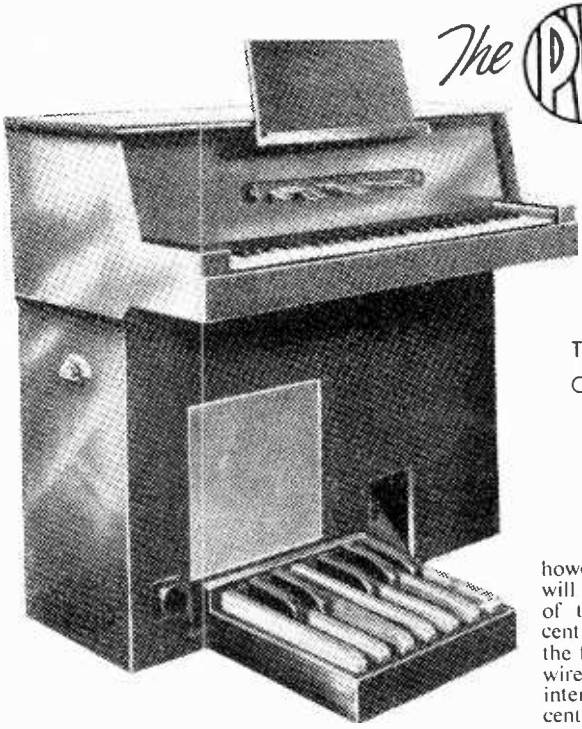
| BANK 1 | | BANK 2 | |
|---|---|---|---|
| R1—50Ω | R6—3.3 KΩ | 27 KΩ | 330 KΩ |
| R2—100Ω | R7—5 KΩ | 39 KΩ | 470 KΩ |
| R3—220Ω | R8—10 KΩ | 50 KΩ | 1 MΩ |
| R4—500Ω | R9—15 KΩ | 100 KΩ | 2.2 MΩ |
| R5—1.5 KΩ | R10—20 KΩ | 220 KΩ | 4.7 MΩ |

| BANK 1 | | BANK 2 | |
|---|---|---|---|
| C1—50 pF | C6—.001 μF | .02 μF | .5 μF |
| C2—100 pF | C7—.002 μF | .03 μF | 2 μF |
| C3—200 pF | C8—.003 μF | .05 μF | 8 μF |
| C4—300 pF | C9—.005 μF | .1 μF | 25 μF |
| C5—500 pF | C10—.01 μF | .25 μF | None |

S1 — S2 — Two-pole, 10-way, two bank Yaxley Switch.
S3 — S4 — Two-pole, 10-way, two bank Yaxley Switch.
T1—T2—S.P.D.T. toggle switches.
2—Small pointer knobs.
3—Insulated sockets, Red, Blue and Black.
5—Plugs to suit above.
4—Crocodile clips.

**Construction**

No special considerations are required in the construction of this unit. As most constructors will have quite a number of spare parts in hand or obtain components cheaply from the surplus market, dimensions of which might differ from those used in the original, it was decided not to give any measurements. In the prototype, however, all switches and components were mounted on a 20 S.W.G. grey metal panel measuring 6in. × 9in., which was afterwards fitted into a hand-polished wooden case. Two dials were then made and fitted to the two range selector switches. Each dial has a 1/16in. thick Perspex cover with a small pointer knob. The dials were marked 1 to 10 with Indian ink on White Bristol board. In order that the instrument will present an all-round pleasing appearance, a symmetrical layout was maintained throughout.



# The PW FULL-COMPASS Electronic ORGAN

This Month Constructional Details are Given of the Mechanical Work Involved in the Tab-board Assembly

By W. J. Delaney (G2FMY)

(*Continued from page* 680 *November issue*)

THE next step is to wire up the keys and distribution strip, but different keyboards will require slightly different treatment. A board was mentioned in the November issue to cover the keyboard and upon which are mounted the distribution strip, etc. Details of assembly are as follows: Beneath the distribution strip a sheet (or two or more odd pieces) of aluminium are mounted running the entire length of the strip, and being 4in. in width. The total width of the board should be such that there is left a space 5in. in width between the front cable run, and the edge of the aluminium strip just mentioned. Further pieces of aluminium are now cut and bent so that they may be mounted on either side of the distribution strip to form a box without a lid, the overall height being also 4in. A lid either in one length or two or more odd lengths will finally be needed. This should be clear from the illustration at the foot of page 679 last month.

Screw down the bottom piece of aluminium to allow the dimensions above mentioned and then complete the distribution strip by mounting in the upper row of holes 168 B.T.S. type Dubilier resistors of 10 MΩ each (20 per cent. tolerance). In the lower row mount the same number of 2.2 MΩ resistors. It will be noted that the number specified does not allow for three resistors to each note, and the upper octave (on the right viewing the distribution strip from the front) has only two channels provided for a reason which will be seen later. Bend forward the lower ends of the 2.2 MΩ resistors and if you wish to save some time and trouble at a later stage short lengths of coloured insulated sleeving may be slipped over the ends using an identical colour for all the centre resistors and other colours for the left- and right-hand ones. This is not essential, however, as the holes are drilled at an angle and this will help to identify them. Attach the strip by means of the small brackets already mentioned, on the centre line of the aluminium strip with resistors to the front, and then, having already checked that the wires from the key contacts are electrically sound inter-connect them as follows. The contact in the centre of the three over each key is joined to the centre of the three resistors for that note, whilst the left-hand key contact is joined to the right-hand resistor of the group for the same note one octave lower. Similarly, the right-hand key contact is joined to the left-hand resistor of the group for the note one octave higher. To assist in identification the note values may be scratched on the top of the distribution strip starting from B at the extreme right and working downwards. Checking will be difficult here unless an ohm-meter reading in meg-ohms is available, so care is needed not to mix up the wires and connections. One advantage of this design is that it will be a fairly simple matter to sort out any errors at a later stage and correct them.

### Tab Board

The most tedious and difficult part of construction is now completed, and it will well repay the constructor to spend considerable care and time over this part of the work, as no matter how good the rest is the entire operation depends upon clean key switching—all notes sounding with the same key movement, etc. The next part of the work, which is also mechanical and calls for some care for efficient working, is the tab board, by means of which the note range of the organ is selected and the tones controlled. This also may be seen in the illustration on page 679 already referred to, and for it one needs some more aluminium sheet, a length of ¼in. silver steel rod, another piece of the 1¾in. paxolin strip and some ex-government or P.O. switches. In the event of the latter being unobtainable, the switches may be made up by using strips of the phosphor bronze already referred to, some ¾in. 6 B.A. bolts and nuts and some P.V.C. or paxolin tubing which will just fit over the 6 B.A. bolts.

To assist those who wish to construct the switches, the arrangement is shown in "exploded" form in Fig. 11 from which the assembly should be found fairly simple. The separate switches, of which 14 are simple closed-circuit components and one a triple assembly of the same arrangement, are mounted on the paxolin strip cut to 12½in. in length, as shown in Fig. 10. When making or assembling these switches from dismantled standard components, use thin insulated strips between the contacts so that

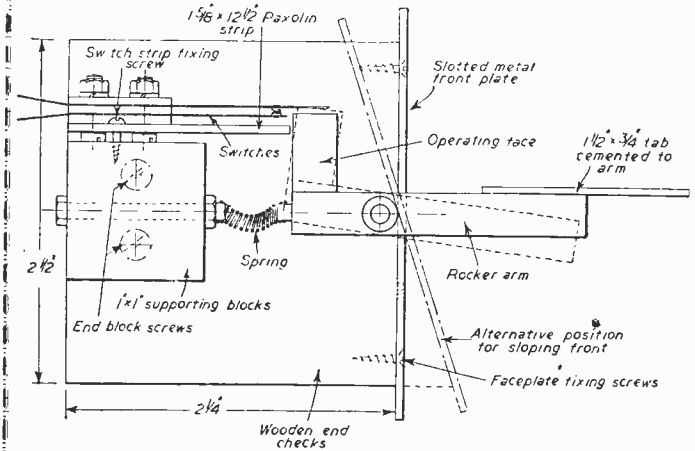



*Fig. 9.—Details of the tab switches.*

the contact points are normally closed. If it is desired to make silver contacts, the phosphor bronze strip should be drilled and a short length of silver wire riveted in the holes, but this is by no means essential, as already pointed out.

The next difficult job is to make the operating toggle. For these, ¼in. Perspex sheet is cut to form 15 strips 2½in. long and ⅜in. wide. A hole is drilled to take the ⅛in. silver steel rod as shown in Fig. 9, and it should here be pointed out that all illustrations are to scale so that the constructor can take off any item which is not actually given a dimension. The end nearest the hole is then filed round by taking off the corners of the Perspex with a file, and the resulting round "key" ⅜in. long is left approximately the diameter of a 6 B.A. bolt. Next, a number of short springs are required, and although the spring curtain rod obtainable from the popular stores may be used, it is rather heavy for the purpose and a lighter gauge is preferable. Most ironmongers carry stocks of springs and long ones may be cut down, and they may be pulled out to give the desired tension. Experiments should be carried out on a single key, mounted as shown in Fig. 9. A 1¼in. 6 B.A. bolt is pushed into a 1in. by 1in. block of hardwood and locked with a nut which will leave a short projecting piece. The spring is placed over this and over the round key on the end of the tab or rocker-arm. Using the spacing shown in Fig. 9, cut the spring so that it will provide a toggle action to the rocker arm. It should be slightly under compression and of such a length that as the end of the arm is lowered the spring will jump to a position above that shown in the sketch, and no exact dimensions can be given as it depends upon the type of spring which is used.

The ends of the silver steel rod are inserted into holes in the end cheeks, and to prevent the rod moving sideways small brass strips are screwed to the wood. Lengths of paxolin tubing or other tube are then inserted between each arm to act as distance pieces, and again, if paxolin is not available, ordinary thin bamboo or cane rods may be cut up. Fig. 11 shows a perspective view of the assembly, and the upper operating face is cemented on after the rocker arms have all been mounted and found to jump satisfactorily. The aim is to have these so that they only require a slight touch to jump from "down" to "up," and again some time must be spent in obtaining

**LIST OF CON**
**For pre-amp unit, cir**

**RESISTORS**
**(All Dubilier type B.T.S. ½ watt 20% except where stated.)**

| | |
|---|---|
| Two at 2.2 Ω. | Two 220 KΩ. |
| One at 4.7 KΩ. | Nine 470 KΩ. |
| Two 12 KΩ (10%). | Four 1 MΩ. |
| Nine 47 KΩ. | One 2.2 MΩ. |
| One 22 KΩ. | Three 10 MΩ. |
| Two 100 KΩ. | |

**CONDENSERS**
**(All T.C.C. except where stated.)**
**Three at 100 pF (Type 101 SMP).**
**Two 2,700 pF (Type CM25).**
**Three 3,300 pF (Suflex, 500 v.w.).**
**One 4,700 pF (Suflex, 500 v.w.).**
**One .005 μF (Type 543).**
**Two .01 μF (Type CP33S).**
**Five .02 μF (Type CP33N).**
**Three .05 μF (Type CP37S).**

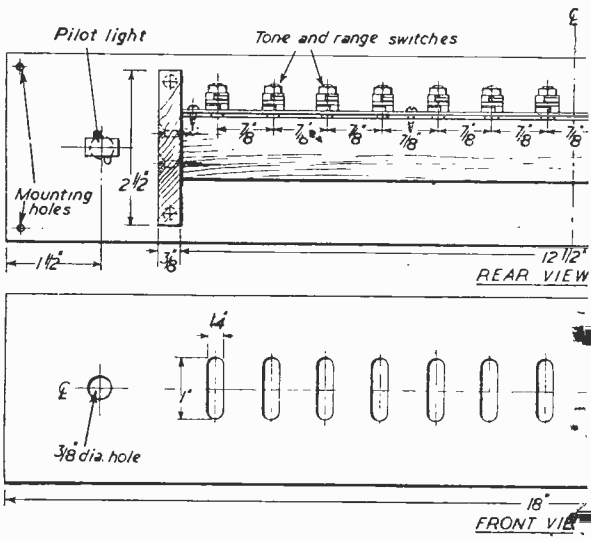


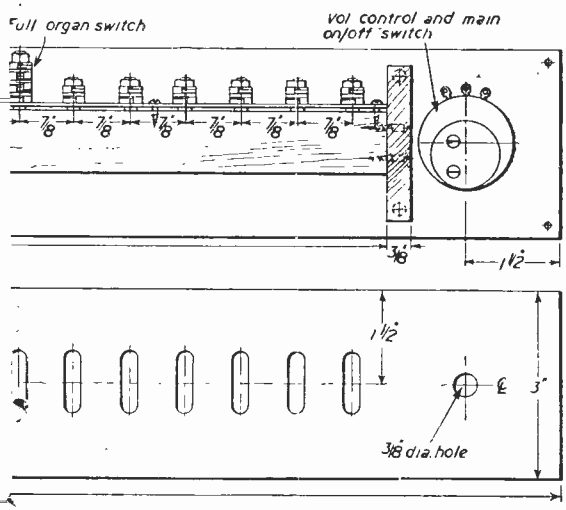

*Fig. 10.—Details of the assembly a*

a quick acting switch which will operate by the merest flick of the fingertip. If too tight, they will not be operated quickly enough in playing, and if too loose, operation of one may cause an unwanted one to operate.

When satisfied that the action is right the distance from the top of the rocker arm to the under-side of the projecting contact should be carefully measured and a piece of the Perspex cut to reach just short of the contact. Cement these pieces in position so that when the tab is up the switch is closed, and when down the switch is opened. This is easily checked with a simple meter. The most satisfactory Perspex cement is probably Tensol, and the tabs are not fixed until later.

**'PONENTS**
cuit on page 754

Three .1 μF (Type CP46S).
One 4 μF Electrolytic (Type CE18L).
One 50 μF Electrolytic (Type CE18C).
Two I.O. Valveholders—McMurdo Silver.
One B9A Valveholders with screen and spring (McMurdo Silver).
One 5 KΩ Midget W.W. Potentiometer—Colvern, etc.
One Co-axial Socket Type, Type L604/S—Belling Lee.
Three 4-way Tag Strips, Bulgin, Clix, etc.
Two 10-way Tag Strips, Type T.98—Bulgin.
4 large grommets.
2 small grommets.
1 top-cap connecter for I.O. valve.
1 yard 5-way screened cable.
1 yard single screened flex.
Short length of twin screened flex.
Chassis, connecting wire, bolts, nuts.




*al front plate of the tab board.*

**Full Organ Switch**

This is a three-element switch made exactly as in the case of the other switches but consisting of three separate elements which must operate together. In the prototype I used the same contact pieces, but drilled a ⅛in. hole just short of the tip of the longer pieces, and when the three units were assembled, using much longer bolts, of course, a short piece of Perspex rod was inserted in the holes with a thin disc cemented on top and bottom. This prevents

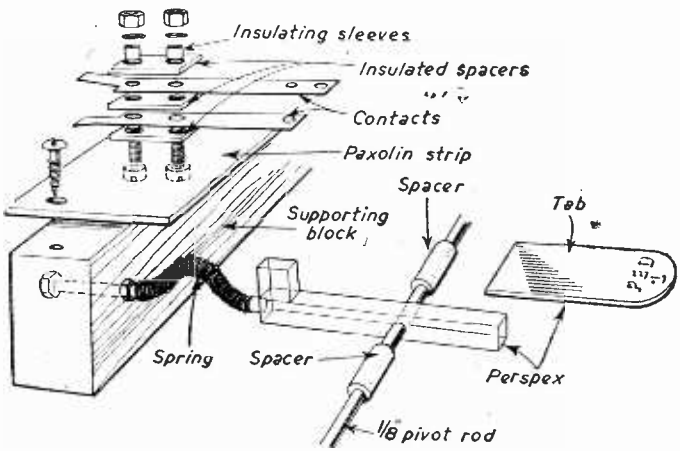



*Fig. 11.—An "exploded" view of the tab switch.*

the rod falling through. Between the three long contacts, spacers of insulated sleeving were slipped over the rod, so that when the operating face raises the lower strip the two above it are also raised evenly at the same time. When satisfactory, cut a front piece of aluminium 3in. by 18in. and drill and cut as shown in Fig. 10. This is attached to the wooden end cheeks of the switch assembly by ordinary wood-screws. No holes are indicated in the illustration as they are not critical and will depend upon the thickness of the cheeks used by the individual constructor. Two ⅜in. holes are drilled as indicated to carry the pilot light and the pre-set volume control and on/off switch.

**Final Design**

At this stage it may be noted that in Fig. 9 two alternative fronts are shown for the tab board assembly. In the final design of the organ some readers may prefer a vertical front above the keys, whilst others may prefer a sloping front as in the heading illustration. The decision must be made before cutting the end cheeks for the tab-board so that these may be cut to a suitable angle. Similarly, the ⅛in. Perspex sheet which is used for the actual tabs may be of the white (opaque) type, with the identifying names typed on paper strips attached by Cellotape, or coloured pieces may be used for identification. Again this depends upon the individual taste and the final design which is aimed at.

With the exception of the foot pedal, which will not be found difficult, all the mechanical work required in the organ is now complete and the

electrical side may be proceeded with. The next stage to be described will be the pre-amplifier, tone-control stage and vibrator, the theoretical circuit for which is given below. These three stages are mounted on one chassis which fits between the screening box holding the distribution strip and the front cable run. Again, this may be seen in the illustration on page 679, and the three stages are housed in a small metal chassis measuring 9in. by 4½in. A drilling and cutting diagram is given and it should be noted that a fixing flange is recommended so that the chassis may be finally fitted with a base cover. A list of parts is given and a wiring diagram will be given in the next issue.

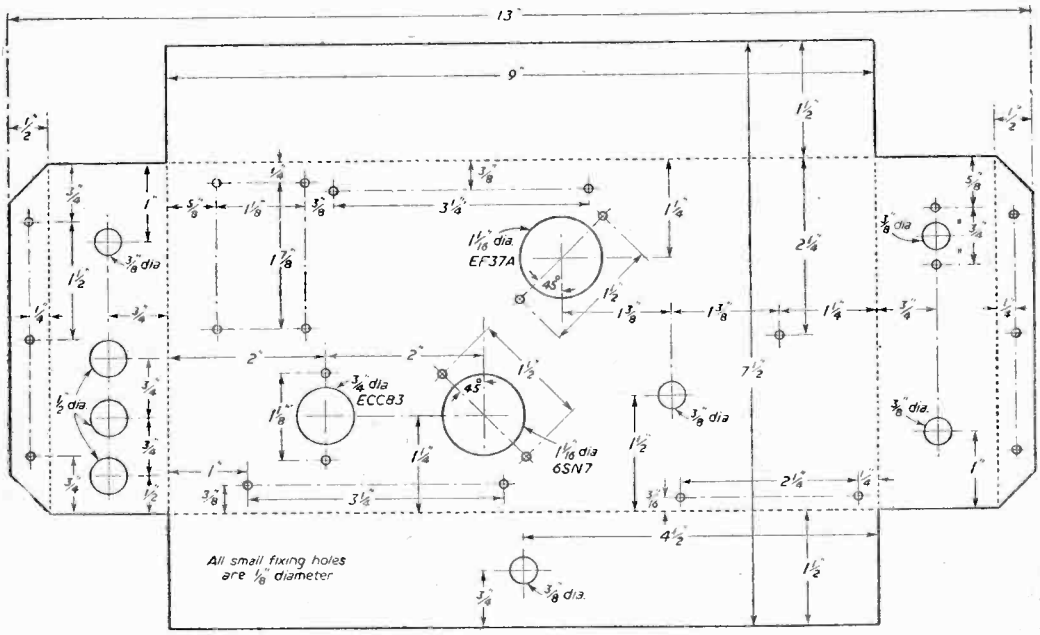



*Fig. 12.—Chassis cutting and drilling details for the pre-amp.*

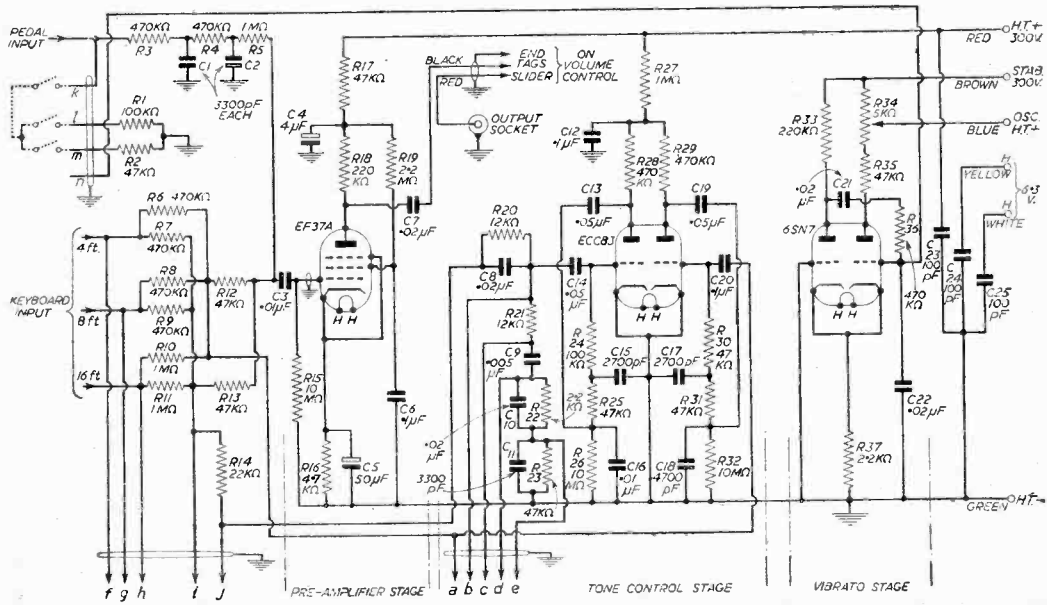



*Fig. 13.—Circuit of the pre-amp unit, which includes the tone filter stage and the vibrato oscillator.*

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AC/HL ... 13/3 | EA50 ... 10/- | KF35 ... 15/3 | Pen423 ... 33/2 | U150 ... 13/11 | Z152 ... 23/3 | 6K8G ... 17/3 | 19BG6G 23/3 |
| AC HLDD 21/11 | EAC91 ... 33/2 | KK32 ... 19/11 | Pen453DD 24/6 | U151 ... 26/6 | ZD17 ... 17/3 | 6K8GT ... 17/3 | 19Y3 ... 13/11 |
| AC044 ... 19/11 | EAF42 ... 18/7 | KL35 ... 15/3 | PenA4 ... 21/3 | U152 ... 16/7 | ZD152 ... 19/11 | 6K25 ... 13/11 | 20D1 ... 12/- |
| AC P ... 13/3 | EB34 ... 12/- | KLL32 ... 21/11 | PenB4 ... 23/3 | U201 ... 13/11 | 1A5GT ... 15/3 | 6L1 ... 23/3 | 20D2 ... 23/11 |
| AC P4 ... 27/3 | EB41 ... 11/4 | KT2 ... 19/3 | PenDD4020 26/6 | U281 ... 13/11 | 1A7G ... 19/11 | 6L6G ... 23/3 | 20F2 ... 23/3 |
| AC Pen | EB91 ... 12/- | KT32 ... 21/3 | PL33 ... 17/3 | U289 ... 16/7 | 1C1 ... 17/3 | 6L7G ... 21/3 | 20P1 ... 23/3 |
| 5 pin ... 21/3 | EBC33 ... 15/1 | KT33C ... 21/3 | PL38 ... 26/6 | U403 ... 13/11 | 1C5G ... 14/6 | 6L18 ... 15/11 | 20P3 ... 17/3 |
| AC Pen | EBC41 ... 15/11 | KT36 ... 23/3 | PL38M ... 26/6 | U404 ... 13/11 | 1D5 ... 13/11 | 6L19 ... 23/3 | 21A6 ... 23/3 |
| 7 pin ... 21/3 | EBF80 ... 18/11 | KT41 ... 21/3 | PL81 ... 22/7 | U4020 ... 13/11 | 1D6 ... 15/11 | 6LD20 ... 15/11 | 25A6G ... 17/3 |
| AC SG ... 23/3 | EBL1 ... 22/1 | KT44 ... 23/3 | PL82 ... 16/5 | UAF42 ... 18/7 | 1F3 ... 15/3 | 6M1 ... 17/3 | 25L6GT ... 16/5 |
| AC SGVM 23/3 | EBL21 ... 21/3 | KT45 ... 23/3 | PL83 ... 23/3 | UB41 ... 12/- | 1FD9 ... 17/3 | 6N7GT ... 23/3 | 25Z4G ... 13/11 |
| AC THI ... 23/3 | EBL31 ... 21/3 | KT61 ... 17/3 | PM2HL | UBC41 ... 15/1 | 1L4 ... 15/3 | 6P25 ... 17/3 | 25Z6GT ... 13/11 |
| AC TP ... 23/11 | EC31 ... 13/3 | KT63 ... 17/3 | Clear ... 12/- | UBF80 ... 19/11 | 1LA6 ... 17/3 | 6P28 ... 17/3 | 27SU ... 19/11 |
| AC/VPI | EC52 ... 19/11 | KT66 ... 23/3 | PM2HL met 12/- | UBL21 ... 20/2 | 1LD5 ... 17/3 | 6P28 ... 23/3 | 35A5 ... 17/3 |
| 5 pin ... 20/7 | EC91 ... 33/2 | KT71 ... 17/3 | PM12M met 19/3 | UCH21 ... 20/2 | 1LN5 ... 15/3 | 6Q7G ... 15/11 | 35L6GT ... 17/3 |
| AC/VPI | ECC32 ... 23/3 | KT76 ... 17/3 | PM22A ... 19/3 | UCH42 ... 21/3 | 1P10 ... 15/3 | 6Q7GT ... 15/1 | 35W4 ... 13/11 |
| 7 pin ... 20/7 | ECC34 ... 23/3 | KT81 ... 23/3 | PM24A ... 25/10 | UF41 ... 16/5 | 1P11 ... 15/3 | 6R7 ... 15/11 | 35Z3 ... 13/11 |
| AC VP2 ... 20/7 | ECC35 ... 23/3 | KT101 ... 24/2 | PM24M ... 21/3 | UF42 ... 23/3 | 1R5 ... 17/3 | 6R7G ... 15/11 | 35Z4GT ... 13/11 |
| AC2 HL ... 14/3 | ECC40 ... 23/3 | KTW61 ... 17/3 | PM202 ... 15/3 | UL41 ... 16/5 | 1S4 ... 16/5 | 6SG7 ... 17/3 | 35Z5GT ... 14/3 |
| AC2 Pen ... 21/3 | ECC82 ... 23/3 | KTW63 ... 17/3 | PP3/250 ... 19/11 | UL44 ... 26/6 | 1S5 ... 16/5 | 6SH7 ... 17/3 | 40SUA ... 13/11 |
| AC2 PenDD 23/3 | ECC83 ... 23/3 | KTZ41 ... 23/3 | PT10 ... 21/3 | UL46 ... 23/3 | 1T4 ... 14/6 | 6SK7GT ... 16/5 | 41 ... 21/3 |
| AC4 Pen ... 23/3 | ECC91 ... 33/2 | KTZ63 ... 17/3 | PT41 ... 21/3 | UR1C ... 13/11 | 1U5 ... 17/3 | 6SL7GT ... 23/3 | 41MHL ... 13/3 |
| AC5 Pen ... 21/3 | ECH21 ... 21/3 | | PX4 ... 19/11 | UR3C ... 13/11 | 2D4A ... 12/- | 6SN7GT ... 23/3 | 41MP ... 19/11 |
| AC5 PenDD 23/3 | ECH35 ... 20/2 | L63 ... 13/3 | PX25 ... 29/10 | UU5 ... 13/11 | 2P ... 19/11 | 6ST7 ... 12/7 | 41MPG ... 23/11 |
| AZ1 ... 14/3 | ECH42 ... 20/4 | L77 ... 13/3 | PY31 ... 13/11 | UU6 ... 13/11 | 3A4 ... 18/11 | 6U4GT ... 21/3 | 41MPT ... 23/3 |
| AZ31 ... 13/3 | ECL80 ... 24/7 | LN152 ... 24/7 | PY80 ... 15/9 | UU7 ... 13/11 | 3D6 ... 15/3 | 6U5G ... 17/3 | 41MTL ... 13/3 |
| | EF9 ... 19/6 | LP2 ... 12/- | PY81 ... 18/11 | UU8 ... 19/11 | 3Q4 ... 15/3 | 6U5 6G5 ... 17/3 | 41MTS ... 26/6 |
| B36 ... 23/3 | EF22 ... 17/3 | LSD3 ... 30/- | PY82 ... 13/3 | UU9 ... 13/11 | 3Q5GT ... 15/3 | 6U7G ... 17/3 | 41MXP ... 19/11 |
| B65 ... 24/3 | EF36 ... 17/3 | | PZ30 ... 19/11 | UY1N ... 13/11 | 3S4 ... 14/6 | 6V6G ... 17/3 | 41STH ... 29/11 |
| | EF37A ... 22/1 | ME41 ... 17/3 | | UY41 ... 13/3 | 3V4 ... 14/6 | 6V6GT ... 16/5 | 42 ... 21/3 |
| C1 ... 12/6 | EF39 ... 16/5 | ME91 ... 17/3 | QP21 ... 21/11 | | 4D1 ... 13/3 | 6X4 ... 13/3 | 42MP Pen ... 21/3 |
| C1C ... 12/6 | EF40 ... 22/1 | MH4 ... 15/3 | QP25 ... 21/11 | V914 ... 12/- | 4THA ... 23/11 | 6X5G ... 13/3 | 42MPT ... 23/3 |
| CBL1 ... 22/1 | EF41 ... 16/5 | MH41 ... 15/3 | | VP2B ... 19/3 | 4TPB ... 23/3 | 6X5GT ... 13/11 | 42MPT |
| CBL31 ... 21/3 | EF42 ... 23/3 | MHD4 Clr. 21/11 | R2 ... 13/11 | VP4B ... 20/7 | 4TSA ... 26/6 | 7A7 ... 17/3 | (Flashed) 23/3 |
| CCH35 ... 21/3 | EF50 ... 22/1 | MHD4 met 21/11 | R3 ... 13/11 | VP13A ... 20/7 | 4TSP ... 23/3 | 7B6 ... 15/11 | 42OT DD 23/3 |
| CL4 ... 20/2 | EF54 ... 23/3 | MHL4 ... 15/3 | R10 ... 53/2 | VP23 ... 15/3 | 4XP ... 19/11 | 7B7 ... 17/3 | 42SPT ... 23/3 |
| CL33 ... 17/3 | EF55 ... 23/3 | MKT4 | R16 ... 26/6 | VP41 ... 20/7 | 5U4G ... 19/11 | 7C5 ... 17/3 | 43 ... 21/3 |
| CY1 ... 15/3 | EF80 ... 21/1 | 5 pin ... 21/3 | RG1 240A 59/3 | VP133 ... 20/7 | 5V4G ... 13/11 | 7C6 ... 15/11 | 431U ... 13/11 |
| CY1C ... 13/11 | EF91 ... 22/1 | MKT4 | | VP1322 ... 20/7 | 5Y3G ... 13/11 | 7D5 ... 21/3 | 451U ... 19/11 |
| CY31 ... 13/11 | EF92 ... 17/3 | 7 pin ... 21/3 | S23 ... 19/3 | VR75 30 ... 17/6 | 5Y3GT ... 13/3 | 7D6 ... 21/3 | 50C5 ... 20/7 |
| | EF95 ... 33/2 | ML4 ... 13/3 | S130 ... 10/6 | VR150 30 ... 15/- | 5Z3G ... 19/11 | 7D8 ... 21/3 | 50CD6G ... 29/10 |
| D1 ... 10/- | EK2 ... 23/11 | MP Pen | S133P ... 16/7 | | 5Z4G ... 13/11 | 7H7 ... 17/3 | 50L6GT ... 16/5 |
| D15 ... 10/6 | EK32 ... 22/8 | 5 pin ... 21/3 | SD3 ... 12/- | W17 ... 15/3 | 6A6 ... 19/11 | 7K7 ... 15/11 | 52KU ... 19/11 |
| D41 ... 12/- | EL2 ... 21/3 | MP Pen | SP4 5 pin 20/7 | W21 4 pin 19/3 | 6A7 ... 20/11 | 7Q7 ... 21/3 | 53KU ... 19/11 |
| D42 ... 13/3 | EL31 ... 27/- | 7 pin ... 21/3 | SP4 7 pin 20/7 | W21 7 pin 19/3 | 6A8G ... 21/3 | 7R7 ... 19/11 | 54KU ... 19/11 |
| D43 ... 17/3 | EL32 ... 17/3 | MS4B ... 20/7 | SP4B ... 20/7 | W42 ... 19/11 | 6A8GT ... 21/3 | 7S7 ... 21/3 | 61BT ... 23/3 |
| D63 ... 12/- | EL33 ... 16/5 | MSP4 5 pin 20/7 | SP13 ... 20/7 | W61M ... 17/3 | 6AB7 ... 17/3 | 7Y4 ... 13/11 | 61SPT ... 23/3 |
| D77 ... 12/- | EL37 ... 22/1 | MSP4 7 pin 20/7 | SP13C ... 20/7 | W76 ... 17/3 | 6AB8 ... 24/7 | 8A1 ... 20/7 | 62BT ... 23/3 |
| D152 ... 12/- | EL38 ... 26/6 | MSP41 ... 19/11 | SP41 ... 23/3 | W77 ... 17/3 | 6AG6G ... 17/3 | 8D2 ... 20/7 | 62DDT ... 15/11 |
| DA30 ... 25/- | EL41 ... 16/5 | MS Pen | SP42 ... 23/3 | W81 ... 24/7 | 6AL5 ... 11/4 | 8D3 ... 23/3 | 62TH ... 21/3 |
| DA90 ... 15/3 | EL42 ... 17/3 | 5 pin ... 20/7 | SP61 ... 23/3 | W101 ... 26/10 | 6AM5 ... 17/3 | 9D2 ... 20/7 | 62VP ... 17/3 |
| DAC32 ... 15/3 | EL81 ... 23/3 | MS Pen | SU25 ... 26/6 | W107 ... 17/3 | 6AM6 ... 23/3 | 9D3 ... 17/3 | 63ME ... 17/3 |
| DAF91 ... 17/3 | EL91 ... 17/3 | 7 pin ... 20/7 | SU2150 ... 26/6 | W142 ... 17/3 | 6AQ5 ... 16/5 | 10C1 ... 21/3 | 62SPT ... 23/3 |
| DAF96 ... 17/3 | EM4 ... 16/5 | MS PenB 20/7 | SU2150A 26/6 | W143 ... 17/3 | 6AT6 ... 15/1 | 10C2 ... 21/3 | 66KU ... 19/11 |
| DCC90 ... 31/6 | EM34 ... 16/5 | MU14 ... 13/11 | | W145 ... 17/3 | 6AU6 ... 22/1 | 10D1 ... 12/7 | 75 ... 21/11 |
| DD41 ... 12/- | EN31 ... 23/3 | MX40 Clear 23/11 | TDD2A ... 15/3 | W147 ... 17/3 | 6B4G ... 19/11 | 10F1 ... 23/3 | 76 ... 13/3 |
| DD207 ... 15/3 | EY51 ... 26/6 | | TDD4 ... 21/11 | W148 ... 17/3 | 6B8GT ... 19/11 | 10F3 ... 23/3 | 77 ... 20/7 |
| DDL4 ... 12/- | EY91 ... 13/11 | N14 ... 15/3 | TDD13C... 21/11 | W149 ... 17/3 | 6BA6 ... 16/5 | 10F9 ... 17/3 | 78 ... 20/7 |
| DDT ... 21/11 | EZ35 ... 13/11 | N16 ... 15/3 | TH4B ... 23/11 | W150 ... 17/3 | 6BE6 ... 21/3 | 10LD11 ... 15/11 | 80 ... 13/3 |
| DF33 ... 15/3 | EZ40 ... 13/3 | N17 ... 15/3 | TH21C ... 29/2 | WD142 ... 18/7 | 6BG6G ... 24/3 | 10P13 ... 17/3 | 805 ... 13/11 |
| DF70 ... 15/- | EZ41 ... 13/3 | N18 ... 15/3 | TH30C ... 23/11 | | 6BR7 ... 25/- | 10P14 ... 17/3 | 83 ... 19/11 |
| DF91 ... 15/3 | | N37 ... 17/3 | TH41 ... 21/3 | X14 ... 19/11 | 6BW6 ... 17/3 | 11D3 ... 21/11 | 84 ... 13/11 |
| DF92 ... 15/3 | FC2 ... 23/3 | N77 ... 17/3 | TH233 ... 21/3 | X17 ... 17/3 | 6BX6 ... 23/3 | 11D5 ... 21/11 | 85A1 ... 29/9 |
| DF96 ... 15/3 | FC2A ... 23/3 | N78 ... 17/3 | TH2321 ... 23/11 | X18 ... 17/3 | 6C4 ... 19/11 | 12A6G ... 17/3 | 85A2 ... 29/10 |
| DH63 ... 15/11 | FC4 ... 25/11 | N142 ... 17/3 | TP25 ... 19/11 | X22 ... 23/3 | 6C5GT ... 13/3 | 12AH8 ... 21/3 | 142BT ... 17/3 |
| DH76 ... 15/11 | FC13 ... 23/11 | N144 ... 17/3 | TP2520 ... 26/6 | X24 ... 23/3 | 6C8 ... 20/7 | 12AT6 ... 15/11 | 161 Bar ... 8/6 |
| DH77 ... 15/11 | FC13C ... 23/11 | N145 ... 17/3 | | X41 Clear 23/11 | 6C9 ... 21/3 | 12AT7 ... 22/1 | 185BT ... 33/2 |
| DH81 ... 23/3 | FW4 500 19/11 | N147 ... 17/3 | U10 ... 13/11 | X41 met... 23/11 | 6C10 ... 21/3 | 12AU6 ... 23/3 | 185BTA... 33/2 |
| DH101 ... 26/6 | FW4 800 19/11 | N148 ... 17/3 | U14 ... 13/11 | X41C ... 26/6 | 6C31 ... 21/3 | 12AU7 ... 22/1 | 202DDT... 21/11 |
| DH107 ... 15/11 | | N150 ... 17/3 | U16 ... 26/6 | X61M ... 21/3 | 6CD6G ... 29/10 | 12AX7 ... 22/1 | 202STH ... 23/11 |
| DH142 ... 15/11 | GDT4B ... 26/6 | N152 ... 23/3 | U18 20 ... 19/11 | X63 ... 21/3 | 6CH6 ... 26/6 | 12BA6 ... 17/3 | 202VP ... 20/7 |
| DH147 ... 15/11 | GT1C ... 25/- | | U19 ... 25/- | X65 ... 21/3 | 6D1 ... 10/- | 12BE6 ... 21/3 | 202VPB ... 20/7 |
| DH149 ... 15/11 | GZ30 ... 13/11 | OA60 ... 6/8 | U22 ... 26/6 | X76M ... 21/3 | 6D2 ... 12/- | 12BH7 ... 23/3 | 203THA ... 23/11 |
| DH150 ... 15/11 | GZ32 ... 18/11 | OA61 ... 6/8 | U24 ... 26/6 | X78 ... 21/3 | 6D3 ... 19/11 | 12C8GT ... 18/11 | 210DDT... 15/3 |
| DK32 ... 19/11 | | OM1 ... 13/11 | U25 ... 26/6 | X79 ... 21/3 | 6D6 ... 20/7 | 12H6 ... 10/- | 21CPG ... 23/3 |
| DK91 ... 17/3 | H30 ... 26/6 | OM5B ... 23/3 | U31 ... 13/11 | X81M ... 20/9 | 6F1 ... 23/3 | 12J5GT ... 13/3 | 210VPT ... 19/3 |
| DK92 ... 17/3 | H63 ... 13/3 | OM10 ... 21/3 | U33 ... 26/6 | X101 ... 33/2 | 6F6G ... 17/3 | 12J7GT ... 17/3 | 215SG ... 19/3 |
| DK96 ... 15/3 | HL2 ... 12/- | OZ4 ... 16/7 | U35 ... 26/6 | X109 ... 21/3 | 6F7G ... 23/11 | 12K7GT ... 17/3 | 220PT ... 19/3 |
| DL33 ... 15/3 | HL2 K ... 12/- | | U37 ... 26/6 | X142 ... 21/3 | 6F11 ... 17/3 | 12K8GT ... 21/3 | 225DU ... 26/6 |
| DL35 ... 15/3 | HL13 ... 13/3 | P2 ... 13/3 | U50 ... 13/11 | X143 ... 21/3 | 6F12 ... 23/3 | 12Q7GT ... 15/1 | 301 Bar ... 8/6 |
| DL63 ... 15/11 | HL13C ... 13/3 | P41 ... 17/3 | U52 ... 19/11 | X145 ... 21/3 | 6F13 ... 23/3 | 12SC7 ... 24/2 | 302 ... 8/6 |
| DL66 ... 15/- | HL21DD 15/3 | P61 ... 15/3 | U70 ... 12/11 | X147 ... 21/3 | 6F14 ... 23/3 | 12SL7GT 23/3 | 302THA... 23/11 |
| DL82 ... 23/3 | HL23 ... 12/- | P220 ... 15/3 | U76 ... 13/11 | X148 ... 21/3 | 6F15 ... 17/3 | 12SR7 ... 15/11 | 304 Bar ... 11/4 |
| DL92 ... 15/1 | HL23DD 15/3 | PA1 ... 19/11 | U78 ... 13/11 | X150 ... 21/3 | 6F33 ... 17/6 | 13VPA ... 20/7 | 328 ... 26/6 |
| DL93 ... 19/11 | HL41 ... 13/3 | Pen 4DD 23/3 | U81 ... 21/11 | | 6G5G ... 17/3 | 14B6 ... 15/11 | 332 Pen ... 17/3 |
| DL94 ... 15/3 | HL41DD 15/11 | Pen 4VA | U82 ... 19/11 | Y61 ... 17/3 | 6H6 ... 12/- | 14H7 ... 17/3 | 354V met 13/3 |
| DL96 ... 15/3 | HL42DD 15/11 | 5 pin ... 21/3 | U84 ... 19/11 | Y63 ... 17/3 | 6H6GT ... 12/- | 14R7 ... 19/11 | 367 ... 50/3 |
| DL145 ... 15/11 | HL133DD 15/11 | Pen 4VA | U101 ... 21/11 | | 6J5 ... 13/3 | 14S7 ... 21/3 | 402 PenA 21/3 |
| DM70 ... 10/- | HVR2 ... 26/6 | 7 pin ... 21/3 | U107 ... 13/11 | Z21 ... 19/3 | 6J5GT ... 13/3 | 15A2 ... 23/11 | 807 ... 25/- |
| DN41 ... 23/3 | | Pen25 ... 15/3 | U142 ... 13/11 | Z63 ... 17/3 | 6J7G ... 17/3 | 15D1 ... 23/11 | 1821 ... 13/11 |
| DN143 ... 21/3 | 1W4/350 13/11 | Pen44 ... 23/3 | U143 ... 13/11 | Z66 ... 29/10 | 6J7GT ... 17/3 | 15D2 ... 23/11 | |
| DW2 ... 13/11 | 1W4 500 13/11 | Pen45 ... 21/3 | U145 ... 13/11 | Z77 ... 23/3 | 6K6GT ... 17/3 | 16A5 ... 17/3 | *Plus Postage 9d.* |
| DW4 350 13/11 | | Pen45DD 21/3 | U147 ... 13/11 | Z142 ... 23/3 | 6K7G ... 17/3 | 17Z3 ... 19/11 | |
| DW4/500 13/11 | KBC32 ... 15/3 | Pen46 ... 23/3 | U149 ... 13/11 | Z150 ... 23/3 | 6K7GT ... 17/3 | 18 ... 21/3 | Subject to stock and price changes. |

# An Electrically-operated Coil-winder

## FITTED WITH A TURNS COUNTER, THIS INSTRUMENT WILL WIND LAYER OR WAVE-FORM COILS

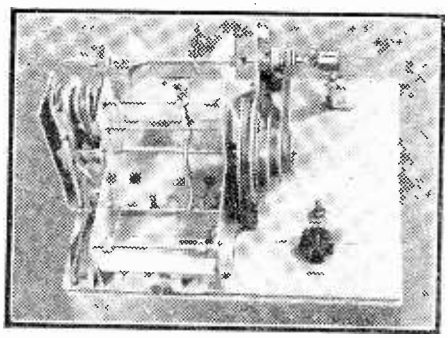
(*Concluded from page* 687, *November issue.*)

MOVEMENT is effected by means of a small threaded rod passing into the flanged piece and controlled by a little wheel fitted to a small bracket soldered to the lower plate (see Fig. 1). This provides for a minute adjustment of the angle of the two plates and therefore the pressure applied to the flanges of the wire-reel.

The illustration of the underside of the base plate shows the position of the motor and variable resistor. The tapped dropping resistor shown below the motor is necessary in the writer's case as the motor used was a 110v. type. There are many ex-Government 230v. motors on the market which are suitable for driving this machine. One of approximately 1/20th h.p. or more should be suitable and in the interests of smooth running and quietness it should be mounted on rubber bushes. A very small pulley is fitted to the motor and a belt from this connects to the largest pulley of the main pulley bank via the rectangular slot in the base plate. This arrangement reduces the speed at the main shaft—for the motor speed, assuming a high revving type, would be too fast—and at the same time imparts the utmost power to the machine. As will be seen, the whole base plate is surrounded with thick felt to ensure a smooth-running machine. The underside of the box, too, is fitted with rubber corners. A condenser of 0.01 $\mu$F may be required across the brushes of the motor if interference is caused.

In order to control the speed of the motor a variable resistor is connected in series with it. This component must be capable of carrying the current of the motor and upon this figure will depend the value of resistor required. Another factor bearing on this point is the amount that the voltage has to be dropped before the motor ceases to work. So the best plan to adopt is to connect in series with the motor a 0.3 amp. tapped dropping resistor as used in A.C./D.C. sets. One of these is usually available and motors of the type required seldom take more than 0.3 amp. Then, with the motor on load, i.e., working the machine, adjust the tappings so that the winder is working as slowly as possible. Measure off this resistance and obtain a variable type of similar value. The one shown is of robust construction on ceramic former and has a value of 500 ohms. This heavy type of potentiometer or variable resistor is available from many advertisers.

The wave-winding attachment is worked by bevel gears driven by the main shaft (see Fig. 1). These



were taken from ex-Government gear, but if the reader finds them difficult to procure, such gears are often available in constructional toy spares. Alternatively, two small fibre pulleys, one running edge-wise on the flat periphery of the other, would undoubtedly work, as the power required is extremely small. The ratio, however, should be 1 to 1. The disc which provides the piston action is 11/16in. in dia. and has a 6 B.A. bolt soldered to the outer edge—radius 7/16in. A link rod loosely connected from this bolt is joined to a similar bolt soldered to the metal strip 3¼in. x ¾in., which provides the necessary movement for this type of winding. The bolt is soldered 15/16in. from the top. The arm is swivel-connected to a small bracket bolted to the base plate.

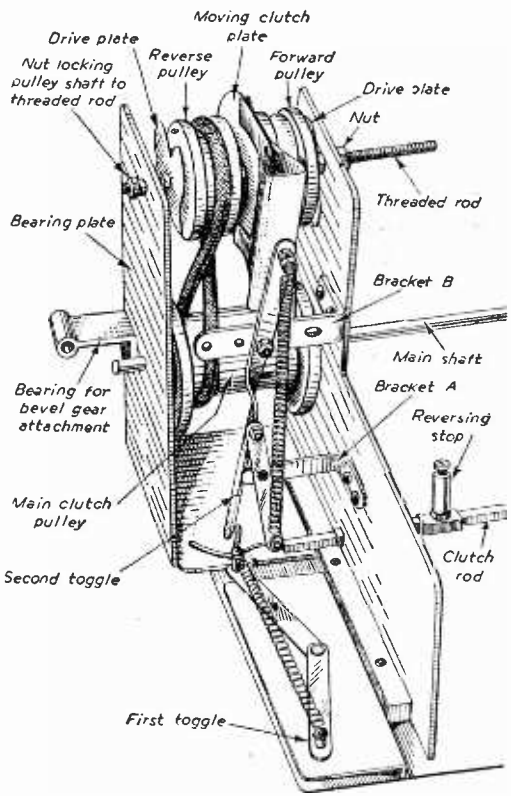



*Fig. 7.—The complete clutch mechanism.*

These bolts should be tapped into the base plate so that the wave-winding attachment may easily be fitted or removed. As mentioned before, a large pulley of 3¼in. dia. is fitted to the bobbin shaft for wave-winding so that an even pattern is obtained. The belt from this pulley is joined to the 1 13/16in. dia. pulley on the main shaft. When winding, the wire is passed through a small hole at the top of the strip and through the tube soldered to it.

The turns counter employed is a standard cyclometer driven by the bobbin shaft via a collar into which a pin ⅛in. long is soldered (Fig. 1). This pin engages the wheel on the cyclometer and, since it

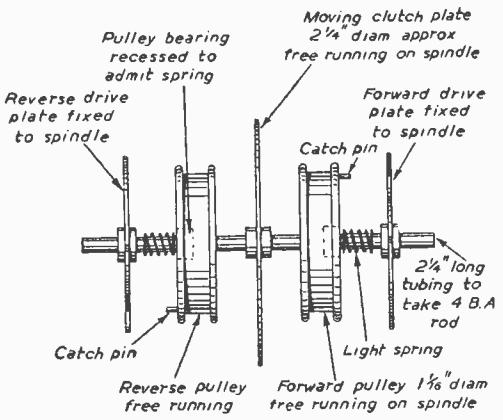



*Fig. 8.—Detailed layout of part of the clutch mechanism. The parts have been spaced for clarity.*

is not a direct drive, runs without vibration. The cyclometer needs a slight alteration before it can be used. Unscrew the end plate and this will reveal the tenths ring geared to the centre spindle. This gearing should be removed (leaving the tenths ring in position) and direct drive substituted. This was accomplished by the writer in the manner shown in Fig. 10. A small brass plate A, with a hole in the centre, is serrated at its outer edges so that it engages the inner aspect of the tenths ring. The cyclometer spindle fits through the hole in the plate and is soldered to it. All that remains is to make a bracket so that the counter lines up with the bobbin shaft.

**Winding Back**

If it is required to wind *back* from the bobbin on to the reel, a longer reel shaft should be kept handy with a pulley of any reasonable size attached. A *twisted* belt will give the desired result.

When using the machine for layer winding, the procedure is to mount the bobbin to be wound centrally on the bobbin spindle and grip the bobbin holders firmly while tightening up. Switch on and give the wire guide a trial run and adjust reversing stops so that the wire guide reverses its direction when it is in line with the ends of the bobbin. Fix the wire spool and feed the wire over the guide and secure the end to the bobbin. The purpose of the 3-bank pulley on the main shaft and the 2-bank pulley on the bobbin shaft is so that different ratios may be obtained between the traverse speed of the wire guide and the speed of the bobbin shaft. The wire guide travels at a constant speed, i.e., the speed of the main shaft, but, by means of the variable ratio pulleys, the bobbin shaft may be run at various speeds in relation to it. Therefore, if fine wire is being used, a large number of turns would be required to fill the bobbin length. By using the large pulley on the main shaft and the small one on the bobbin shaft, the bobbin revolves at high speed. Alternatively, with thickish wire the bobbin can be made to run slower in relation to the wire guide so that a smaller number of turns can be accommodated in the same length of winding. In effect, therefore, we have a variable speed traverse of the wire guide. After a little experience one soon gets to know the best pulleys to use and in any case the wire is, to a large extent, self-accommodating because, due to the steady tension, each turn lays itself snugly against the previous one, and so on.

It is essential that the guide is brought as close to the bobbin as possible. That is the reason for the extension rod on the wire guide and it should under no circumstances be omitted.

One or two adjustments may be necessary to the clutch mechanism before it works smoothly. The toggles should work nicely if the specification is followed. The springs should be strong enough to produce a nice snap action but not so strong that undue pressure is required to work the toggles. The light springs fitted between the forward and reverse clutch pulleys and their associated drive plates should be strong enough to move the pulley away from the plate when the opposite pulley is engaged. The springs, when compressed, i.e., pulley engaged, should fit within the recessed portion of the pulley (see Fig. 7). Another point to watch in order that a smooth clutch action is ensured is to see that both toggles are lined up accurately when held in their dead-centre positions. The angle of the fork at the end of the first toggle may need some adjustment so that the arms pull over the second toggle when the first is just past dead centre.

The rubber bands on the clutch pulleys must be taut enough to prevent slip, but if too tight will prevent the pulley from being pushed against its drive plate by the moving clutch plate.

The link between the clutch actuating rod and the first toggle must have a free action where it joins the toggle.

In conclusion, it can be stated that practically any

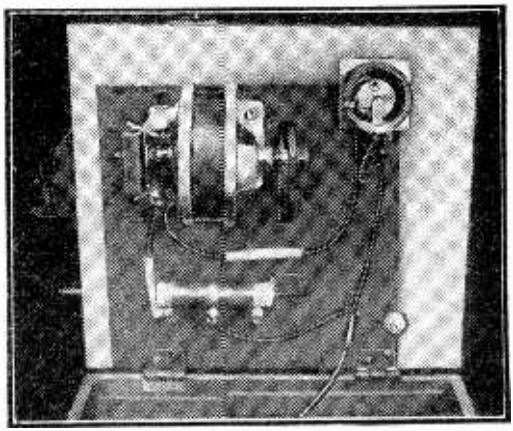


*Fig. 9.—View of the underside of base plate showing felt surrounding the motor, and speed control.*

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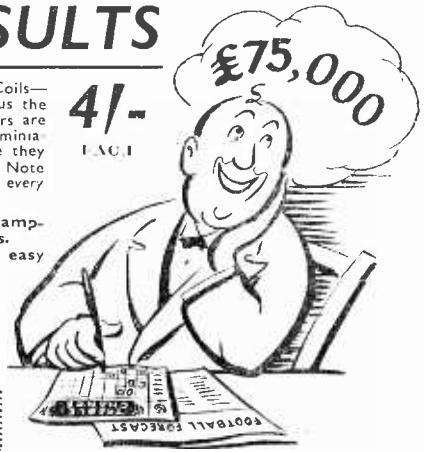


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|---|---|---|
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| 2 | ⅞in. x 1¼in. | 18/9 |
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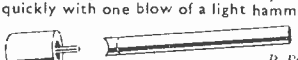

*P. Pat.* 11321/53

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|---|---|---|
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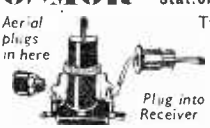


| Type | metres |
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coil, choke or transformer may be perfectly wound on this machine. As regards layer winding, mains transformers, of course, have to be interleaved so that the machine has to be stopped every two or three layers. There are many cases, however, L.F. chokes, output transformers, etc., where the winder may be left to do its work unaided.

**Practical Details**

For a medium- and long-wave coil it is best to start with the long-wave winding, so it is necessary to fix the honeycomb attachment to the machine—not forgetting the large bobbin shaft pulley—and disconnect the main clutch pulley.

The width of the honeycomb coil produced by the machine is about ⅜in., although the throw of the arm is much greater. So, having selected a suitable paxolin former, mount it on the bobbin spindle so that the winding arm, when perpendicular, is in line with the centre of the space allocated for the long wave coil. With regard to the guide tube through which the wire passes, it is essential that the inner aspect of each end is countersunk and perfectly smooth so that chafing of the wire is obviated.

From coil data tables wind on the required number of turns. It should be remembered that with a honeycomb pattern a turn is slightly longer than a straight pile wound turn, so that if a slightly larger frequency coverage is undesirable, the number of turns may be reduced.

The turns counter gives an exact indication. It reads to 9999 and a fifth figure shows tenths of a turn, so that there is plenty of scope for accuracy.

Having completed the long-wave winding, a coupling coil may be wound in the same manner if desired. Then remove the wave-winding attachment and its pulley. Tighten the screw in the main clutch pulley and this will put the traverse wire guide into action. The winder is switched on temporarily so that the wire guide may be brought to a position where it is in line with the start of the medium-wave winding. Then the wire is fed over the guide to the former and this winding may be completed.

**L.F. Transformers**

Intermediate-frequency transformers are easily made by adopting long-wave coil technique as outlined above.

At Fig. 12 will be seen a greatly enlarged section of a honeycomb coil showing the pattern produced.

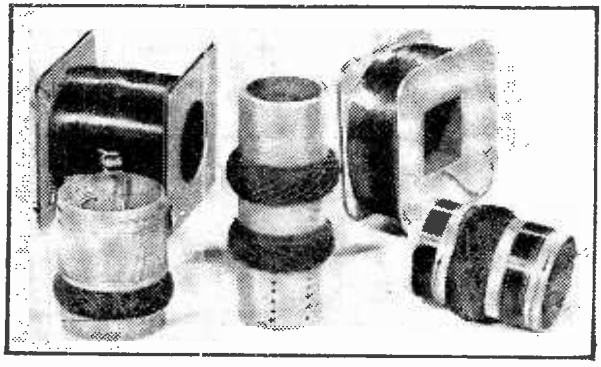

*Fig. 11.—A group of typical coils wound on the machine.*

Fig. 11 shows a group of various coils produced on the machine.

With the automatic reversing clutch in use for layer winding, a minimum winding length of about ⅛in. is available, which is handy for air-cored chokes as used in filter circuits, etc. High-frequency chokes may be wound in sections by moving the bobbin along the shaft after each section has been wound. If it is desired to pile wind into a narrow slot, this may be achieved by disregarding the wire guide. Before leaving the subject of honeycomb coils it may be mentioned that this type of coil may, with

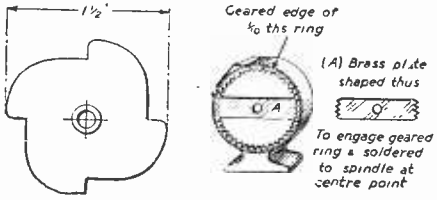


*Fig. 10.—The modifications to the turns counter.*

advantage, be coated with thin shellac varnish or dipped in wax and allowed to drain.

**Transformers and Chokes**

For such items as field coils, output transformers and L.F. chokes, the winder may be left unattended after completing the preliminary adjustments. These consist of setting the reversing stops for the length of winding required, using the approximately correct pulley ratio for the gauge of wire in use and roughly adjusting the wire tensioning device. Final adjustment of this latter feature is carried out during the early stages of winding. With regard to the pulley ratios, it will be found useful to keep a little reference data chart showing pulley ratios used for certain wire gauges.

When winding mains transformers it is unfortunate that full advantage may not be taken of the automatic feature because the machine has to be stopped to incorporate paper interleaving between windings. As is commonly known, commercial transformers are usually interleaved at every layer to ensure the utmost efficiency and service. After some years of transformer winding, however, it is the opinion of the writer that to interleave at two to three layers on the primary is sufficient. Using this procedure, only one failure has occurred, this on a transformer after eight years of service. The method seems to be justified as a time-saving factor when dealing with normal voltage transformers.

Concerning secondary windings, it is most advisable to interleave at every layer because the wire is usually fairly thick and this causes greater pressure of one layer upon the other, with the consequent risk of chafing insulation. Interleaving usually avoids this entirely. It should be mentioned that when using the winding machine any interleaving can, of course, be carried *in situ* and further winding proceeded with.

If correct interleaving paper is not available, tissue paper may be used successfully, but on no account should gummed paper be used.

It will, no doubt, be realised that there is a limit to the thickness of wire that can be wound on the machine. For example, it would be unreasonable to expect to wind 18 or 16 gauge, which is commmonly used for 4-volt windings requiring a current of 3 to 5 amps. Fortunately, however, the number of turns is usually small and hand winding is not difficult. For this purpose the machine is still valuable, for after the primary has been completed and insulated (the same set-up being retained) the secondary may be proceeded with by turning the bobbin with the left hand and guiding the wire with the right. And one still has the advantages of a stable bobbin and a stable reel of wire, together with the fact that the turns counter is still functioning.

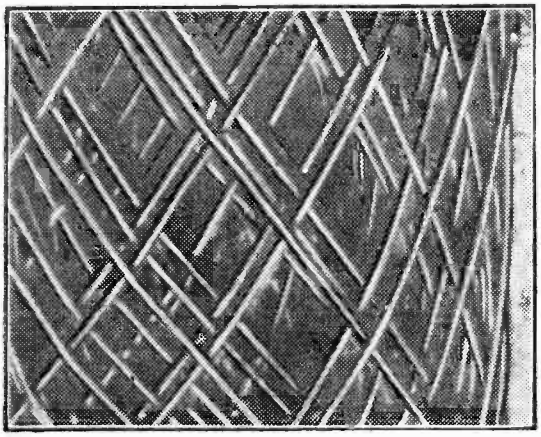

*Fig. 12.—An enlarged view of the wave-winding produced on the machine.*

Before starting to wind a transformer the bobbin cheeks should be drilled with a sufficient number of holes to avoid having to make them during winding —a distinctly awkward procedure. It is not difficult to visualise the approximate position of these holes, and in any case a few extra ones will be an advantage. Both ends of the bobbin should be used in an endeavour to even up the winding and to avoid lumpiness of the wound bobbin. During winding, a little judicious thought with regard to tappings will be useful. For instance, it is obviously better for a tapping to be taken from a turn lying near the end cheeks. This may often be easily arranged by spacing the turns so that the required turn comes in that position or by leaving the winding of that layer a little short. Incidentally, when dealing with thick wire carrying a heavy current, spacing of the turns is definitely an advantage.

**Tapping Points**

With regard to making the actual tappings, the following method may be adopted when using thick wire. Having reached the point where the wire is to be tapped, leave about 6in. beyond this and then snip off. At the exact point where it will pass through the end cheek bend the wire to a right-angle and pass the free end through. Because the wire is thick it will not be temporarily self-retentive. Clean off the insulation at the angle and with a large pair of pliers press a flat into the wire. Clean off the free end of the wire on the reel and squeeze flat. Then bend a small hook to engage the angle (see Fig. 13). The joint is soldered and will be very little thicker than the thickness of the wire. The joint should be insulated before proceeding. If it cannot be avoided to bring a tapping lead over previously wound turns, the wire must be extremely well insulated.

The design of a transformer is really quite simple providing certain laws are adhered to and having constructed it according to plan and with normal

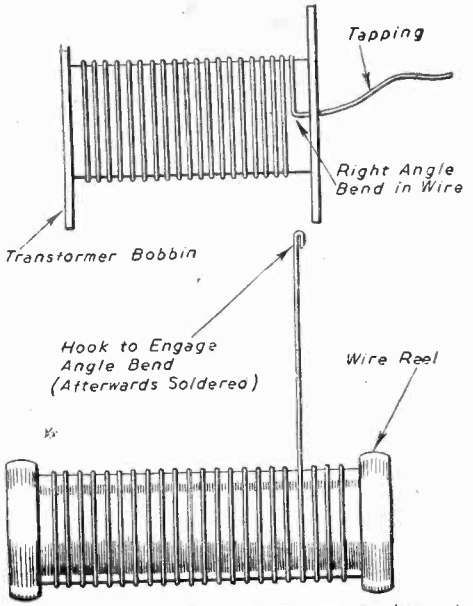


*Fig. 13.—Method of making a tapping when using a heavy gauge of wire.*

care one can be certain that it will perform correctly. Various data is necessary so that one can assess the core sizes, current carrying capacity of wire, etc., and in this respect one cannot do better than procure our publication "Coils, Chokes and Transformers." In this book will be found all the information required for designing any transformer, together with the necessary data sheets concerning wire and stalloy stampings.

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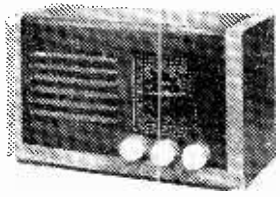

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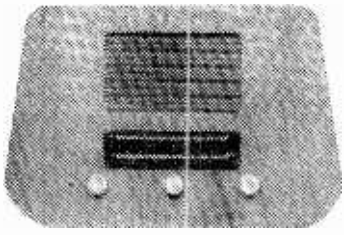

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**MT2**

Primary: 200-220-240 v. Secondaries: 350-0-350 v. 80 mA., 0-4 v. 5 amp., 6.3 v. 4 amp., 0-4-5 v. 2 amp. 17/6 each.

**MT3**

Primary: 200-220-240 v. Secondary: 30 v. 2 amps., Taps at 3 v., 4 v., 5 v., 6 v., 8 v., 9 v., 10 v., 12 v., 15 v., 18 v., 20 v., 24 v., 17/6 each.

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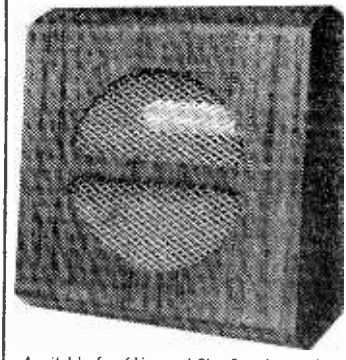

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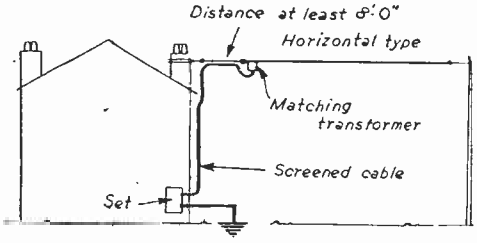
5/6 VINCE'S CHAMBERS, VICTORIA SQUARE, LEEDS 1

# Interference-free Radio

## LOCATING AND CURING RADIO'S GREATEST BUG-BEAR

By F. E. Apps




THE goal of completely "interference-free" radio and television reception has yet to be reached. In fact, in the past few years it has become considerably worse, especially in large towns and built-up areas. One has to be drawn to the conclusion that it can never be attained until or unless the powers that be pass a law compelling all persons manufacturing, selling or operating any electrical apparatus liable to cause interference to radio or television reception, to fit the same with efficient suppressors. Unfortunately this law has yet to be passed, so until then we must carry on the struggle against pretty hopeless odds with the weapons we have at hand. This article hopes to show how to get the best from your set with the minimum of interference.

### Radio

The fitting of an interference suppression circuit in radio receivers in this country is very uncommon, although in the United States most manufacturers fitted them, but from my own experience of them they were not very efficient and did not warrant the extra valve or valves that the circuit demanded. It is proposed not to deal with these circuits at all, but to try to procure better reception with the radio receiver as it stands.

Interference can reach the radio receiver either by radiation or it can be mains borne. If it is radiated interference it can reach the receiver either by the aerial, frame aerial, or plate aerial, or even by unscreened coils on the top of chassis. The aerial itself may even pick up interference from nearby metallic objects. This is often the case with indoor aerials where the aerial runs parallel with internal electric light wiring. In large towns, especially where factories abound, an outdoor aerial with screened down-lead is essential for good clear reception. The aerial itself, whether of the horizontal or the vertical type, must be well clear of the house, about 8ft. away is the minimum distance. The screened lead is connected to the aerial and to the receiver by means of matching transformers at either end. This type of aerial, the anti-interference type, is manufactured in this country by several firms and they are very efficient, indeed, and will even in the very worst possible conditions give one quite reasonably quiet reception (see Fig. 1). A point to remember is that many manufacturers now fit a plate aerial

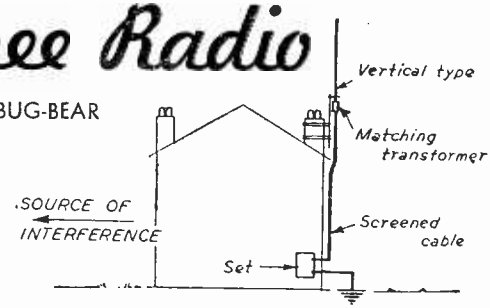



*Fig. 1.—Aerial arrays for minimising interference.*

on the inside of cabinet which is permanently connected. Disconnect this if fitting an outdoor interference aerial. It is as well to check that the interference is not coming from your own house before blaming outside sources. Faulty wiring, switches or any of your own electrical appliances may be causing trouble for you or your neighbours, so check up your own house first.

### Locating the Source

The position where the aerial is to be erected is also of great importance. It should be placed as far away as possible from the suspected source of interference. It may be neon signs, trolleybus wires, electric railway, factory or a garage where charging plant is installed. If a portable set with a frame aerial is available the direction, or its reciprocal, of the interference can be found. Tune the set into its best position for interference, then revolve set until the interference reaches a maximum, when the interference will be in the plane of the frame. Thus, should the frame be pointing due north and south, the interference is coming from either of these two directions (see Fig. 2).

It may be necessary in some very bad interference areas to try various alternative positions and so arrive at a point where interference is at a minimum.

It is essential that the screened cable is soundly earthed. Use a rising main water pipe, or an earth rod or plate well buried in the ground. The aerial length for a horizontal type should be at least 20 to 30ft. in length. For the vertical type a rod of from 10 to 15ft. is all that is required.

### Mains-borne Interference

The foregoing has only dealt with interference that is picked up by the aerial or aerial circuit, but there is another way in which a set can pick up quite a considerable amount of noise. This is mains-borne interference, and happily it is not quite so common as the aerial borne type. A method of checking whether the interference is either aerial or mains borne is as follows. Disconnect the aerial from the set, including the plate type, if used. With the set now tuned to a point where no signals are received, if interference is still being heard then it is probably being mains borne. The usual method of reducing this interference is by means of a suppressing circuit in the mains lead (Fig. 3). The condensers used must be of at least 500 V.D.C. working type. The chokes should be wound with about No. 26 D.S.C. on a 1in. former and consist of from 80 to 100 turns. The whole must be

well insulated from ground and fitted into a metal box which should be soundly earthed. Be careful to fit fuses and ensure that the whole is 100 per cent. safe before connecting up. Keep only the radio set in circuit with this suppressor. Don't connect, by means of adaptors, other electrical apparatus to it, as the chokes will not carry a lot of current and if overloaded will heat up and burn out. There are several types of these suppressors on the market and

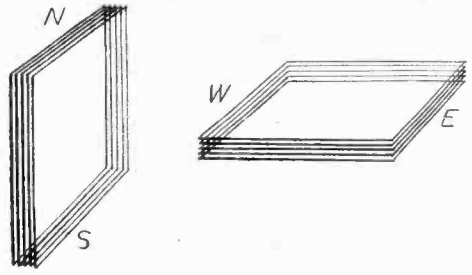



*Fig. 2.—How a frame aerial may be used to locate the direction from which interference is coming.*

they are made in various sizes for various current ratings.

There is nothing more we can now do to eliminate this troublesome interference. As I first mentioned in this article, the only real solution is for the Government to pass a law prohibiting, under penalty of a heavy fine, the manufacture, sale or use of any electrical apparatus which radiates or causes interference. When this is done, if ever, then the Post Office interference investigation department will be of some real use. At the present moment, all that it can do is to locate the interference for you and then ask the owners if they will please suppress it. If the owners say no then there is no more they can do. I would advocate that under the new law, if passed, the offending apparatus should be immediately put out of operation, and the owners be compelled to suppress it, or that the Post Office do the suppressing and present the owner with the bill for same.

**Television**

Unlike radio, all television sets have a vision and sound interference suppression circuit. This acts as a complete cut-off for high level interference and is only of real use when the incoming signal is of good strength. It is more efficient on vision than it is on sound. In fact, on sound, if the interference level is high, the interference suppression circuit, if it does its job, will only cause bad quality reception, if not bad distortion. Normally, it is quite efficient for moderate interference level but in cases of heavy interference other methods are necessary.

In television, practically all interference is radiated and it is mostly from motor-car ignition systems, so

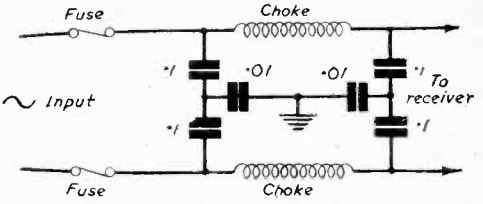



*Fig. 3.—Typical mains interference suppressor circuit.*

it is a case of positioning and orientation of aerial again. If on a main road where the traffic is heavy, the aerial should be placed as far back as is possible. Remember that a car will radiate interference up to about 100ft., and as the interference level drops rapidly as the distance away increases (almost inverse square law), only a few feet may mean quite an appreciable improvement. Where signal strength is high an indoor aerial may in some cases improve reception, but again the old method of trial and error must be used in positioning the same. I had an instance of this the other day. A friend of mine living on a busy main road was getting a lot of visual interference. He had tried an outdoor single dipole, and then a dipole and reflector type, but the interference was still bad. I tried an indoor aerial and after a few positionings of same found a place where the picture input was still good, but the interference level had diminished quite an appreciable amount.

# Radio Servicing Certificate Examination

THE Radio Trades Examination Board and the City and Guilds of London Institute have announced that for the 1953 Radio Servicing Certificate Examination 309 candidates attended, of which 126 qualified for the award of the certificate. This figure includes 30 candidates who passed the practical test having been referred last year. 87 candidates were successful in the written papers, but were referred in the practical test.

The 1954 examination will be held on May 4th and 6th for the written papers, and May 15th for the practical test. The closing date for entries is February 1st, 1954, and regulations and forms of application may be obtained from the Secretary, Radio Trades Examination Board, 9, Bedford Square, W.C.1.

**Change in Regulations**

The following new regulations for entry to the Radio Servicing Certificate Examination have now been approved :

In order to be eligible for the examination candidates must prove that :

(a) They have had gainful full time occupation in commercial radio engineering or commercial radio service for a minimum period of 3 full years and be not less than 19 years of age on the February 1st preceding the examination they wish to sit, but will not be eligible for the award of the certificate until attaining the age of 21 years or

(b) They have completed a course of technical instruction approved by the Board and have had one year's full time gainful occupation in radio service work provided they are not less than 19 years of age on the February 1st preceding the examination, but will not be eligible for the award of the certificate until attaining the age of 21 years.

(c) That they have undergone an approved course of training in Her Majesty's Forces and have also had a minimum of six months commercial radio servicing or radio engineering experience.

This represents a reduction of the two years of full time gainful experience in the case of classes (A) and (B).

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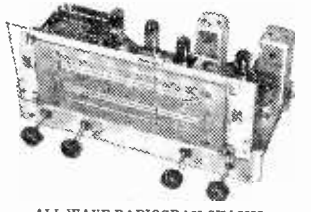

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| 50 12 v. T.C.C., | 1,9 | 60+100,350 v. Hunts., | 11 6 |
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| 50,50 v. T.C.C., | 2/- | | |

**SPECIALS.**—Can Types. 500 mfd. 12 v., 3/-; 1,000 mfd. 12 v., 5 -; 2,000 mfd. 6 v., 4,6; 16 mfd. 700 v. Hunts, 6 6.

**SENTERCEL RECTIFIERS.**
**E.H.T. TYPE.**—K3/25 2Kv., 4 3; K3/40 3.2 Kv., 6/-; K3/45 3.6 Kv., 6 6; K3/50 4kv., 7 3; K3/100 8 Kv., 12 6; K3/160 14 Kv., 18 -.

**MAINS TYPE.**—RM1, 125 v., 60 ma., 4/-; RM2, 100 ma., 4 9; RM3, 120 ma., 5,9; RM4, 250 v., 275 ma., 16/-.

**KNOBS, GOLD ENGRAVED.**—Walnut or Ivory, 1¼in. diam., 1 6 each. "Focus," "Contrast," "Brilliance," "Brilliance—On-off," "On-Off," "Volume," "Vol.—On-Off," "Tone," "Tuning," "Treble," "Bass," "Wavechange," "Radio-Gram," "S., M., L. Gram.," "Record-Play," "Brightness," Ditto not engraved, 1 - each.

**COILS.**—Wearite "P" type, 2,6 each. Midget "Q" type, adj. dust core, 3,6 each. All ranges.

**REACTION COND.**—.0001, .0003, .0005 mfd., 3 6 ea.

**SURPLUS MAINS TRANS.**—Prim. 0-200 250 v.; Sec. 275-0-275 v., 60 m/a, 6.3 v. 3 a., 6.3 v. 1 a., 10 6; ditto, 200-0-200 v. 80 m/a., 6.3 v. 3 a., 6.3 v. 1 a., 12.6. Oscilloscope Transf. Prim. 0-240 v. Sec. 800 v. 15 m/a., 5 v. 2 a., 5 v. 2 a., 4 v. 1 a., 17/6.

**VIBRATOR TRANS.**—6 v. input, 230 v. 50 m/a. output, 9/6. P. & P., 1/-.

**BATTERY CHARGER.**—200 250 v. Output 6 v. and 12 v. 1½ amps., in steel case complete with fuse and leads, ready for use. OUR OWN MAKE. FULLY GUARANTEED, 35/-, P. & P., 1/-.
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**ACID HYDROMETER.**—Brand new ex-Govt. Unbreakable. Packed in metal case, 7in. x 1¼in. dia., 4/6.

**FULL WAVE BRIDGE SELENIUM RECTIFIERS.**—6 or 12 v. 1 amp., 8,9; 2 a., 11,3; 3 a., 12 6; 4 a., 15/-.

**C.R.T. HEATER ISOLATION TRANSFORMER.**—Low leakage winding with 25% sec. boost, 2 v., 10 6; 4 v., 10 6; 6.3 v., 10 6; 12 v., 10 6.

**H.F. MIDGET CHOKES.**—14 M.H., 2,6 each.

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**50 MICRO-AMP. MOVING COIL METER.**—1¼in. x 1¼in. Flush Mounting, 3in. scale. By Marconi Inst. Ltd. A superb meter. **BRAND NEW.** Only 50/- ea. P.P. 1/- extra.

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3in. Plessey, 12/6. 5in. Plessey, 13 6, 6½in. Truvox, 14 6. 8in. Lectrona, 15,6. 10in. Lectrona, 25 -. 5in. G.E.C. Energised 700Ω field with trans., 19 6.

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465 Kc/s Slug tuning. Miniature. Circular Can, 2½in. by 1½in. diam. Fits octal V-holder cut out. High Q. and good bandwidth. By Pye Radio.

**BRAND NEW 6/9 PAIR**

# The Beginner's Guide to RADIO

The Eighth of a Series of Articles Specially Written for Those Who Have Become Interested in Radio for the First Time. Explaining the Principles of Radio Transmission and Reception

By F. J. CAMM

LAST month we dealt with simple tests, and there are one or two others which can be carried out. Suppose, for example, signals are not heard after the simple coil test explained last month, then the reaction circuit has broken down.

The reaction circuit consists of only a reaction condenser and coil, so that one can soon find any fault arising here, and the absence of reaction, when the maximum H.T. is applied to the valve, will show that the reaction circuit is faulty. Now pass on to the first L.F. stage. If, when one attaches the 'phones to the anode terminal of the detector valve, the signals are heard, proceed as follows: Remove the lead joining the anode terminal to the second valve, and join the 'phones to this as before described, taking one side of the 'phones direct to the H.T. battery in order to eliminate any decoupling resistances or other parts included in the anode circuit of the valve. If signals are still quite in order pass on to the following valve, and so on. If, however, nothing can be heard, the first thing to do is to test the valve. If it is correct, then the only components used to couple the detector valve to this one are the L.F. transformer or R.C.C. components. Substituting other parts is the easiest way of finding out what is wrong. If one cannot obtain substitutes, the primary and secondary windings of the L.F. transformer may be tested for breaks in the following way. Disconnect all leads from the transformers and then join one primary terminal to the positive socket of a grid bias or pocket-lamp battery. To the other primary terminal join one side of the 'phones. Now join the other lead of the 'phones to one side of a high resistance—such as a grid leak—and the other side of the resistance should be carefully touched on the 1½-volt socket. If a scratching sound can be heard in the 'phones then the primary is unbroken. If, however, nothing can be heard, try the 3-volt socket and gradually work upwards. Do not omit the resistance, and do not apply too high a voltage. If nothing can be heard at 12 volts or so, then the primary is broken. Test the secondary similarly.

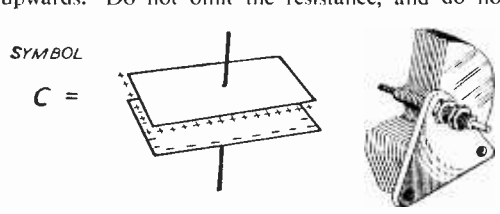


*Fig. 32.—A capacitor, and a variable component which acts in exactly the same manner.*

With a simple voltmeter and/or milliammeter, the receiver may be tested at each stage by including the meter or meters as shown last month. The figure showed how the voltage at the anode of a valve may be obtained by connecting a voltmeter across the valve. This will, sometimes, give a false reading in certain cases owing to the shunting effect of the resistance of the meter. However, if the voltmeter is connected across the anode load resistance the voltage drop which occurs will enable the anode current to be calculated by the simple application of Ohm's Law. As also, if it is connected across the biasing resistor. Alternatively, if the anode circuit be opened and a milliammeter be joined in series (either at the H.T. or cathode end) the current indicated will enable the resistance values to be checked (knowing the voltage applied).


*Fig. 33.—A simple inductance.*

A microammeter in series with the grid of an L.F. valve will check whether or not the valve is running into grid current. If a resistance is to be checked it may be connected in series with a battery and milliammeter and its value calculated in the absence of an ohmmeter.

**About Inductance**

We have now obtained some practical elementary experience in building and testing a simple receiver, and we have also learned about the units of current resistance and pressure (amperes, ohms and volts). Although I have only briefly touched upon it I have also referred to the *capacity* of a condenser and the *inductance* of a coil. Condensers, as is well known are of two types—fixed and variable. The latter are always used in connection with an inductance for tuning purposes. We know that the unit of capacity is the farad; the unit of inductance is the henry, with sub-units of the *milihenry* (one-thousandth of a henry) and microhenry (one-millionth of a henry). When a pressure of 1 volt is induced through a coil and changes at the rate of 1 ampere per second it is said to have an inductance of 1 henry.

Now before we can understand what inductance means it is necessary to deal with what happens when current is passed through a wire. Until quite recently

it was believed by scientists that an electric current was a kind of fluid which travelled through a circuit from the positive pole of a battery to the negative, whereas it actually passes in the reverse direction. It is general knowledge now that all matter, whether solid, liquid or gaseous is composed of atoms.

The atomic theory is that there are certain substances called elements which consist in their purer state entirely of atoms of one kind only. Copper is such an element and it consists of copper atoms and nothing else. Carbon is also an element and so is gold, silver and platinum. Substances which are not elements are called compounds and they are made up of groups of atoms of various kinds. Thus, water consists of hydrogen and oxygen, two atoms of hydrogen combining with one of oxygen, to form a *molecule* of water. It is for this reason that the chemical symbol of water is $H_2O$.

Although that is the basis of the atomic theory, recent investigations have shown that it is not strictly correct. Hitherto, it was thought that the atom was indivisible. We now know that it is and this discovery has revolutionised science for it has proved that all elements and compounds, whether solid, liquid of gaseous, *have the same components differently arranged.*

The atom is a body of unimaginable smallness and it has been calculated that if a drop of water were to be magnified to the size of the earth, the atoms composing it would appear to be about the size of a cricket ball. In reality, of course, it is more like a miniature solar system consisting of a "sun" with an attendant retinue of planets. The sun or central body is called the *nucleus* and the planets are known as *electrons*. An electron is a minute charge of negative electricity. It *is* electricity. The electrons rotate round the nucleus at a speed of about 1,000 miles per second and but for this high speed the nucleus which is positively charged, would attract the negative electrons and they would be pulled in towards it. Similarly, the earth would fall on the sun were it not for the high speed at which it rotates with the sun as its centre of rotation.

Matter in its normal state has all its atoms in a tranquil or inert condition. Each atom has its right amount of electrons rotating round it and there are no external electrical effects. If, by some means one of these atoms loses an electron its stability is upset. A little bit of negative electricity has been taken away and too much positive electricity remains. In other words equilibrium has been destroyed. The whole thus assumes an excessive positive charge and it at once endeavours to attract into its own system any free electrons which happens to be in the neighbourhood. In this condition it is known as a positive *ion*. Conversely, if an atom is given an extra electron, then it has a superfluity of negative electricity and becomes a negative ion. All this leads up to my next point which is that a conductor, such as a copper wire, may be regarded as a substance containing electrons which are loosely bound to their respective nuclei and which, under the influence of some force, such as the electro-motive force of a battery or mains voltage, are easily made to move from one atom to another in a systematic manner.

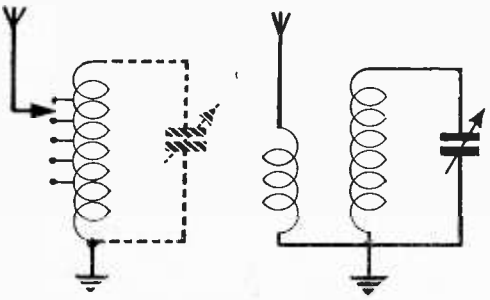

*Fig. 34.—A simple aerial tuning circuit. Greater selectivity is obtained when a coupling coil is included and a tuning condenser is employed.*

In non-conductors, or insulators, the electrons are bound tightly to their nuclei and under the influence of the same force are very hard to move systematically, although they can be slightly displaced. Among good conductors of electricity are metallic substances, the atoms of which will readily part with an electron. A perfect insulator does not, of course, exist.

The force required to bring about a systematic movement of electrons is, of course, the *electro-motive* force. Now what happens when a current flows along a copper wire? The E.M.F. in this case is supplied by either the battery or the mains and is analogous to a pump circulating water through a pipe, the water eventually returning to the pump. In the battery the place of the pump is taken by the chemical action of the *electrolyte*, the substance in the cells which removes electrons from the positive plate and transfers them to the negative, whence they travel via the outside circuit back to the positive terminal.

At the negative terminal of a battery there is a superfluity of electrons. Let us trace one of them through a copper wire joined to each terminal of a battery. The electron rushes off the terminal and hits a copper atom, knocking an electron out of its orbit and taking its place. This displaced electron rushes against the next atom, driving out an electron as before and occupying its place. Thus a wave of collisions passes down the wire, until the detachable electron nearest the positive terminal is driven out of its place.

In addition to the effects caused within the wire by the passage of electrons, there is also another effect *outside* the conductor. When a current of electricity flows along a wire, the surrounding ether is in a state of strain. This is a magnetic strain, that is, the wire is surrounded by magnetic lines of force in the form of circles which are nearly concentric.

When the current is first switched on through the conductor, these lines of force spread out from the middle of the conductor, becoming larger and larger until they reach a maximum. Similarly, when the current is switched off the field of force gradually begins to diminish. This field of force may be regarded as a kind of invisible sleeve formed round the wire. The field of force is not in the least hampered by insulation.

**Inductance**

We have already seen that a current experiences difficulty in starting to flow and also in stopping. This means that a conductor, especially one in the form of a helix, solenoid or coil, resists any change in current which passes through it. Inductance is the electrical equivalent to inertia in mechanics. It is difficult to start a motor-car by pushing it, but once the motor-car is in motion it is equally difficult to stop it. The inductance of a length of wire depends on its form—how it is arranged or wound.

*(To be continued)*

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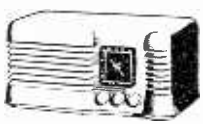

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Driving head 1/6
Double pointer 4d.
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Dial Front Plate 2/6
Engraved Glass Dial 180-550 and 800-2 200 m. With station names, new wavebands ... 1 6
T.R.F. Coils, 180-550, 800-2 200 metres, pair 6 6
Punched chassis 3-valve plus rectifier T.R.F. 3 9
Cabinet, Bakelite, in Walnut or Ivory or Wooden in Walnut finish ... ... ... 17 6
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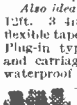

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7 amps.... ... ... ... 8/6
2 volt 10 amp. (by famous maker) 4/11

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SP501A, 500-0-500 150 mA. 5 v @ 2-3 a. 6.3 v. @ 2-3 a. 6.3 v. @ 2-3 a. ... ... 50 -
SP425A. 425-0-425 200 mA., 6.3 v. @ 2-3 a. 6.3 v. @ 3-5 a. 5 v. @ 2-5 a. ... ... 67 6
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| 1G6 | 6/- | 6SG7 | 6/- | 25A6 | 8/6 |
| 1L4 | 5/6 | 6SH7 | 4/6 | 25L6 | 8/- |
| 1LD5 | 5/6 | 6SJ7 | 6 - | 35L6 | 8 6 |
| 1LN5 | 5/6 | 6SK7 | 4 6 | 43 | 8/6 |
| 1T4 | 6/6 | 6SL7 | 8/- | 50L6 | 8/- |
| 2X2 | 5/- | 6SN7 | 8/6 | 61P | 6/6 |
| 3D6 | 4/6 | 6U7 | 7/- | 75 | 8/- |
| 5V4 | 8/6 | 6V6 | 7/- | 77 | 7/- |
| 5X4 | 11/6 | 6X5 | 7/- | 80 | 8 - |
| 5Y3 | 8/- | 6Z4 | 7/6 | 83 | 10 6 |
| 5Z4 | 8/- | 7B7 | 7/- | 210LF | 2 - |
| 6A7 | 8/6 | 7C5 | 6/6 | 807 | 7/6 |
| 6AG7 | 8/6 | 7C6 | 7/- | 1619 | 8/- |
| 6B8G | 4/- | 7C7 | 7/- | 1622 (3L6) | 9 - |
| 6B8M | 5/6 | 7D3 | 7/- | 1625 | 4/- |
| 6CD6G | 11/- | 7H7 | 7 - | 1626 | 3 6 |
| 6CH6 | 6/6 | 7Q7 | 7/- | 5763 | 8/6 |
| 6C5G | 5/6 | 7R7 | 8 - | CV271 | 3 6 |
| 6C5M | 6/- | 7S7 | 7/- | CV1310 | 9 - |
| 6C6 | 6/- | 7Y4 | 7/- | HL2 | 2 - |
| 6C8 | 11/6 | 10D1 | 4 - | KF35 | 7/- |
| 6D6 | 6/- | 12AT7 | 7 - | MH4 | 5 - |
| 6F6 | 7/- | 12AU7 | 9 - | ML4 | 6 6 |
| 6F7 | 7/- | 12AX7 | 6 6 | QP21 | 7 - |
| 6F8 | 6/6 | 12C3 | 8/6 | VR55 | 7/- |
| 6H6G | 2/- | 12H6 | 2/- | VR56 | 5/6 |
| 6H6M | 2/6 | 12J5 | 4/- | VR57 | 7/- |
| 6J5G | 5/- | 12K7 | 8/6 | X66 | 8/6 |
| 6J5M | 5/6 | 12K8 | 8,- | Y63 (6U5) | 5/6 |
| 6J7G | 5/- | 12Q7 | 8/- | 38 | 10/- |
| 6K6 | 7/- | 12SC7 | 5/- | UCH42 | 11/- |
| 6K7G | 4/6 | 12SK7 | 7/6 | UL41 | 8/6 |
| 6K7M | 5/- | 12SL7 | 8/- | UBL21 | 11/6 |
| 6K8 | 9/- | 12SQ7 | 8/6 | UAF42 | 11/6 |
| 6L6 | 8/6 | 12SR7 | 7 - | UCH21 | 11/6 |
| 6L7 | 6/- | 12Y4 | 7/- | EL91 | 11/6 |
| 6N7 | 5/6 | | | | |

**COMMUNICATIONS RECEIVER R.1155** The famous ex. Bomber Command Receiver known the world over to be supreme in its class. Covers 5-wave ranges 18.5-7.5 mc/s. 7.5-3.0 mc.s, 1,500-600 kc's, 500-200 kc's, 200-75 kc's, and is easily and simply adapted for normal mains use, full details being supplied. Aerial tested before despatch these are BRAND NEW AND UNUSED IN MAKERS' ORIGINAL TRANSIT CASES. ONLY **£11 19 6.**

A few used receivers, also tested working before despatch, are available at **£7 19 6.** A few of the **R.1155 N** model can also be supplied. This is the latest version which covers the Trawler Bands, and in addition is fitted with ultra slow motion tuning. Used, but tested working before despatch, ONLY **£17/19 6.**

A factory made Power Pack, Output Stage and Speaker, contained in a black crackled cabinet to match the receiver, can be supplied at ONLY **£5/10.** Operates receiver immediately.

DEDUCT 10/- IF PURCHASING RECEIVER & POWER PACK TOGETHER.

Please add carriage costs of 10/6 for Receiver, and 5/- for Power Pack.

**COMMUNICATIONS RECEIVER R.1224A.** An ex. R.A.F. 5 valve Battery Superhet which covers 1.0-10.0 mc s (30-300 metres), in 3 switched wave bands. Employs RF stage and 465 kc/s I.F., large Muirhead slow motion tuning dial, aerial trimmer, reaction/BFO control, sensitivity control and H.I. impedance and 600 ohm line outputs. Exceptionally sensitive and selective. Complete with valves in wooden cabinet, with hinged lid, size 14½in. x 10in. x 9½in. Finished in grey, with calibrated chart. Requires only 2 v. L.T., 9 v. G.B., 120 v. H.T. BRAND NEW IN MAKERS' PACKING. ONLY **£3/19 6** (carriage, 7/6).

**V.H.F. RECEIVER R.1132A.** Covers 100-124 mc/s with variable tuning. Complete with all valves, and in BRAND NEW condition. ONLY **45/-** (carriage, etc., 7/6).

**POWER PACK TYPE 3.** Used by the Services with the above receiver. A standard 19in. rack mounting job to match the receiver, this is for 200 250 v. 50 cycle mains with output of 250 v. D.C. 100 ma. and 6.3 v. 4 amps. Is fitted with H.T. current meter and voltmeter, and is a really superb unit, which can be used for a variety of sets. Tested working before despatch. ONLY **90/-** (carriage, etc., 5/-).

**RECEIVER 25/73.** Part of the TR.1196. Covers 4.3-6.7 mc/s., and makes an ideal basis for an All Wave Superhet, full modification data being supplied. Complete with valves, 2 each EF36 and EF39, and 1 each EK32 and EBC33. ONLY **22/6** (postage, etc., 2/6).

**RECEIVER R.1225.** Covers 100-150 mc/s, and contains 5 valves EF50, 2 of EF39 and 1 of EB34, together with a multitude of short wave components. An excellent little breakdown unit for ONLY **25/-** (postage, 2/6).

**INDICATOR UNIT, TYPE 95.** Exactly the same as the Type 62, but for 50 cycle operation. Built on a two-deck chassis, it contains VCR97 Tube with mu-metal screen, 16 valves SP61, 2 of EB34 and 4 of EA50, also shoals of components. In new condition. A snip at ONLY **59.6** (carriage, 7/6).

**INDICATOR 62A.** Another two deck chassis job, this contains VCR 97 tube with Mu-metal screen, 12 valves EF50, 4 of SP61, 3 of EA50 and 2 of EB34. IN NEW CONDITION IN MAKERS' TRANSIT CASES. ONLY **99/6** (carriage, etc., 10/6).

**TRANSFORMERS.** Ex. W.D. & Admiralty. Built to more than 50% safety factor, with normal A.C. Mains Primaries. All Brand New and Unused.

330 v.-0-330 v., 100 ma., 4 v. 3 a. **22/6.**

EHT 1,400 v. 2 ma., 520 v. 10 ma., 300 v. 10 ma., 2 v., 1.5 a. ... ... ... ... ... **21/-**

L.T. 6.3 v. 7.7 a., 4.2 v. 2.5 a., 4 v. 1 a. ... **19/6**

L.T. 4 v., 20 amps. C.T. ... ... ... ... **30 -**

Please add 2/6 per transformer postage.

**AVO MODEL 40 UNIVERSAL TEST METERS.** Have had some use but every meter has been thoroughly checked and tested, and is GUARANTEED IN PERFECT WORKING ORDER. An ideal opportunity to acquire a first grade tester at low cost. ONLY **£9/19/6.**

*C. W. O. Print name and address clearly. Amounts given for carriage refer to inland only.*

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## LYONS RADIO

LTD.

**3, GOLDHAWK ROAD, Dept. M.P.**

**SHEPHERDS BUSH, LONDON, W.12.**

*Telephone : SHEpherds Bush 1729*

**L.T. METAL RECTIFIERS.**—Full wave bridge type, 6 v. or 12 v. 3 a., size 3½in. sq. x 1in. PRICE **12/6.** Full wave C.T. types. 6 v. 1 a. PRICE **4 -** 6 v. 1 a. PRICE **4/9.**

**EXTENSION SPEAKERS.**—Standard low impedance moving coil 6½in. loudspeakers fitted in attractive cabinet with polished walnut finish, approx. size, 9 x 8½ x 4ins. PRICE **35/-.**

**A.C. POWER UNITS.**—Input 200/250 v. A.C. mains. Outputs : 6.3 v. for total loading of 4 a. and approx. 220 v. smoothed D.C. for total loading of 60 m/A. A double section choke filter is incorporated to give exceptionally good smoothing and rectifier employed is a 5Z4. These power units are suitable for most communications receivers and will make a good standby unit for general use. Housed in metal cases, 8½ x 6½ x 4ins. Made in our own workshops from first-grade components. PRICE **70 -.** post 2/6.

**ELECTROMAGNETIC MICROPHONES.**—2in. dia. round hand type as fitted to air pilots oxygen mask, with on/off switch and short lead. PRICE **3/6,** post 9d. Can be used with the A1368 described below.

**AMPLIFIERS UNITS, TYPE A1368.**—These are two valve A.F. amplifiers and can be used for intercom. purposes or as a microphone pre-amp. With slight mod. (details supplied) can also be used as a gramophone amplifier. Valves fitted are VR21 (210LF) and VR35 (QP21). Operated from 2 v. L.T., 90-120 v. H.T. and 9 v. G.B. Housed in neat metal cases, 7 x 5 x 4ins., in good condition. A REAL SNIP AT ONLY. **10/6,** post 2/-.


Accurately tests High, Low and Grid Bias Batteries. Write for leaflet 29 M.

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**3 SPEED AUTOCHANGERS.** Collaro 3RC 521. Supplied brand new in unopened cartons, complete. With L.P. and Standard pick-up heads. 100-250 v. A.C. Only a limited quantity available but one will be reserved for you on receipt of £1 deposit.

**BARGAIN PRICE £9.19.6.**

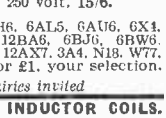
Carriage 7/6.

**L.T. METAL RECTIFIERS.** 6 or 12 volt. bridge. ½ amp., 4/11 ; 1 amp., **5/6** ; 2 amp., **7/6** ; 3 amp., 8 11 ; 4 amp., 10/11 ; 6 amp., **14/6.** 125 v. H.W. RM1, 60 mA., 3/9 ; RM2, 100 mA., 4 3 ; RM3, 120 mA., 5/3 ; RM4, TV Rectifier, 275 mA., 250 volt, **15/6.**

**VALVES.** 6AM6, 6CH6, 6AL5, 6AU6, 6X4, 6BE6, 6BA6, 12BE6, 12BA6, 6BJ6, 6BW6, 6BW7, 6AT6, 1T4, 1U5, 12AX7, 3A4, N18, W77, U78, **7/6** each, any 3 for **£1,** your selection.

*Overseas enquiries invited*

**TELETRON SUPER INDUCTOR COILS.**



**Miniature dust core types.** Dual Wave TRF, 7/- pr. Super Het Coils for all Bands. AE & OSC. 6/-pr. Hi.Freq. crystal Transformer coils, triple wound for crystal diodes, 3/- ea. IFT's HF Chokes, etc. Stamp for list & Circuits.

**The Teletron Co., 266, Nightingale Rd., London, N.9.**

# Programme Pointers

By MAURICE REEVE

**The Edinburgh Festival**

THE Edinburgh International Festival has rightly and properly established itself amongst the leading festivals of the present day. And listeners should be particularly grateful for having a marvellous series of programmes brought to them in their homes. But like all worthwhile things—from Test matches to Promenade concerts, or from The Archers to Gilbert Harding—it cannot remain static; it will either advance or retire. Presuming it to be a certainty that it will do the former, the question will be—on what lines?

The composition of its programmes is, of course, no concern of mine except—and a big exception it is—in so far as they concern the franchise of radio listeners. As with the Proms, the tendency at Edinburgh would seem to be to get bigger and bigger, just for the sake of getting bigger. In my estimation, the Proms have greatly degenerated in recent years (the performance at the final concert of the season of Eileen Joyce in the Schumann was quite unbelievably bad, though the vast audience screamed and yelled its approval like any Wembley cup-final crowd does when its heroes score goals irrespective of the quality of the play), with symphonies, concertos, arias, scenas, overtures, suites, etc., etc., etc., thrown at us in huge masses. They are no longer concerts of taste and discrimination as they once were. And Edinburgh is similarly heading that way and is leaning towards becoming a huge emporium. Is it necessary to go such vast distances to hear Beethoven's third concerto and Tschaikovsky's fifth symphony—works which are coming to us from all corners of the earth throughout the year? Surely, sirs, the answer is in the negative.

**"Leisure Hour"**

This is surely one of the most innocuous and goody-goody shows the BBC has ever mounted. Quite pleasant if pleasantness is all one wants, utterly harmless and unoffending. I heard Bransby Williams give a marvellous little sketch of an old salt who was a devil with the ladies. Gerald Moore is an entertaining broadcast raconteur, but his "solos" at the end of each reminded one more of a terribly shy child going up for her grade four than a radio pianist. Also, in his story of Kreisler never having played in Wigmore Hall, either Mr. Moore's or Kreisler's memory was at fault.

**"A la Carte"**

This was an amusing half-hour about food, interestingly read by Gladys Young, Carleton Hobbs and David Peel, and compiled by P. J. R. Wright. But, just imagine, nothing from Dickens, who tickled our palates more than any writer who ever lived.

**The Theatre**

And so to the theatre. What is a masterpiece? Surely as good a definition as any would be: A piece which, dealing with a major problem that its author thinks should be solved on the lines he expounds therein, continues to grip us and hold us long after the problem's solution has become part and parcel of our lives. Thus Dickens remains a great novelist and Ibsen, whose "Rosmersholm" recently enthralled us as much as ever, a great dramatist. Mary Wimbush, James Bale, Robert Harris and Malcolm Hayes gave full justice to the famous play.

A. E. W. Mason's "Witness for the Defence," though not a masterpiece, interested by virtue of its solid Edwardian atmosphere, and some capital acting parts which are as effective over the radio as they were over the footlights. The woman with a past will, I trust, ever be good entertainment. Renee Goddard, with Stanley Beard, David Peel and others, saw to it that, in this instance, she was.

Joseph Conrad's dramatic story of a Russian spy in London 50 odd years ago made a gripping radio play in the capable hands of Belle Chrystall, Richard Hurdnall, Lewis Stringer, Ivan Sampson and many others. I wonder if Conrad was ever so slightly influenced, in ending the story, by Anna Karenina?

D. H. Lawrence's essay in dramatic writing, "The Widowing of Mrs. Holroyd," hardly seemed worth putting on, but "As you Like It" was a joy. How that text came over! like dewdrops or sun shafts.

**"Earthquake in Greece"**

This was not so good, and didn't capture the atmosphere to anything like the same degree. Whilst the remarks, and voice, of the distinguished person at the conclusion spoiled whatever effect of realism had previously been achieved. It was a production blunder.

**"Civil Engineer"**

If a voice symbolising Dunkirk, the odd round—in case—, the old home, in spite of, or what you will that's typical of British do-or-die-ism, few better than Leslie Perrins's could be found. It was, therefore, not surprising to hear its stoicism and resolution when turning on "Civil Engineer," a good feature chiefly dealing with last winter's floods, though his name was not advertised in *The Radio Times*.

**Quiz**

"What Do You Know?" is a good, smart, snappy feature, under a very capable chairman, Franklin Engleman. I wonder how many more varieties of the quiz it will be possible to devise? A good question for one of them might be, "why do the producers of the many Trollope serials leave out the apostrophe? The "I cannots" and "I will nots," give them such a stilted air. I cannot (can't) say whether Trollope himself does, as I plead guilty to never having read him. But Dickens, and other contemporaries, certainly do not (don't).

# OPEN TO DISCUSSION

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

## Lining-up a Superhet

SIR,—One of the amateur constructor's chief difficulties in aligning a newly-built "superhet" receiver is to know the optimum setting of the tuning gang for reception of a station around 250 metres and around 430 metres.

Manufacturers could greatly assist their customers if they provided information about their coils in one of two ways, and probably stimulate their sales thereby.

*Method* 1. (Adopted by Osmor for battery coil pack.) State the number of degrees out of 100 or 180 that the tuning gang should be opened from the fully-meshed position for reception of the North Regional and M.W. Light (usually approximately 70 deg. and 146 deg. open respectively).

*Method* 2. The provision of a cheap two- or three-waveband tuning scale in cardboard, with a central hole so that a push-on aerp pointer could be used; for purposes of economy only two tracking points need really be marked per waveband.

I think it is a fair one for manufacturers to assume (a) that stray capacities average 25 pF., and (b) that a nominal 500 pF. gang makes 490 pF.—MAJOR R. PAGE, R.A.E.C. (Bulford).

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

## The R184

SIR,—Having for a long time past been a regular reader of PRACTICAL WIRELESS, I now wish to make use of the excellent section "Open to Discussion." I would like, through this medium, to get into touch with a fellow reader who has an A.M. receiver, type 184. I am informed that with modifications this unit tunes to the V.H.F. transmitter at Wrotham.—PETER S. MATTHEW (West Wickham).

## Radio-controlled Models

SIR,—I am glad to see an article in "Transmitting Topics" (October) on radio control of models. Interest in this branch of radio is on the increase. This is proved by the fact that Tyneside Group membership has increased 100 per cent. during the last 12 months.

I would like to draw your attention to a mistake in this article, which might be misleading to some people. Mention is made of "full permitted output of 5 watts" and again "the full 5 watts into the aerial." The Postmaster-General would not like this. The maximum power permitted is "5 watts *input* to the valve or valves which drive the aerial." It will be a good transmitter (portable) indeed which will deliver even 4 watts into the aerial. As a matter of interest, 1 watt output is usually quite ample, and this figure is much more easy on power supplies.

Wishing you every success during your next 21 years.—N. F. ARMSTRONG (Newcastle-on-Tyne, 3).

## Battery Super-regenerative Receiver

SIR,—Readers may perhaps be interested in a battery version I have made of the Super-regenerative Receiver, designed by Mr. P. W. Moir, which appeared in your issue for February, 1952.

Having no mains, I hunted round for some battery acorns and was at last successful in obtaining some 958s and 959s.

The valve sequence in the set I have made is T.R.F. stage 959, det. 958, L.F. transformer coupled to 1T4, thus being R.C. coupled to a 1S4 output.

I am using an 18 pF. tuning and 25 pF. R.F. stage condenser, both with slow motion.

The set runs on 90 volts H.T. and 1.5 L.T., and works a 9in. loudspeaker.

I hear the relay station of London and Uxbridge traffic control at full speaker strength as well as 'planes of all kinds in transit to and from the U.S.A., and from the two "local" service stations (Naval and R.A.F.).

On 10-turn coils I can get both Wenvoe and Holme Moss sound, with a vertical dipole made from two legs of a discarded telescopic camera tripod.

I should have said that the two tuning condensers are both of the miniature split stator type.

The set is built on an aluminium chassis, 9in. by 9in., and is housed in a case, also of aluminium, made from the outer case of a TR9 sawn in half.—C. A. C. CLARKE (Port Isaac).

## Medium-wave Reception

SIR,—I feel that the BBC should make an effort either to add further medium-wave Light Programme transmitters or to increase the power of their present one, reception of which is far from good in many parts of the country. If good reception of the Light could be secured all over Britain on the medium waves there would no longer be any necessity for long-wave tuning in broadcast receivers. In fact, many household radios would only need arrangements for the medium waves, thus reducing the price of the set.—B. DWYER (Leicester).

(*continued on page* 777)

**EX-A.M. RECEIVER TYPE R1155.**

Brand new and unused.
5 Frequency ranges : 18.5-7.5 Mc/s ; 7.5-3.0 Mc/s ; 1,500-600 Kc/s ; 500-200 Kc/s ; 200-75 Kc/s. Supplied in maker's original wood transit case. LASKY'S PRICE. £11 19 6. Complete. R.1155 Receivers. Second hand, aerial tested. £7 19 6.
Carriage and packing 12 6 per unit extra, including 10 -, which will be refunded on return of packing case.

**FULLY ASSEMBLED POWER PACK AND OUTPUT STAGE FOR R1155 RECEIVERS.**

For use on 200-250 volt A.C. mains. Wired and complete with valves. In steel case, black crackle finished, size : 12 x 5½ x 7 in. LASKY'S PRICE, 79 6. Carriage 5/- extra.
Power pack as above, complete with 6½in. loudspeaker. PRICE £5/5/0. Carriage 5 - extra.

**SPECIAL C.R.T. OFFER**
Brand new and unused 12in. ion trap type television cathode ray tubes. 6.3 volt heater. 7-9 kV. E.H.T. 35 mm. neck. Black and white picture. By famous manufacturer. PERFECT. £12 19 6. Carriage and insurance 15 - per tube extra.

**TELEVISION SELENIUM RECTIFIERS**
The very latest " Sentercell " S.T.C. range.

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| K3/40, 3.2 kV. | 7 6 |
| K3/45, 3.6 kV. | 8 2 |
| K3/50, 4.0 kV. | 8 8 |
| K3/100, 8.0 kV. | 14 8 |
| K3/160, 12.8 kV. | 21 6 |

**MAINS TRANSFORMERS**
All 200-250 volts c.p.s. primary Finest quality, fully guaranteed.
**MBA/3.** 350-0-350 v. 80 mA. 6.3 v. 4 a., 5 v. 2 a. Both filaments tapped at 4 volts. An ideal replacement trans. Price, 18/-.
**MBA/5.** 250-0-250 v. 125 mA. 6.3 v. 4 a., 5 v. 3 a. With mains tapping board. Price, 27 6.
**MBA/6.** 350-0-350 v. 100 mA. 6.3 v. 3 a. 5 v. 2 a. With mains tapping board. Price, 22 6.
**MBA 7.** 250-0-250 v. 80 mA. 6.3 v. 3 a., 5 v. 2 a. Both filaments tapped at 4 volts. Price, 18/-.
**MBA/8. SPECIAL OFFER.** Drop through type. 235-0-225 v. 60 mA. 6.3 v. 3 a., 12 6.
**AT/3.** Auto transformer. 0-10-120, 200-230-240 volts, 100 watts. Price, 17/6.

**CRYSTAL DIODES**
Glass type. Wire ends, 1 6 each

**AMPLIFIERS**
**4-Watt Model.** Ex Government. Complete with 10 valves : 2 25L6 ; 1 6H6 ; 1 25Z6 ; 6 6SK7. For operation on 110 volts A.C. D.C. Balance and push pull. High, medium and low impedance inputs. A.G.C., etc. LASKY'S PRICE £5 19 6 complete. No circuits available. Carriage 10 - per unit extra.

**ROMAC 25 WATT AMPLIFIER**
Complete with 7 valves, including 2 6L6 in push pull. Provision for high and low imp. microphone. Also fitted with long and medium wave radio tuner unit. For use on 200-250 v. 50 c.p.s. mains. BRAND NEW AND UNUSED.
LASKY'S PRICE £25 0 0.
Carriage 25/- extra.

**VALVES. 10,000 IN STOCK AT THE LOWEST POSSIBLE PRICES.**
SOME EXAMPLES.

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|---|---|---|---|---|---|---|---|
| 5U6 | ... | 10 - | | | | | |
| 5Y3 | ... | 9 - | | | | | |
| 6AM6 | ... | 9 - | | | | | |
| 6H6 | ... | 2 6 | | | | | |
| EF50, Red New Sylvania | | 10 6 | | | | | |

**SPECIAL OFFER.** 4 Valves : 1 each 1R5, 1T4, 1S5 and 3S4.
**LASKY'S PRICE 32/6.**
POST FREE.

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| 1S4 | ... | 9 - | 1A7 | ... | 9/- | 6J7 | ... | 6 6 | EF39 | ... | 7 6 |
| 3S4 | ... | 9 - | 12K8 | ... | 8 6 | HL2 | ... | 3 6 | 12K7 | ... | 10 6 |
| 1T4 | ... | 9 - | 12Q7 | ... | 8 6 | KT2 | ... | 3 6 | 6L6 | ... | 10 6 |
| 1R5 | ... | 9 - | 6AL5 | ... | 9 - | 6K8 | ... | 9 6 | EA50 | ... | 2 6 |
| 1S5 | ... | 9 - | 6K7 | ... | 4 6 | U50 | ... | 9 - | EBC33 | ... | 7 6 |
| 1C5 | ... | 9 - | 1D5 | ... | 8 6 | ECH35 | ... | 13 6 | 35L6 | ... | 10 - |

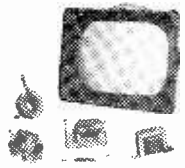
**DINGHY AERIALS, WITH REFLECTORS**
Umbrella type, with wire mesh reflector. Complete with setting up instructions. Mast not supplied. Ex. American Air Corps. Ideal for short-wave reception.
LASKY'S PRICE, 6 -. POST FREE.

**R.1132.A RECEIVERS**
Supplied in maker's original wood transit case. Frequency coverage 100-124 Mc/s. 11 valves : 1 VR65, 1 VR66, 4 VR53, 2 VR54, 1 6J5, 1 VS70, 1 VR57. Large tuning scale with slow motion drive. 0-5 mA. tuning meter. R.F. and L.F. gain controls, jack sockets for line and 'phone.
Totally enclosed in metal case, grey enamelled with plated handles. Size : 18 x 10 x 11in. Supplied with all valves, also circuit and calibration chart.
**GRADE 1.** Brand New 79 6. **GRADE 2.** Soiled 49 6.
**GRADE 3.** Secondhand 39 6. Carriage 10 - per unit extra.

**LASKY'S TV. CONSTRUCTOR'S PARCEL**
All brand new components by Igranic. Comprises E.H.T. flyback line transformer, 7-10 kV. with ferroxcube core, and rectifier heater winding ; scanning coils, frame output transformer. Elac focus unit with vernier adjuster, U37 EHT. rectifier 12in. cathode ray tube and ion trap, mask and glass.

**LASKY'S PRICE FOR THE COMPLETE PARCEL. £15 19s. 6d.**
Carriage and insurance 15 - extra.

**The Constructor's Parcel As above but less cathode ray tube and ion trap.**
**LASKY'S PRICE, 79 6. Postage 3 6 extra.**



**DE LUXE T.V. CABINETS.** Our new B51 Mark II model. For 12in. c.r. tubes. Finished in beautiful figured walnut veneer, with either light, medium or dark polish. Supplied complete with mask, glass, back, speaker baffle and fret, castors and c.r.t. neck protector. Inside dimensions : 16½in. deep, 17¼in. wide, 28in. high. Overall height 32in. and width 18½in. **LASKY'S PRICE, £9 10 0.** Carriage 12 6 extra.

**LARGE SCREEN T.V. CABINET**
Specially designed for use with the latest large screen 16in. and 17in. c.r. tubes. Finished in figured walnut veneer, beautifully polished in either light, medium or dark shade. Supplied with back, speaker baffle and fret, castors and c.r.t. neck protector. Control panel aperture cut out at upper r.h. side. Inside dimensions : 16½in. deep, 17¼in. wide, 28in. high. Overall height 32in. and width 18½in. **LASKY'S PRICE, £8 10 0.** Carriage 12 6 extra.

**CONDENSERS**
Electrolytic Cans.

| | |
|---|---|
| 16 mfd. 500 v.w. | 3 6 |
| 24 mfd. 450 v.w. | 3 11 |
| 32 mfd. 500 v.w. | 5 11 |
| 60 mfd. 350 v.w. | 3 6 |
| 64 mfd. 450 v.w. | 4 11 |
| 8+8 mfd. 450 v.w. | 3 11 |
| 8+16 mfd. 450 v.w. | 3 11 |
| 8+32 mfd. 450 v.w. | 3 11 |
| 16+8 mfd. 500 v.w. | 4 6 |
| 16+16 mfd. 500 v.w. | 4 6 |
| 16+24 mfd. 450 v.w. | 4 11 |
| 16+32 mfd. 450 v.w. | 4 9 |
| 20+20 mfd. 275 v.w. | 2 - |
| 32+32 mfd. 500 v.w. | 4 11 |
| 32+32 mfd. 350 v.w. | 2 11 |
| 60+100 mfd. 350 v.w. | 7 6 |
| 250 mfd. 350 v.w. | 4 11 |

**MANY OTHER TYPES IN STOCK**
Send us your requirements.


**COLLARO 3-SPEED AUTO CHANGERS**

Brand new and unused in maker's original carton. Fitted with twin crystal heads.
LASKY'S PRICE. £9 19 6.
Carriage 3 6 extra.

**BAFFLE RADIO CABINETS**

Pleasing design, complete with drilled chassis, dial, drum drive and back. Finished in satin mahogany veneer, natural polish. Outside dimensions : 17½in. wide 11½in. high 5in. deep.
LASKY'S PRICE, 36 -.
Carriage 2 - extra.

**METAL RECTIFIERS**
6 and 12 volt F.W. Bridge.

| | |
|---|---|
| 0.6 a. | 4 6 |
| 2 a. | 9 - |
| 3 a. | 9 11 |
| 4 a. | 12 - |
| 6 a. | 17 6 |
| 6 Volt centre tapped bridge. 0.75 a. | 3 9 |
| 1 a. | 3 11 |

**S.T.C. SENTERCELL RECTIFIERS**

| | |
|---|---|
| RM.1 | 3 10 |
| RM.2 | 4 3 |
| RM.3 | 5 - |
| RM.4 | 18 - |

**LOUDSPEAKERS**
First Quality. All 3 ohm speech coil. Less output trans.
3in. ... 13 6 8in. ... 15 -
4in. ... 10 6 10in ... 17 6
5in. ... 13 6
6½in. ... 13 6
Now available. 12in. Goodmans heavy duty 15 watts. 15 ohms.
LASKY'S PRICE. £5 19 6.
Carriage 3 6 extra.

**9in. TABLE T.V. CABINET**
Medium shade mahogany. Complete with back, safety glass and speaker fret. Internal dimensions, 19½in high, 16in. wide, 11in. deep. LASKY'S PRICE. 39 6. Carriage 7 6 extra.

**L.F. TRANSFORMERS**
465 Kc/s Iron dust cores in cans, midget type. Size : 1in. x1½in.x2½in. Price 9 6 per pair.
WEARITE TYPE 550. 415-520 Kc/s. 10 - per pair.
WEARITE TYPE 503. 150-170 Kc/s. 10 - per pair.

**TEST PRODS.** Fused, with fully retractable points. Price 4 11 per pair.

**GRAM MOTORS.** Rim drive. For 200-250 v. 50 c.p.s. Many uses. 9 6 each.

# LASKY'S RADIO

**Lasky's (Harrow Road), Ltd.,**
**370, Harrow Road, Paddington, London, W.9**
*Telephones :* CUNningham 1979-7214. All Depts.

MAIL ORDER AND DESPATCH DEPARTMENTS : 485-487, HARROW ROAD, PADDINGTON, LONDON, W.10.

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## Using the R1155

SIR,—I feel that my experiences with the R1155 might be of help to any would-be modifiers among your readers. I carried out Mr. Cruickshank's modification to the first R.F. stage, but using a 6AC7 instead of the EF50.

I found that, whereas signal levels generally had increased, so had the noise level. Thus, the signal/noise ratio was no better, if not worse.

Also, severe cross-modulation was found to be taking place on range 3 (M.W.), the Third Programme modulation being present on all signals. (I am close to a relay.)

I next tried an EF39 as first R.F., only to find signal levels lower than when using the original KTW62, and signal/noise only slightly improved.

The real solution was found by replacing the original KTW62 and building an external pre-selector, using, in the writer's case, a B7G 6F12.

The solution has several advantages :

(a) Greater signal levels.

(b) Better signal/noise ratio.

(c) Reduction of second channel interference.

(d) Pre-selector can be made to match any antenna (dipoles, etc.), whereas the R1155 will normally only match the long wire type.

A final hint is : use the 1155 with headphones for DX listening. It was designed for headphones, and works much more quietly when they are used.

All the above tests were carried out on the 14 Mc/s amateur band.—B. JENKINSON (Sheffield).

## Re "A Plaintive Cry"

SIR,—I was surprised to note a part of Nottingham is still on D.C. and seeing the "Coronet A.C.4" is practically the same as Burne-Jones Ltd. supplied to the blind years ago, I would (in face of the BBC threat to put the West Region on the V.H.F. bands, thus putting all blind people's sets out of action for West Region) be pleased if you would supply diagrams of a good low-priced adaptor that could be put in the present medium/long waveband sets now in use.

This would save the N.I.B., London, a lot of worry and expense.—J. O. COLEMAN (radio repairer to Plymouth District N.I.B.).

## A.C. Band-pass 3

SIR,—May I also offer my congratulations to you on designing the A.C. Band-pass 3.

I completed the set about seven months ago and I got extremely good results from it.

Later, I added the R.F. stage and volume was greatly increased.

I have also added a pair of short-wave coils, which give me a range of 12-30 metres.

This was the first all-mains receiver I ever made, as I am only 15 years old, and was rather hesitant about attempting such a set, because my only previous experience was with small battery sets utilising 2-volt valves (HL2, KT2, etc.). However, I am now looking forward to constructing your "Coronet Four" superhet, so please add my name to the list of satisfied constructors of such grand little circuits published in PRACTICAL WIRELESS.—J. OLIVER (Madeley, Shropshire).

# News from the Clubs

### RADIO SOCIETY OF GREAT BRITAIN

**Gen. Sec.** : John Clarricoats (G6CL), New Ruskin House, Little Russell Street, London, W.C.1.

**London Meetings Programme :**

NOVEMBER 20th. "The Television Society's New TV Station," by Messrs. H. de L. Banting ; D. N. Corfield, D.L.C.(Hons.), A.M.I.E.E., and E. A. Dedman.
December 18th. Annual general meeting, followed by extraordinary general meeting.
January 29th, 1954. "Art and Science in Sound Reproduction," by Mr. F. H. Brittain, D.F.H. (Research Laboratories, The General Electric, Co., Ltd.).
February 26th. "Practical Aspects of Tape Recording," by Mr. S. A. Lacey (Research department, Murphy Radio, Ltd.).
March 26th. "Trustworthy Valves and Their Manufacture," by Mr. G. P. Thwaites, B.Sc.(Eng.), A.M.I.E.E., A.M.Brit.I.R.E.

### EDINBURGH AMATEUR RADIO CLUB

**Hon. Sec.** : D. Black, 16, Edina Place, Edinburgh.

THE following programme has been arranged for this year:
November 18th. R.S.G.B. lecture on tape.
December 2nd. Audio Amplifiers, by T. Telford.
December 16th. TV Construction, by C. Patrick.

The club station (GM3HAM) will operate every alternate week. New members and visitors welcomed. Club-rooms, 16, Bothwell Street (Downstairs), Easter Road.

### WELLINGBOROUGH AND DISTRICT RADIO AND TELEVISION SOCIETY

**Hon. Sec.** : N. M. Seabrooke, 85, The Drive, Wellingborough, Northants.

NOVEMBER 19th. "The Commercial Side of Radio and Television." An informal discussion led by Mr. R. S. Marriott, manager of W.I.C.S. Radio/Electrical Dept.
December 18th. "Some Problems Affecting Reception of Radio and Television in This Area." Talk by Mr. A. C. Homer, Post Office Engineering Dept., Northampton.
January 21st. "Some V.H.F. Phenomena, With Demonstrations," by Mr. G. A. Wilford. N.B. This lecture will start promptly at 7.30 p.m., as some of the demonstrations may cause local interference with TV.
February 18th. 'More About Electricity." A welcome return of Mr. M. Robins, lecturer on electrical engineering at Wellingborough Technical College.
March 18th. "Television Aerials." Talk by Mr. J. W. Hobley.
April 20th-23rd. Hobbies and Careers Exhibition, at the Drill Hall, Wellingborough. The society has been asked to organise the Radio Hobby stand.
May 20th. Annual general meeting.

The club-room is situated above the Co-op. Society's Fruit Shop, Silver Street, Wellingborough. Meetings every Thursday, 7.30 p.m.

### CLIFTON AMATEUR RADIO SOCIETY

**Hon. Sec.** : C. H. Bullivant, 25, St. Fillans Road, London, S.E.6.

AT the society's annual general meeting, held on September 11th, the following were elected as officers for the ensuing year : Chairman, J. Lambert (G3FNZ) ; Hon. Secretary, C. H. Bullivant (G3DIC) ; Hon. Treasurer, N. Moore ; Committee, Messrs. E. Smith and D. Veasey.

The society continues to meet every Friday at 7.30 p.m. at the club-rooms, 225, New Cross Road, S.E.14, and new members and visitors are always welcome.

Preparations are in hand for participating in the M.C.C. during November, and a committee has been formed to arrange operators, log keepers, etc.

Recent events on Friday evening have included a talk on V.H.F. by one of our junior members, G3JRC, an entertaining quiz devised by G3FNZ and a Junk Sale. A full programme has been arranged by the committee covering the next few months, one of the highlights being a film show.

### STOKE-ON-TRENT AMATEUR RADIO SOCIETY

**Hon. Sec.** : K. H. Parkes (G3EHM), 159, Belgrave Road, Longton, Staffs.

THE club premises are situated at the Cottage Inn, at the rear, in Oakhill. At present, the main object is to re-equip our workshop with a full range of tools and accessories so that any type of constructional work can be undertaken by members. This should fill a long-felt want.

The headquarters will also open on Tuesday nights for enthusiastic constructors. It is hoped that large quantities of tea will be readily available for members. All persons interested in joining the society are asked to write to the secretary and are invited to come along any Thursday night.

# News from the Trade

### New G.E.C. Flashers

LONDON and provincial cities and towns have fitted an increasing number of flashing signs and lights. The problem of preventing electrical interference from these flashing lights spoiling viewers' and listeners' enjoyment of television and radio programmes has become acute. The General Electric Co. Ltd., working in collaboration with the Post Office Engineering Department, has evolved a lampholder adaptor flasher with a built-in suppressor unit that has passed Post Office tests and complies with the relevant clauses of B.S.800 (limits of radio interference) covering television bands of 40-70 Mc/s. It is also highly effective on the broadcast radio bands. The price of the new flasher is 14s.

Ratings of the flasher are :

| Volts | Watts |
|---|---|
| 100/115 | 15/20 |
| 200/260 | 30/40 |
| 100/115 | 30/40 |
| 200/260 | 60/80 |
| 100/115 | 60/80 |
| 200/260 | 100 |

A special version of the unit suitable for use with Christmas and party decoration lamps has also been developed.—General Electric Co. Ltd., Magnet House, Kingsway, W.C.2.

### Radio Mail Test Instrument Kits

THE recent appearance on the market of these kits has opened up new fields for constructors and others whose needs for really cheap test gear has not been catered for hitherto.

The latest addition is an Inductance Bridge Kit, priced 42s. 6d., covering from 50 $\mu$Hy. to 100 Hy. in five ranges. This generous coverage compares well with the flexibility of the six range Res/Cap Bridge Kit supplied by the same firm at 31s. 6d., covering from 10$\Omega$ to 5M$\Omega$, and from 500 pF to 50$\mu$F.

Each kit is supplied with a ready calibrated panel, a separate direct reading scale being given for each range. Clear diagrams and comprehensive instructions make assembly remarkably easy with the simplest of tools.—Radio Mail, 4, Raleigh Street, Nottingham.

### New Mullard Deaf Aid Valves

TINY valves, an inch long and thinner than an ordinary pencil, are the latest contribution of Mullard Ltd. to deaf aid design. Battery economy, making possible even smaller deaf aid appliances, has thus been achieved.

These new valves reduce low tension drain by 33 per cent. Filament consumption of previously available Deaf Aid valves was 15 mA. These new valves, designated the Mullard DF64 and DL64, consume only 10 mA. filament current. They mark a significant advance in L.T. battery economy, the most pressing problem of deaf aid design. Batteries of a given size will now last longer, or smaller batteries may be used to give the same life as the standard batteries used with 15 mA. valves. In practice the L.T. current will now be 20 mA. for a three-stage amplifier using types DF64 and DL64, compared to 30 mA., using the 15 mA. types. The design rating of the L.T. voltage, 1.25 v., permits the use of any of the types of L.T. battery at present available, including mercury cells.

The potential reduction in battery size using the new Mullard valves is not confined to the L.T. cell. These new subminiatures have been specially designed to give optimum performance with H.T. supplies of 15 v., as opposed to 22½ v. in the case of current types. The valves themselves are smaller than their 15 mA. counterparts.—Mullard Ltd., Century House, Shaftesbury Avenue, W.C.2.

### Teletron Coils

AMONG the range of precision-wound coils manufactured by the Teletron Company is a new triple-wound H.F. coil designed especially for use with the modern Germanium crystal diode. The design is such that minimum damping of the tuned section takes place and maximum selectivity with high sensitivity is obtained. A standard .0005 $\mu$F tuning condenser should be used and the results are better than with the ordinary type of coil. The price is 3s.—The Teletron Co., 266, Nightingale Road, Edmonton, N.9.

### Ediswan (Mazda) Valve Booklet

A NEW handy pocket-size booklet has been issued by the Edison Swan Electric Co. Ltd. In 64 pages it covers all the Mazda valves with principal characteristics, Mazda valve complements of standard television receivers, equivalents, etc. The booklet is available free of charge from any Ediswan district office.—Edison Swan Electric Co. Ltd., 155, Charing Cross Road, London, W.C.2.

### Gillon Electric Ltd.

A NEW company under the above title has recently been formed by Mr. G. D. Gilbert and A. L. Leeson, late of Allen Components. They will specialise in the manufacture of radio and television components and the address s Rookstone Works, Rosemary Lane, Camberley, Surrey.

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Telegrams : Newnes, Rand, London.
Registered at the G.P.O. for transmission by Canadian Magazine Post.

# R.S.C. 25 Watts "PUSH-PULL" QUALITY AMPLIFIER

We are proud to introduce our A II Quality Amplifier, which we consider to be the best value in amplifiers offered to-day. The volume of its high fidelity reproduction is completely controllable, from the sound of a quiet intimate conversation to the full, glorious volume of a great orchestra. Its sensitivity is so high that in areas of fair signal strength it can be operated straight from a crystal receiver. Entirely suitable for standard or long playing records in small homes or in large auditoriums. For electronic organ or guitar or for garden parties or dance bands. The kit is complete to the last detail, and includes easy to follow point-to-point wiring diagrams.

Twin volume controls with twin input sockets allow SIMULTANEOUS INPUTS for BOTH MICROPHONE and GRAM, or TAPE and RADIO. SEPARATE BASS and TREBLE CONTROLS, giving both LIFT and CUT. FOUR NEGATIVE FEEDBACK LOOPS with 15 db in the main loop from output transformer to voltage amplifier. Frequency response ± 3 db, 50-20,000 c.p.s. HUM and DISTORTION LESS THAN 0.5 per cent. measured at 10 watts, six B.V.A. valves, Marconi Osram KT series output valves, A.C. only, 200-230-250, v. 50 c/cs. input. 120 v. H.T. LINE. Paper reservoir condenser. Compact chassis. Matched components. Size 14 - 10 - 9ins. Outputs for 3 or 15 ohm spkrs. Available in kit form at the amazingly low price of 9 gns. Plus carriage 5/-. Or ready for use 59/- extra.

**BATTERY SET CONVERTER KIT.** All parts for converting any type of Battery receiver to All Mains A.C. 200-250 v 50 c/cs. Kit will supply fully smoothed H.T. of 120 v 90 v, or 60 v at up to 40 mA, and fully smoothed L.T. of 2 v at 0.4a to 1 a. Price, complete with circuit, wiring diagrams and instructions, only 48/9. Or ready to use, 7/9 extra.

**PERSONAL SET BATTERY SUPERSEDER KIT.** A complete set of parts for construction of a Unit (housed in Metal Case) to replace Batteries where A.C. Mains supply is available. Input 200-250 v 50 c/s. Outputs 90 v 10 mA and 1.4 v 250 mA, fully smoothed. For 4-valve receivers. Price complete with circuit. Only 35/9. Or ready for use, 42/6. Size of unit, 5½ x 4 x 1¼ins.

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

**BATTERY CHARGER KITS.**
For mains 200-250 v 50 c s.
To charge 6 v acc. at 2 a, 25/6.
To charge 6 or 12 v acc. at 2 a 31/6.
To charge 6 or 12 v acc. at 4 a, 49/9.
Above consist of transformer, full wave rectifier, fuses, fuseholders and steel case. Any type assembled and tested. 6/9 extra.

**EX-GOVT. VALVES (NEW)**

| | Each | | Each | | Each |
|---|---|---|---|---|---|
| 1T4 | 8/9 | 6L6G | 11/9 | 35Z4GT | 10/6 |
| 1R5 | 8/9 | 6Q7G | 9/11 | 35L6GT | 9/11 |
| 1S5 | 8/11 | 6SL7GT | 11 9 | D1 | 1/9 |
| 3S4 | 9/9 | 6V6G | 8 9 | EF36 | 5/11 |
| 5Y3G | 8 9 | 6V6GT | 8 9 | EB91 | 8 9 |
| 5U4G | 10/6 | 6X5GT | 8 9 | EF91 | 9/9 |
| 5Z4G | 9/6 | 8D2 | 2 11 | EL32 | 6/11 |
| 6AL5 | 9/9 | 807 | 6/11 | MU14 | 9/6 |
| 6F6G | 7 11 | 9D2 | 2/11 | MS Pen | 5/9 |
| 6AM6 | 9/9 | 954 | 1/11 | RK34 | 1/11 |
| 6J5G | 5/11 | 12K7GT | 10/6 | SP4 | 5/9 |
| 6J7G | 7/6 | 12K8GT | 10/6 | SP61 | 2/9 |
| 6K7G | 6/11 | 12Q7GT | 10 6 | VU120 | 2/11 |
| 6K8G | 11/9 | 15D2 | 5/9 | | |

**ELECTROLYTICS** (Current production. Not ex-Govt.)

| Tubular Types | | | |
|---|---|---|---|
| 8/μF 350 v | 1 9 | 8/μF 500 v | 2/11 |
| 8/μF 450 v | 1 11 | 16/μF 450 v | 2/9 |
| 8/μF 500 v | 2/9 | 24/μF 350 v | 2 11 |
| 16/μF 350 v | 2/3 | 32/μF 350 v | 2 11 |
| 16/μF 450 v | 2 9 | 32/μF 500 v | 3/11 |
| 24/μF 350 v | 3/6 | 40/μF 450 v | 4/11 |
| 32/μF 350 v | 3/6 | 64/μF 450 v | 4/9 |
| 25/μF 25 v | 1 3 | 8-8/μF 350 v | 3/9 |
| 50/μF 12 v | 1 3 | 8-8/μF 450 v | 3/9 |
| 50/μF 50 v | 2 3 | 8-16/μF 450 v | 3/11 |
| | | 8-16/μF 450 v | 4/6 |
| | | 16-16/μF 450 v | 4/11 |
| Can Types | | 16-32/μF 350 v | 5/3 |
| | | 32-32/μF 350 v | 4/11 |
| 8/μF 450 v | 2/3 | 32-32/μF 450 v | 5/11 |

**WILLIAMSON AMPLIFIER KIT.** All parts to Author's spec. Only 14 gns.

**A PUSH-PULL, 3-4 watt HIGH-GAIN AMPLIFIER FOR £3/12/6.** For mains input 200-250 v 50 c/s. Complete kit of parts including circuit, point to point wiring diagram, and instructions. Amplifier can be used with any type of Feeder Unit or Pick-up. This is not A.C./D.C. with "live" chassis, but A.C. only with 400-0-400 v trans. Output is for 2-3 ohm speaker. (We can supply a very suitable 10in. unit by R.A. at 31/-.) The amplifier can be supplied ready for use for £1 extra. Carr. 2/6. Full descriptive leaflet. 9d.

**BRAND NEW COLLARO 3 SPEED AUTOMATIC RECORD CHANGERS.** Type RC3.521, complete with P.U. (2 plug-in crystal heads). Mains input 200-250 v. Limited number at only £9.19.6.

**P.M. SPEAKERS.** All 2-3 ohms. 5in. Goodmans, 14 9. 6½in. Elac., 14 11. 6½in. Plessey with 5,000 ohm trans., 14/11; 8in. Plessey, 15 9. 8in. R.A. Heavy Duty 18 9. 10in Rola 29 6. 10in. Plessey, 18 6. 10in. R.A., 31 -. 10in. Rola with 5 000 ohm output trans., 31 9; 12in. Truvox, 49 9.

**EX-GOVT. SMOOTHING CHOKES.**

| | |
|---|---|
| 250 mA 40 H 200 ohms, tropcalised | ... 17/6 |
| 250 mA 10 H 50 ohms, potted ... | ... 17/6 |
| 250 mA 20 H 250 ohms, trop. ... | ... 14/9 |
| 200 mA 20 H 200 ohms, trop. ... | ... 12/9 |
| 150 mA 6-10 H 150 ohms tropicalised ... | 7/9 |
| 100 mA 7-10 H 100 ohms ... ... | ... 6/11 |
| 100 mA 5 H 100 ohms, tropicalised | 7 11 |

**COAXIAL CABLE,** 75 ohms, ½ in., 9d. yard. Twin Screened Feeder, 9d. yard.

**CHASSIS,** 16 s w.g. Undrilled Aluminium Receiver Type 6 x 3½ x 1½in., 2/6; 7½ x 4½ x 2in., 3 3; 10 x 5½ x 2in., 3/9; 11 x 6 x 2½in., 4 3; 12 x 8 x 2½ in., 5/3; 16 x 8 x 2½in., 7 6; 20 x 8 x 2½ in., 8 11; Amplifier type (4 sided), 12 x 8 x 2½in., 7 11; 16 x 8 x 2½in., 10/11. 14 x 10 x 3in., 13 6; 20 x 8 x 2½in., 13/6.

**SILVER MICA CONDENSERS,** 5, 10, 15, 20, 25, 30, 35, 40, 50, 100, 120, 150, 200, 230, 300, 400, 500, 1,000 (.001 mfd.), 2,000 pfd. (.002 mfd.), 5d. each, 3/9 doz., one type.

**VOLUME CONTROLS** with long (1in.) spindles, all values, less switch, 2 9, with S.P. switch, 3 9.

# R.S.C. MAINS TRANSFORMERS (FULLY GUARANTEED)

**Interleaved and Impregnated. Primaries 200-230-250 v 50 c s Screened.**

**TOP SHROUDED, DROP THROUGH**

| | |
|---|---|
| 250-0-250 v 70 mA, 6.3 v 2.5 a ... | ... 12 11 |
| 260-0-260 v 70 mA, 6.3 v 2 a, 5 v 2 a | ... 14/11 |
| 350-0-350 v 80 mA, 6.3 v 2 a, 5 v 2 a | ... 17/9 |
| 350-0-350 v 80 mA, 6.3 v 2 a, 4 v 2.5 a | 14 11 |
| 250-0-250 v 100 mA, 6.3 v 4 a, 5 v 3 a... | 23 9 |
| 300-0-300 v 100 mA, 6.3 v-4 v 4 a, c.t. 0-4-5 v 3 a ... ... ... ... | 23 9 |
| 350-0-350 v 100 mA, 6.3 v-4 v 4 a, c.t. 0-4-5 v 3 a ... ... ... ... | 23 9 |
| 350-0-350 v 150 mA, 6.3 v 4 a, 5 v 3 a | 29 11 |
| 350-0-350 v 150 mA, 6.3 v 2 a, 6.3 v 2 a, 5 v 3 a ... ... ... ... | 29 11 |

**FULLY SHROUDED UPRIGHT**

| | |
|---|---|
| 250-0-250 v 60 mA, 6.3 v 2 a, 5 v 2 a. Midget type 2½-3-3in. ... ... ... | ... 16 9 |
| 350-0-350 v 70 mA, 6.3 v 2 a, 5 v 2 a | ... 18 9 |
| 250-0-250 v 100 mA, 0-4-6.3 v 4 a, 0-4-5 v 3 a ... ... ... ... | ... 25 9 |
| 250-0-250 v 100 mA, 6.3 v 6 a, 5 v 3 a, for R1355 conversion ... ... ... | ... 29 9 |
| 300-0-300 v 100 mA, 0-4-6.3 v 4 a, 0-4-5 v 3 a ... ... ... ... | ... 25 9 |
| 350-0-350 v 100 mA, 0-4-6.3 v 4 a, 0-4-5 v 3 a ... ... ... ... | ... 25 9 |
| 350-0-350 v 150 mA, 6.3 v 4 a, 5 v 3 a | ... 33 9 |
| 350-0-350 v 180 mA, 6.3 v 6 a, 6.3 v 3 a, 5 v 3 a ... ... ... ... | ... 45 9 |
| 350-0-350 v 250 mA, 6.3 v 6 a, 4 v 8 a, 0-2-6 v 2 a, 4 v 3 a, for Electronic Eng. Televisor ... ... ... | ... 67 6 |
| 425-0-425 v 200 mA, 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, etc. ... | 51 - |
| 450-0-450 v 250 mA, 6.3 v 6 a, 6.3 v 6 a, 5 v 3 a ... ... ... ... | ... 65 9 |

**ELIMINATOR TRANSFORMERS**

| | |
|---|---|
| Primaries 200-250 v 50 c/s, 120 v 40 mA | 7 9 |
| 120 v 40 mA, 6-0-6 v 1 amp ... | ... 14/9 |
| 90 v 10 mA, 8-0-8 v 250 mA ... | ... 8/11 |

**FILAMENT TRANSFORMERS**
All with 200-250 v 50 c/s primaries 6.3 v 1.5 a, 5 9; 6.3 v 2 a, 7 6; 0-2-6.3 v 2 a, 7 9; 12 v 1 a, 7 11; 6.3 v 3 a, 9/11; 6.3 v 6 a, 17 6; 0-2-4-5-6.3 v 4 a, 16/9; 12 v 3 a or 24 v 1.5 a, 17 6.

**CHARGER TRANSFORMERS**
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*No. of Blueprint*

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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*

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**One-valve : 2s. each.**

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### QUERY COUPON

This coupon is available until Dec. 7th, 1953, and must accompany all Queries, sent in accord with the notice on page 774.
PRACTICAL WIRELESS, Dec., 1953.

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for a cold winter by making our low cost **Electric Blanket**. 27 yards of special heater wire and blueprint. 20/-. Blueprint only 1/6.

## CONNECTING WIRE SNIP

P.V.C. insulated 23 s.w.g. copper wire in 100ft. coils. 2/9 each. Colours available: Black, Brown, Red, Orange, Pink, Yellow, White, Transparent. 4 coils for 10/-.

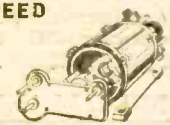
## LAST FEW £3/19/6

The Lectross warms room as it dries clothes. Size 3ft. wide. 3ft. high and 5in. deep. It has four stove-enamelled rails and works off A.C. or D.C. mains, consuming 650 watts. Fully guaranteed. Price £3.19.6. plus 7/6 carriage.

## SOMWEAVE

This really lovely loud-speaker fabric we offer at approximately a third of today's cost. It is 12in. wide and our price is 12/- per yard or panels 12in. x 12in., 1/9 each. This is also very suitable for covering plain wooden cases for portable radio amplifiers, etc.

## MULTI-SPEED MOTOR



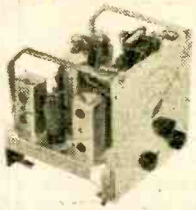
Works off A.C./D.C. mains fitted with gearbox any speed from 1 r.p.m. 12/6. post and pkg., 1/6.


Complete kit comprises Hi-craft 40 watts control unit, starter lamp, lamp holders, clips and wiring diagram. Price less tube 22/6 plus 1/6 post. With tube 30/-, carriage and insurance 3/6. Tubes 7/6 each, carriage free, minimum quantity 5.

## PLUGS for MODERN VALVE HOLDERS

Each is fitted with a rubber shroud. For B7G button base and type 2 for B8A. Price 1/4 each, discounts for quantities.

# BARGAINS OF THE MONTH

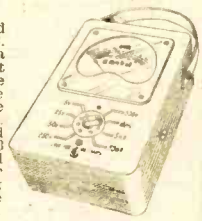


## SUPERHET RADIO by BEETHOVEN

Extremely well built on chassis, size approx. 9½ x 7½ x 8½, using only first-class components, fully aligned and tested—110-240 volt A.C. mains operation. Large clear edge-lit dial. Three wave bands covering 200-550, 35-120, 13-42 metres. Complete with five Mullard valves, frequency changer, double diode triode, pentode output and full wave rectifier. Complete with Rola loud speaker ready to operate.

Special cash with order price this month, £7.17.6, carriage and insurance 7/6. Hire purchase terms, £3 deposit, balance over 12 months.

## MULTI-METER KIT



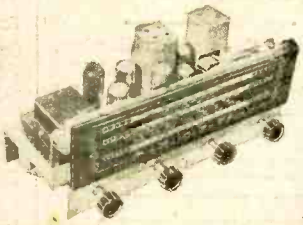
The Multi-meter illustrated measures D.C. volts, D.C. m-Amps and ohms. It has a sensitivity of 200 ohms per volt and is equally suitable for the keen experimenter, service engineer or student. All the essential parts including 2in. moving coil meter, selected resistors, wire for shunts, 8 point range selector, calibrated scale, stick on range indicator and full instructions for making are available as a kit, price 15/-, plus 9d. post and packing.

## HUGE NEW PURCHASE

We have purchased another large quantity of the Collaro Auto record changer type R.C. 3/521, three-speed suitable for all types of records and with the latest type crystal pick-ups.

Buy one this month as you will not be able to again at this special price of £10.0.0. plus 7/6 carriage and insurance.

## THE "WINDSOR"



This is a 5 valve A.C. superhet, covering the usual long, medium and short wavebands. It has a particularly fine clear dial with an extra long pointer travel. The latest type loctal valves are used and the chassis is complete and ready to operate.

Chassis size 15in. x 6in. x 6in. Price £9.19.6 complete with 8in. speaker. Carriage and insurance 10/-. H.P. terms £3.7.0 deposit. Table model cabinet to suit 37/6 plus 3/6 postage and insurance.

## TABLE RADIO CABINET

Due to a special purchase, we are able to offer this very fine cabinet, size approx. 16 x 16 x 7 —walnut veneered and satin finished. Complete with 3 colour, 3 waveband glass scale at only 37/6, carriage and packing 3/6. We also have a limited quantity of the complete chassis to fit these cabinets, specifications 5 loctal valves, standard long—medium and short wavebands: A.V.C. 8 in. speaker. A.C. mains operation. Price £9.19.6. plus 10/- carriage and insurance. H.P. terms £3.7.0 deposit, or with cabinet £4.0.0.

# AUTO-RADIOGRAM 29 GNS.

**RADIOGRAM CABINET.** Console Type Cabinet. With full grained walnut finish, will take standard type auto change gram unit. Price, £11.10.0. H.P. terms, £3.17.0 deposit, and 12 monthly payments of 16/9, plus 15/- carriage.

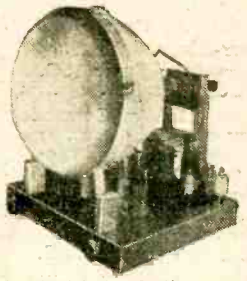
**Radio Chassis to suit.** £8.19.6. H.P. terms, £3 deposit and 10 monthly payments of 13/-, plus 7/6 carriage.

**Auto Change Units.** For long-playing and standard records with suitable pick-up head, £11.11.0.

**SPECIAL OFFER.** Cabinet Radio Chassis and Auto Changer, 29 gns. H.P. terms, £10.14.0 deposit and 12 monthly payments of £2.3.0.

## THE "SUPERIOR" 15in. BIG PICTURE

**Up to the minute TV for only £37-10-0.**



A 20 valve televisor for the amateur constructor, all components, valves and 15in. Cossor Cathode Ray Tube costs £37.10.0. plus £1 carriage and insurance or £12.10.0 deposit and 12 monthly payments of £2.11.6. Constructor's envelope giving full details and blueprint, 7/6. Returnable within 14 days if you think you cannot make the set.

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