A BEGINNER'S GUIDE TO RADIO

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PRACTICAL WIRELESS

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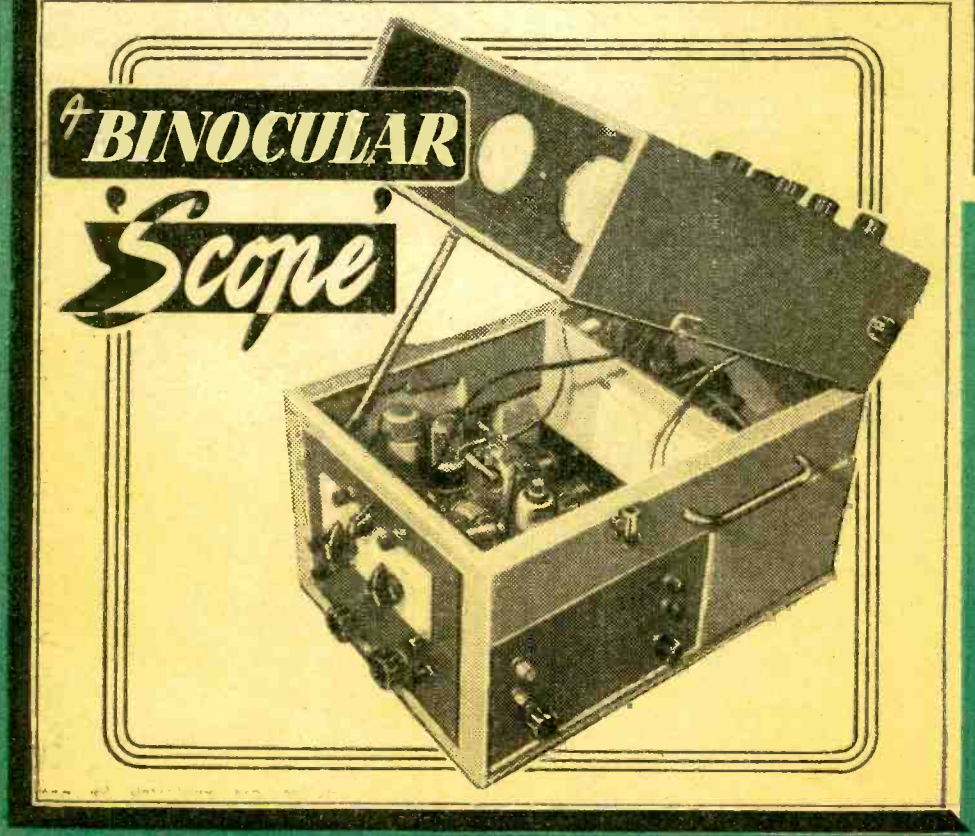
EDITOR:
F.J.CAMM



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A FULL-COMPASS ELECTRONIC ORGAN, ETC., ETC.

Practical Wireless

EVERY MONTH
VOL. XXX, No. 567, JANUARY, 1954

Editor F. J. CAMM

22nd YEAR OF ISSUE

COMMENTS OF THE MONTH

By THE EDITOR

More About Interference

THE Radio Industry Council is very properly concerned about the problem of interference as it affects both sound and vision receivers. The greatest publicity on this subject has been given to the interference with vision programmes caused by ignition systems, vacuum cleaners and other electrical apparatus. The trade launched a campaign early in 1953 to lessen this cause of complaint, and an Act was passed making it compulsory for all new cars to be fitted with suppressors as from July, 1953. Pressure, which was brought to bear in Parliament by M.P.s to get the regulations modified so that they applied also to older cars, which are in the majority, was unsuccessful. It is not generally realised that TV receivers can cause very severe interference with sound programmes.

One aspect of the matter, however, which has not been aired and which deserved consideration on the part of member firms of the R.I.C., is that manufacturers of both radio and TV receivers in some cases also manufacture hair dryers, vacuum cleaners and electro-medical apparatus which is unsuppressed. Once they have successfully campaigned therefore for the fitting of suppressors to motor-cars they should, at least, set their own house in order by not selling unsuppressed apparatus. They admit that the cost of suppression is small and we suggest that the R.I.C. should instruct its members to fit them.

This criticism applies equally to dealers who may one day sell a TV receiver to one person and the following sell a hair dryer to the next-door neighbour. The trade should really be quite consistent about this. Motor-cars, after all, only give rise to spasmodic interference, but a vacuum cleaner which may be running for an hour can completely obliterate the picture for that time; and equally a TV receiver can cause such chronic interference with sound receivers in the neighbourhood that the programmes lose all entertainment value. So when the trade criticises causes of interference it should first set its house in order. Physician heal thyself.

Some well-known makers of TV receivers also manufacture the unsuppressed devices to which we have drawn attention.

NEXT MONTH!

The Universal (AC/DC) Version of the CORONET 4

THE WHITE PAPER

THE long-awaited White Paper on television policy in relation to commercial TV programmes does not contain any surprises and it merely reaffirms what has already been stated in Parliament. It will be remembered that in the previous White Paper on broadcasting the Government stated that in the expanding field of television, provision should be made to permit some element of competition. The Government also promised that Parliament should have an opportunity of considering the terms and conditions under which competitive television would operate.

Since that statement fears have been expressed that TV on a commercial scale would degenerate to the semi-lewd programmes common in America. The White Paper endeavours to set such fears at rest, by stating that the BBC will continue to be the main instrument for broadcasting in this country and that the Government has authorised a very considerable extension of the BBC's activities which will bring more than 90 per cent. of the population within range of the TV programmes—the highest density of coverage of any country in the world. Programmes will not be sponsored. The advertiser will buy programme time and the proprietors of the commercial station will be entirely responsible for the programme material. The White Paper says that there is a vast difference between accepting advertisements in the programmes and sponsoring. The Government, however, should remember that advertisers are not going to pay large sums of money merely to get a mention in intervals in the programme.—F. J. C.

ROUND the WORLD of WIRELESS

First Aid by Telephone

THE Touring Club de France has provided gendarmerie stations with small cars that are fitted with all necessary tools for rapid repair work and a complete first-aid medical outfit.

First-aid telephone stations already exist every two and a half miles on the roads from Paris to Calais, Lille and Havre.

Broadcast Receiving Licences

THE following statement shows the approximate number of sound receiving licences issued during the year ended September, 1953. The grand total of sound and television licences was 13,090,990.

Region	Number
London Postal ...	1,700,454
Home Counties ...	1,457,428
Midland	1,304,171
North Eastern... ...	1,688,052
North Western ...	1,321,128
South Western ...	1,023,810
Wales and Border ...	658,240
Total England and Wales	9,153,283
Scotland	1,109,387
Northern Ireland ...	213,061
Grand Totals	10,475,731

Queen is Patron of Radio Show

THE Radio Industry Council announces that the National Radio Show (of Great Britain) will be held at Earls Court, London, from August 25th to September 4th, with a pre-view for overseas and other special visitors on August 24th. It will be organised on the same lines as the show in September, 1953, when the total attendance exceeded 300,000.

The Queen has consented to be patron of the exhibition, this being the first time that the reigning monarch has accepted the patronage. Her Majesty, as Princess Elizabeth, was patron of the Radio Show in 1951 jointly with Queen Mary, who was patron from 1947 until her death in 1953.

Success in America

MR. H. W. READ, sales manager of Whiteley Electrical Radio Co., Ltd., returned recently from a very successful business trip to America.

As a result of his visit, the well-known Stentorian loudspeakers are to be distributed throughout the United States. The success of this new enterprise, in the face of severe competition from American manufacturers, is a tribute to British technical achievement.

Brightening the Home

LONGER plays, more light music and variety are the main ideas behind the BBC's plans to brighten up the Home Service.

Mr. Andrew Stewart, 45-year-old Scot who became Home Service Controller at the beginning of 1953, intends to back this policy by dropping the type of programme that is more effectively done by television, such as a relay broadcast from a circus or theatre.

"We are going to leave broadcasts of stage plays to TV," he states, "and concentrate on longer-lasting plays which are original works or adapted from books, and designed to appeal to the imagination."

Bad Yorkshire Listening

WEAK radio reception along the North-East coast of Yorkshire is causing considerable annoyance to listeners in that region.

The low-powered transmitter built at Scarborough to improve coastal reception has little effect on some of the more remote districts, where it is impossible to receive a signal without a great deal of background noise. G.P.O. officials are checking up on licences in the Whitby area and residents there are hoping that engineers will hear for themselves the very poor service that is being provided.

Hungarian Radio Transmitters for China

HUNGARY is making radio-transmitters for China, according to a report in the newspaper "Szabad Nép."

They are being made at the Beloiannis factory at Budapest on the basis of experimental work carried out in connection with the recent erection of a new 135-kilowatt relay station at

The new "Take It From Here" team seen during its first meeting. Left to right: Dick Bentley, June Whitfield, Jimmy Edwards and Alma Cogan.

Balatonszabadi, near the north-eastern end of Lake Balaton.

The new station was opened by the Deputy Minister of Post, Mr. Antal Katona, on October 24th. It will relay programmes brought from Budapest by underground cable. A novel feature of the new station is that water used to cool the transmitting tubes is afterwards used to warm the buildings.

Tannoy in Canada

ALREADY the name and fame of Tannoy has spread thinly over the North American Continent with such installations as at United Nations, New York, and in the House of Commons, Ottawa. In order further to propagate distribution of their products, and in particular the now famous "Dual Concentric Speakers," a new company has been formed, "Tannoy (Canada), Ltd.," with headquarters in Toronto. The resident executive in charge of this American project is Mr. F. A. Towler, who was for many years sales manager in London. He is accompanied by his wife, Mrs. Mary Towler, who was also at one time a personal secretary in the Tannoy organisation.

Inauguration of this dollar-earning project ties up with the Tannoy exhibition at the Audio Fair in New York, where the Canadian company are displaying a wide range of Tannoy products. Mr. Michael Fountain (Mr. Tannoy, junior) has departed for New York to supervise these American activities.

Home Service Transmitter at Bexhill

A NEW low-power Home Service transmitter at Bexhill was brought into operation on Sunday, November 8th, to replace the temporary low-power transmitter at Hastings. The new transmitter uses the same wavelength, 206 metres, and radiates the same programme, the West of England Home Service.

The Bexhill transmitter has a power of 2 kW and its service area includes not only Hastings and St. Leonards but also Bexhill, Eastbourne, Battle and Hailsham.

Radar Association—Tech. Division

THE Radar Association was originally formed as a social club for ex-war-time members of the Royal Air Force who had been engaged as radar mechanics and operators. In recent years the increasing demand to expand the technical side has resulted in the creation of a new technical division, membership of which is open to those who are, or have been, engaged on radar either within industry or H.M. Forces. As a result of the formation of this new division a series of lectures has been arranged as part of the 1953-54 winter programme. An operational division caters for those who are or have been engaged on the operational side of radar, and part of the new programme will be devoted to this aspect.

Pye's £20,000 Award

AT a dinner in London recently it was announced that the Government had made an award of £20,000, free of tax, to Pye, Ltd., Cambridge, for the development work they had done during the war in producing the radio-operated fuse and the No. 19 communications set for tanks.

Mr. C. O. Stanley, chairman of Pye, Ltd., said that this was one of the splendid examples of co-operation between the Service departments, the Supply Ministries and a free enterprise organisation. He said he was convinced that exactly the same exchange of ideas could and should operate in peacetime for the benefit of the nation.

Mr. Stanley went on to say that the company had decided that the £20,000 award should be given to the men who had been responsible for the inventions, but he recognised that however ingenious the inventors had been the success of their work had depended on every man and woman in the factory. Consequently, his company have decided, subject to the agreement of their shareholders, to match the government's £20,000 by presenting the sum of £20,000 to the employees' benevolent fund, so that everybody in the Pye organisation could feel that they had had a hand in this success.

Better Sound

THE BBC is contemplating the erection of a chain of 51 very high frequency radio transmitters at a total cost of £1,500,000.

It is expected that each station will eliminate interference from foreign transmitters and give listeners reception of higher fidelity, especially after dark.

Nineteen of the transmitters would be used for the Home Service and sixteen each for the Light and Third Programmes.

Mr. H. W. Read, sales manager of Whiteley Electrical Radio Co., Ltd., alights from the B.O.A.C. "Stratocruiser" at London Airport on his return from a recent business trip to America.

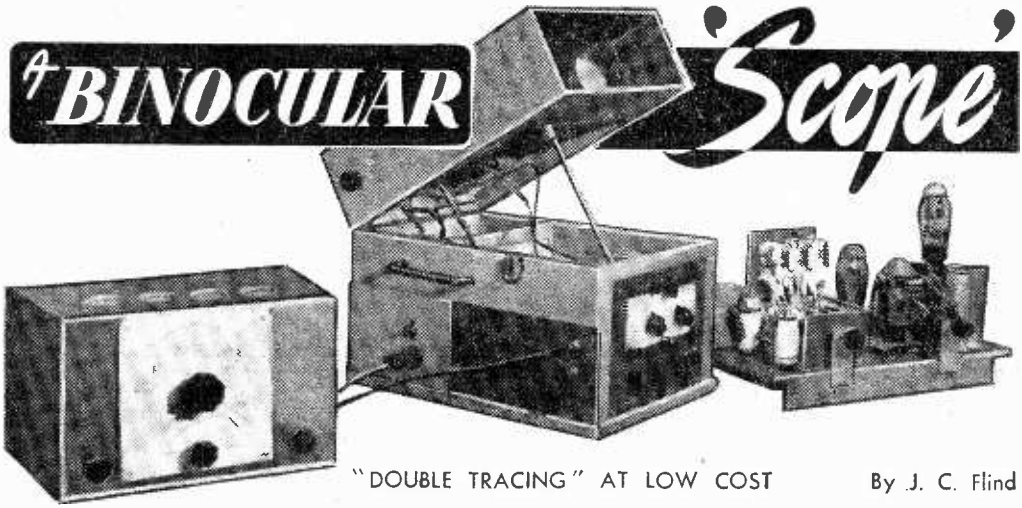
Smog Warning

MR. HAROLD MACMILLAN, Housing Minister, told the House of Commons recently that the possibility would be discussed of a warning by radio of the approach of foul weather conditions similar to the fog period that clamped down on London last winter.

Licence Rush

THE arrival of a detector van in Brighton caused the number of sound licences taken out to increase by 1,336.

A BINOCULAR 'Scope



"DOUBLE TRACING" AT LOW COST

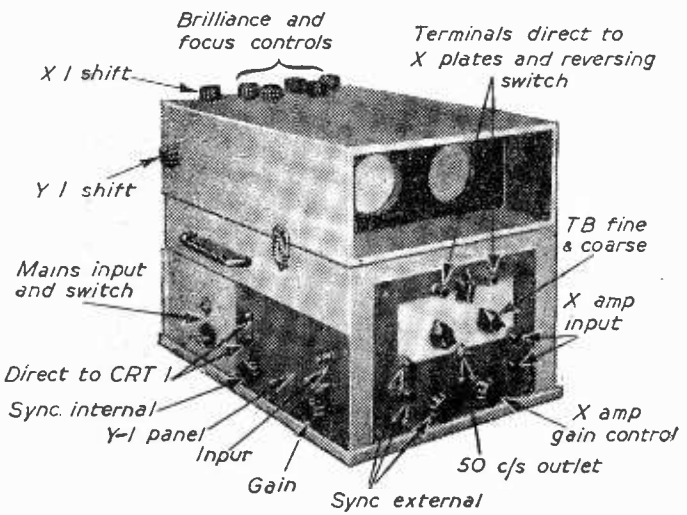
By J. C. Flind

THE instrument to be described in these notes is the outcome of some years of experimental work carried out with a conventional "one-eyed" oscilloscope, in the course of which its limitations became more and more of a handicap. The new instrument represents an attempt to provide at reasonable cost those extra facilities which mean so much.

The most serious shortcoming of the usual 'scope, in the author's view, is the lack of provision for double-tracing, and from time to time various forms of mechanical and electronic switching were tried. They were not a success, however, partly owing to the small size of the tube used, and partly because of the complications involved in providing polarising voltages to separate the two traces on the screen. Finally, the solution which is embodied in this design was suggested by an article in an old copy of PRACTICAL WIRELESS, where a contributor described the use of a twin-tubed ex-Service unit, now, alas, no longer obtainable.

In the "Binocular 'Scope" the two tubes are mounted side by side, and as close together as can conveniently be arranged. The "X" input, usually from the timebase, is common to both, while there are two quite separate "Y" input channels, one running to each tube. Thus, the instrument can be made to show simultaneously what is happening at any given moment, either in two distinct circuits, or at two different points in the same circuit, both traces being referred to the same timebase. For example, it is possible to study on one tube the effect of progressive variations of the tone control settings in a gramophone amplifier, while at the same time monitoring the input by means of the other tube. Sources of distortion, e.g., in n.f.b. loops, can be identified and many other applications will at once suggest themselves.

A second important point was the fact that all experimental apparatus must inevitably be modified from time to time, in the light of the worker's changing needs and, perhaps, growing experience. Accordingly, the whole instrument has been designed on the unit principle: the "core" is a heavy-duty power-pack, whose various outputs terminate in four-pin sockets made from discarded battery-type valveholders (not the least of the attractions of this design is the way in which it finds uses for these "spares-box" components!). Into these sockets are plugged the double C.R.T. unit, the timebase and X-amplifier combined, and the two separate Y-amplifiers; any one of these can be withdrawn for examination or alteration, without the need to unsolder any joints. This has inevitably involved a case of fairly generous dimensions, but this is in some ways an advantage; when the time comes to



Main features of the 'scope are indicated here

try out modifications there will be room for them, and there is a reasonable distance between the mains transformers and the C.R.T.'s, which helps to avoid "spot-wobble," which, however desirable it may be in a large-screen televisor, is not to be encouraged in an oscilloscope!

In order to keep down the cost, it was decided to use ex-Service tubes, valves and transformers as far as possible, and in particular to avoid E.H.T. circuits calling for high-voltage capacitors; accordingly, the 'scope was designed around the popular 2½in. tube, the V.C.R. 139-A, which has now reappeared on the surplus market, complete with base and a very efficient mu-metal screen, at reasonable prices.

The lay-out plan, Fig. 1, and the half-tone illustrations give a general idea of the arrangement and the dimensions; the power-pack occupies the rear portion of the main box, leaving the front part free for the timebase and amplifiers and their controls. Each of these latter units is built on a small separate chassis, made from heavy-gauge tinplate, and these chassis are bolted to the control panels, and not to the cabinet. Each panel is held in place by small brass screws, so that if any item has to be removed it is only necessary to undo these screws, unplug from the power pack and withdraw the sub-assembly complete.

The two V.C.R. 139-A's occupy a deep lid, fitting flush on top of the main box and hinged to it at the rear. When in use, the lid is lifted to a convenient viewing angle and held in place by a strut; this has the additional advantage of providing ventilation for the valves, etc.

The brilliance, focus and shift controls form part of the tube circuits, and are mounted at the rear of this lid; the tubes themselves are set back about 3in., so that they are viewed at the bottom of a sort of shallow-box, painted matt black, so helping to ensure easy visibility of the traces.

The Power Pack

This is required to furnish the following:

1. 6.3 volts×1.3 amps., for the gas-filled triode in the timebase. As the manufacturers of this type of valve usually specify that the potential difference between the heater and the cathode must not exceed about 50 volts, this winding *must* be separate from No. 2, and it cannot be earthed.

2. 6.3 volts×2.7 amps., for the heaters of the remaining valves. One side of this winding should be earthed.

3. 5.0 volts×2 amps., for the rectifier heater.

4. H.T. at 200 volts×40 mA., for the various amplifiers and the timebase.

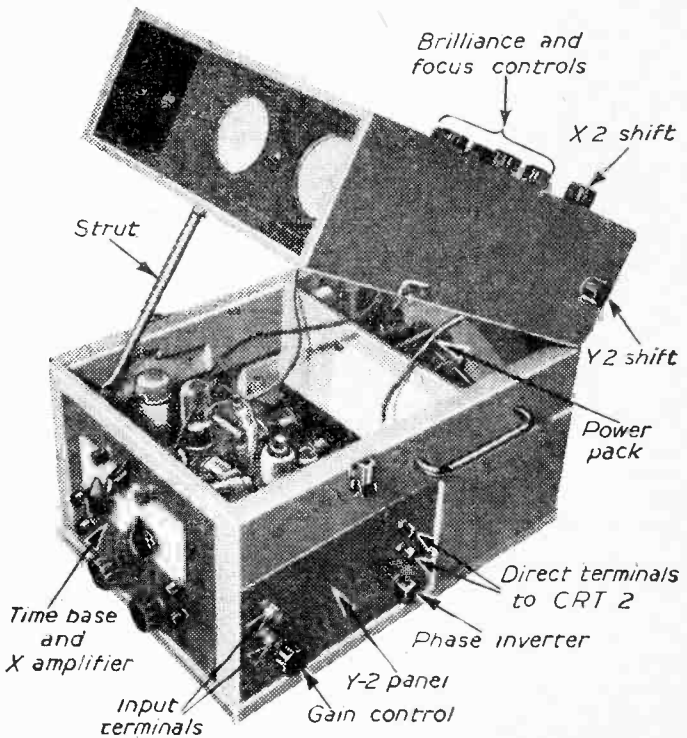
5. E.H.T. at 650 volts, for the two C.R.T.'s and the shift network.

6. 4 volts×2 amps., for the C.R.T. heaters (an entirely separate transformer is advised).

In spite of this formidable-looking list, the whole job can be done with two mains transformers, easily available: T.1 is actually an ex-equipment transformer supplied by Alpha Radio Supply Co., of Leeds, and T.2 an ordinary 4-volt 3-amp. heater type. The primaries are connected in parallel, and notwithstanding the fact that No. 1 heater supply operates at up to 100 volts positive, and No. 6 at about 350 volts negative, no trouble has been experienced on the score of insulation.

As will be seen from the circuit diagram, Fig. 2, V1, which may be a 5Z4 or similar type, is connected as a full-wave rectifier, giving about 350 volts positive at the cathode. This is smoothed by C1 and C2 and the L.F. choke Ch. 1—anything which will carry 40 milliamperes will do here. The smoothed output of some 300/325 volts then goes four ways: one line runs direct to Socket No. 5, feeding the C.R.T. anodes, and the other three, via dropper resistors, bringing the voltage down to about 200, to the timebase and the Y-amplifiers. This dropping of the excess 120 volts gives an opportunity to decouple the supplies from one another and so to prevent unwanted interaction.

One end of the 350-volt transformer secondary is taken to a half-wave metal rectifier, fitted in such a way as to give *negative* H.T. (for this component two ex-equipment 250-volt rectifiers, wired in series, were employed), and this is smoothed in the normal way. The current passed is very small, so that a miniature choke is sufficient, but it is to be noted that the two 8-μF condensers must be separate from one another: i.e., they must not have a common



Another view of the instrument with further indications.

negative lead, and if they are of the metal-can type the cans must be isolated from one another and from earth.

As already explained, the various outputs terminate in 4-pin sockets. Nos. 1-4 are mounted along the bottom edge of the partition dividing the power-pack from the amplifiers, so that they lie close to the three sub-chassis, and No. 5, carrying the supplies to the C.R.T.'s, is fitted at the top edge of the box, near the hinge.

Mains transformers and chokes must, of course, be kept as far away as is conveniently possible from the C.R.T.'s, and in the original instrument they go at the bottom of the rear compartment. No distortion of the trace due to these components has been detected with the layout given. Ch.2 which, as stated above, carries only a very small current, can, if necessary, be mounted quite near the tube bases.

A fuse consisting of a pocket-torch bulb, fitted

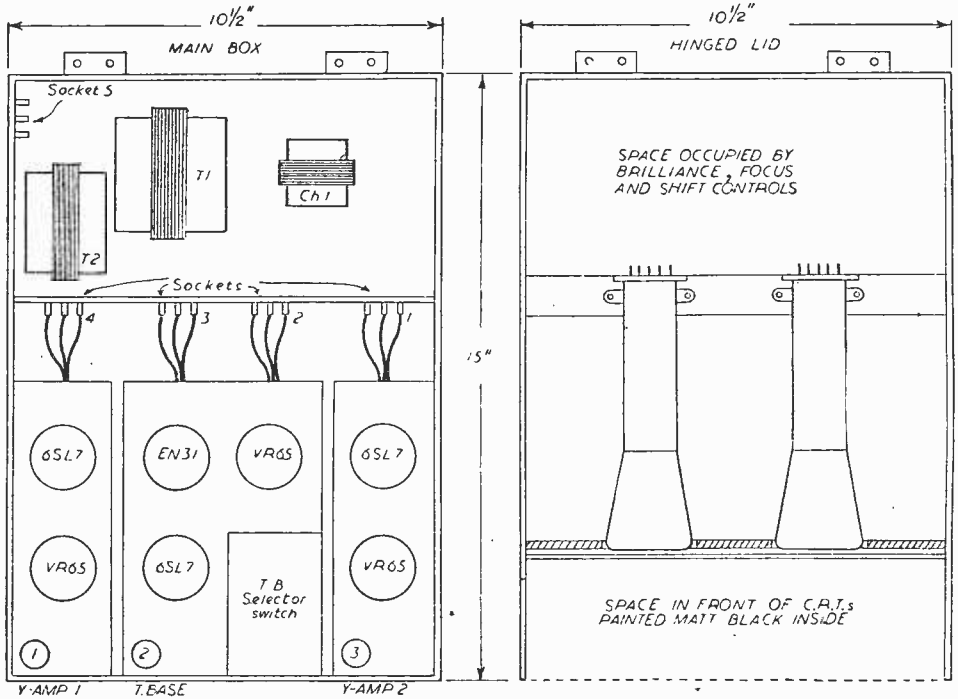


Fig. 1.—General layout of main components.

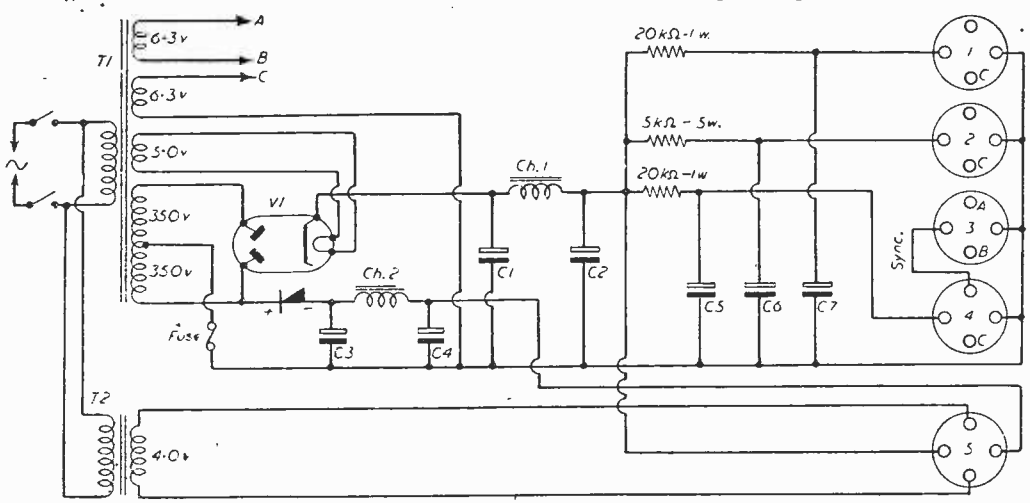


Fig. 2.—The power pack—C1 to C7 inclusive are 8μF 450 v.w. electrolytics.

between the centre tap of the secondary winding of T.1 and the chassis, gives adequate protection against accidental short-circuit or breakdown of any of the smoothing condensers.

It will be seen that there is a special connection marked '*sync*' between the otherwise unused positions on sockets Nos. 3 and 4. This is provided to carry the synchronising impulses, when required, from No. 1 Y-amplifier to the timebase, and the connections to the plugs will be dealt with when these units are discussed.

The C.R.T. Unit

The construction of this part is comparatively simple, consisting as it does of a shallow tray, some 4½in. deep. The two tubes lie side by side, separated at about 4in. centres, with their "business ends" showing through holes cut in a partition set 3in. in from the open end. These holes, about ½in. larger in diameter than the external measurements of the tubes themselves, should be lined with sponge-rubber shock-absorbers, which can conveniently be cut from an old cycle handlebar grip. A black cardboard mask, with 2½in. circular apertures, will hide the sponge rubber, and this in turn can be covered with a piece of celluloid or Perspex, scribed with cross-lines suitably spaced. (It is a mistake, by the way, to have too many cross-lines: 1-centimetre squares are about right for general purposes.) Finally, the inside of the box surrounding the tube faces should be painted a matt black.

The way in which the rear ends of the tubes are fixed will, of course, depend on the fittings with which they are provided: usually there is a pair of lugs on the mu-metal screens, with oval holes allowing a small degree of fore-and-aft movement, and these can be screwed to a cross-batten fastened to the inside of the lid.

The controls governing brilliance, focus and X and Y shifts should next be fitted: it is suggested that the Y-shift potentiometers should go one on each side of the lid, projecting horizontally, and the X-shifts on the top, at the extreme rear corners. This leaves the central section clear for the two brilliance and the two focusing controls, and gives a logical arrangement, easily remembered, so that there is no need for the control knobs to be labelled with their functions.

The circuit, shown in Fig. 3, may seem at first rather complicated, but it is not so once the underlying principle has been grasped. Essentially, it is a potentiometer chain. Full H.T. voltage is brought in at the point C, which is one of the pins of the connecting plug, made from the base of a discarded battery valve, which engages with the power socket No.5, and full negative H.T. comes in at another of the pins, marked D. Approximately 650 volts are available, so the apparatus must be treated with a certain amount of respect. The remaining two pins, marked A and B, of course carry the 4-volt heater supplies for the C.R.T.'s.

The author has found that the best way to make a satisfactory connecting plug from an old valve-base is, after clearing out the glass and fixing compound, to drill right down each of the pins with a 1/16in. twist drill. The leads, made from plastic covered flex, should then be bared for about 1½in. and inserted from inside the valve-base, so that the bared wire protrudes from the small hole, and no un-insulated wire is left inside. A touch of solder will secure the connector, which is then cut off flush with the end of the pin and a sound, safe job results.

The first link in the potentiometer chain consists of five resistors in parallel: the four 0.5 megohm variables VR 1/4 and the composite resistor R9/R10, which consists of two 150,000 ohm resistors in series, each by-passed by a .1 capacitor, C3-C4. The voltage drop across this group of resistors is about 100 volts, and as the C.R.T. anodes Nos. 1 and 3 are fed from the centre tap of R9/R10 they are about 50 volts negative to the "top" ends of VR 1/4, and about 50 volts positive to their "bottom" ends. Accordingly, the X and Y plates connected to the sliders of VR 1/4 can have their D.C. potential varied to this extent, and this will result in the operator having at his disposal the required degree of X and Y shift.

(To be continued)

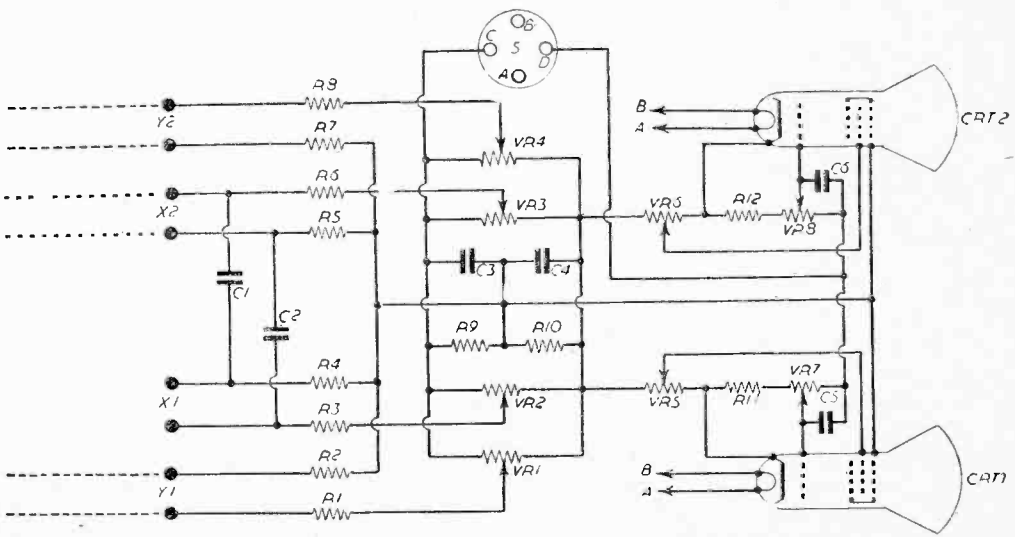
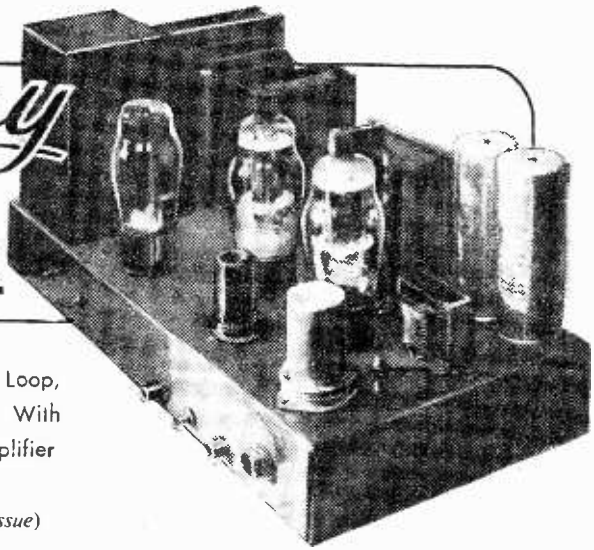


Fig. 3.—The cathode-ray tube unit.

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.

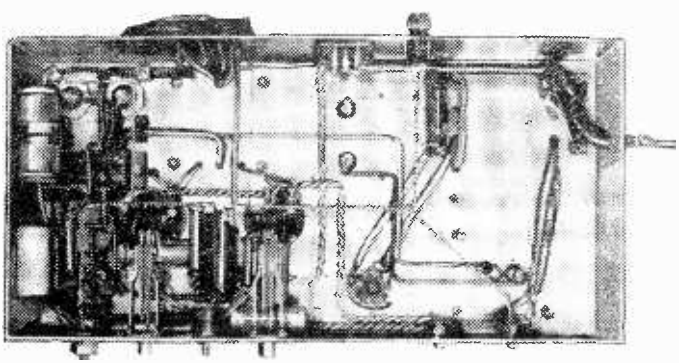
(*Continued from page* 732. *December*, 1953, *issue*)

CARE here must be taken to see that the correct leads are joined together, otherwise damage to the transformer or output valves will ensue. It will be noted that the earth wire of the three-core main flex (where used) is not taken to chassis, but to the earth busbar which in turn is only taken to chassis at one place—at the input socket. Where a separate earth wire is to be used it can be taken to the earth terminal which is insulated from chassis, at the back of the amplifier. The layout is such as to avoid the use of long paxolin tag strips for mounting components which, though neat and mechanically strong, occasion the use of longer wires than are really necessary. Each component is accessible and easily seen, yet electrically and mechanically in the best possible position. Electrolytics are as far away as possible from sources of heat, and many things of that nature were kept in mind. Wiring is best carried out by completing the mains transformer and rectifier first, then all heater wiring, following this by wiring up away from the valve holders—that is start from the valve holder and work away from it, fitting the underside electrolytics last. A good way with the earth busbar is to make bend and cut it as per the drawing without actually fitting it, using it as a marker to cut the leads of the other components to fit. Fig. 10 is a template and it is important to use it in reverse, that is to mark out the *underside* of the chassis and the *inside* of the sides. We shall next describe the tone control preamplifier which consists of one 6SL7 double triode and has full compensation for 78 and 33⅓ recordings, bass and treble lifts and cuts, plus a 9 kc/s whistle filter giving a 32db very sharp cut so that it interferes as little as possible with "straight-line reproduction."

This amplifier can be constructed as described for a total cost not exceeding £12, which includes all valves and ironmongery down to the smallest detail, with the constructor being assured of the long life of every component.

In the detailed discussion on the main amplifier we found that in its final form it required 0.4 volts R.M.S. input for 6 watts output. Coming now to the T.C. Pre-Amplifier, if we allow for an output of up to 1 volt R.M.S. without distortion, this will be more than ample to take care of the input requirements of the main amplifier and from this base line we can proceed to work out the rest of our requirements.

First it is necessary to find out what sort of "sound" is likely to be fed into the amplifier, for it is very unsatisfactory to find, shortly after constructing a piece of equipment, that it has to be modified in order to take care of another "accessory," so that it must be our aim to make the amplifier as universal as possible within the prescribed limits of economy with quality. From that it follows that it must have several switched inputs. Firstly, of course, is Radio; then comes Gram with separate switching for LP and 78: a microphone input will perhaps only occasionally be useful, but it is a definite requirement and it would be as well to have an input to



Compare this illustration with the diagram at the foot of the next page.

mix with any other (accepting the fact that tone-control will apply equally to both) so that the microphone could be transferred to the mix position and a running commentary could be given, say, on top of a Tape recording. If we here limit our inputs and combine Tape with T.V. sound we will have Radio; Gram; Mic; Tape/T.V.; and Mix, making five in all, with five switch positions, Gram requiring two and Mix none.

Dealing with the inputs in that order, we have now to find out what sort of "tone-control" we wish to apply. One of the most troublesome things in radio is the annoyance caused by the 9 kc/s whistle of an interfering station, particularly noticeable when using wide-range reproducing equipment, and until recently very little could be done about it without causing a very appreciable deterioration in the quality of the reproduced sound. The latest way of attacking this problem is by using a parallel T network in a feedback circuit, and so effective is a well-designed network that on listening to the local station without an interfering whistle it is extremely difficult to detect by ear whether the filter is in or out; yet tune to another local station with a 9 kc/s "whistle" at a very high annoyance level and switch in the filter and the whistle disappears magically. Another troublesome phenomenon experienced by most listeners with wide-range equipment is the distortion of the radio transmitter caused by excessive modulation. This results in that peculiar "cracked" sound on loud passages particularly annoying when listening to the piano, and it is

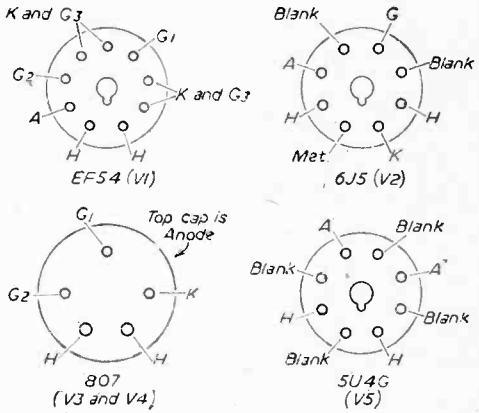


Fig. 11.—Valve base data for the valves used in the amplifier.

noticeable that very rarely is this distortion heard when listening to the cheaper varieties of commercial receivers. From this we can deduce that if the high-

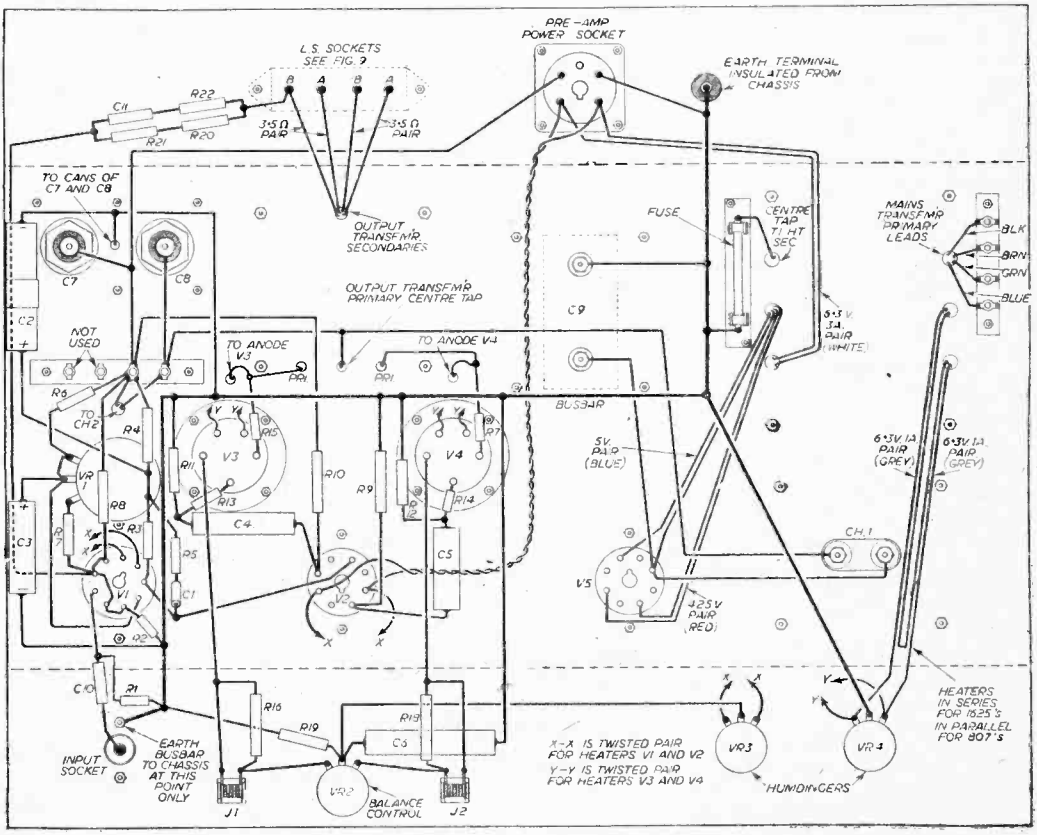
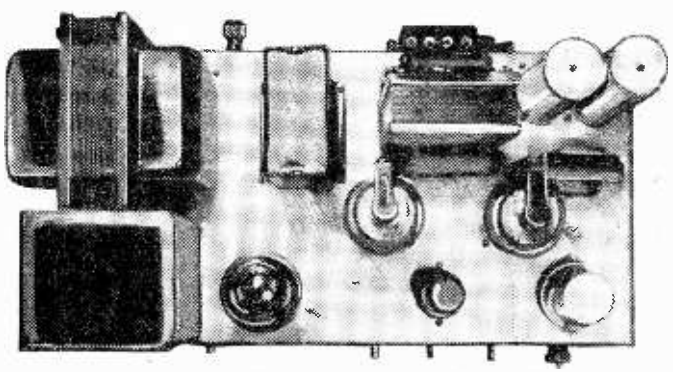


Fig. 12.—Wiring details for the amplifier.

frequency response of the receiver is decreased, then the effect of this type of distortion is reduced. (This, of course, pre-supposes that the radio detector in each case is distortionless up to a high level of modulation.) But if our equipment is to have any semblance of being high quality it is inapplicable to cut the top to this degree, for not only is it the material being played which gives "quality" enthusiasts pleasure but that the reproduced sound really sounds like the "real thing." Fortunately, there is a way in which this type of distortion can be limited without seriously affecting the reproduced sound, and that is by using a low-pass filter. Now although the whistle filter cannot properly be described as a low-pass filter, inasmuch as the right-hand side of the V cut is a V and does not come away at the bottom making a figure L, in actual practice it is so effective in reducing the worst of the transmitter distortion that it is not worth while, in this design, to introduce more components and switching to make it into a true low-pass filter. Before leaving the radio input it would be as well to consider a little the amount of gain required. The amplifier will be fed preferably from a distortionless detector, and here no difficulties should arise as such a detector generally means a large output—rather any difficulty there may be would result from the large output overloading the input stage of the pre-amplifier; we can therefore leave the question of gain to be dealt with under the other inputs, as also the bass and treble controls.



A plan view of the complete amplifier.

Tone Control

From radio to gram really does bring us to this question of tone-control, for particularly as regards the bass the degree of lift required will be much more than on radio, as here we have to make up for the lack of bass in the recording characteristic. It will be obvious from the first paragraph that the writer favours separate switching for LP and 78; it can be and is done by utilising the variable controls to give the required characteristic—it eases the design requirements, but in practice it is rather a nuisance; the real question is how to control the variable amount of "tone." Switching three different degrees of lift and cut is very popular, but it is surprising how often the user feels he should have just that little bit more or less, in other words just in between any two positions. It would be comparatively easy to arrange to have variable potentiometer controls for the bass and treble lifts using negative feedback, but we also have to consider the "cut" positions. Leaving aside the fixed cut for LP equalisation compensating for the rising treble response, surely it is very rare that any substantial cut is used with quality equipment, particularly when regard is made of the falling response of even the best loudspeakers. If this can be accepted we could use the whistle cum-low-pass filter for our top cut, utilising the on/off switch of the potentiometer to bring it in or out. In actual practice this makes a very neat arrangement—as the potentiometer is rotated clockwise from the switch "on" position the treble is increased, turning anti-clockwise from the maximum position to the stop immediately before the switch operates in the level response position; turn more still and the switch goes over bringing in the treble cut. We can do exactly the same with the bass cut control—using the potentiometer on/off switch to bring in the one bass cut, for the same reasoning can apply here as with the treble. It is extremely rare to have to use a bass cut, generally only when a "boomy" loudspeaker is in use. That brings us to the question of where our turnover positions or start of lifts and cuts are to take place.

An examination of most of the bass lift tone control devices recommended or in popular use shows that generally this turnover takes place at 1,000 cycles per sec. and that at about 300 c/s there is substantial "lift." Now it is the writer's contention that this is a very bad thing. In the user's attempt to satisfy his ear as to natural reproduction, particularly at low or medium volume levels, he is foiled by the lift at about 300 c/s emphasising the panel resonances, peaky response and general boominess of his loudspeaker, and so used to this is the average listener that it is commonplace to hear "boom" described as bass. Though, of course, any "lift" at 50 c/s with ordinary circuitry will involve some lift at 200 c/s, a reduction of turnover frequency to 500 c/s effects a substantial improvement, so that in this design that will be the turnover frequency used. To some extent the same reasoning holds good as regards the treble lift: as most loudspeakers and some ears start to fall at 5,000 c/s, instead of using the common 1,000 c/s, we shall increase it to 2,000 c/s. Coming now to the "amount" of bass and treble lifts and cuts, the LP equalisation is fixed at approximately 12db lift at 50 c/s and 11db cut at 10,000 c/s, and here it will be as well to mention that generally it is best to arrange the LP cut at the input of the T.C. in order to avoid the rising treble response overloading the input stage of the amplifier. Over and above the fixed lift in the bass the user must have some more if he feels that the recording needs it, and if we allow 6/7db for this it gives some total of 18db approximate overall lift, which will be more than sufficient for use on the other inputs. Last of all we have to consider the total gain required at middle frequencies when using the lowest likely input, i.e., what is to be the minimum input for full output.

(To be continued)

Building the "SOUND-MASTER"

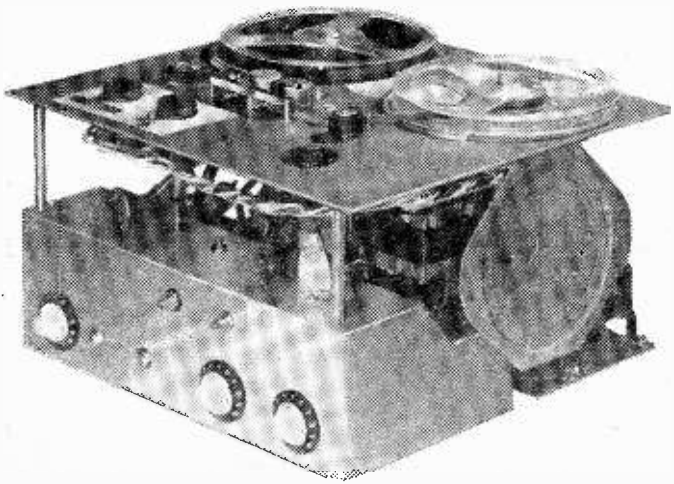
THE FIRST ARTICLE ON THE LATEST HIGHLY EFFICIENT HOME CONSTRUCTOR TAPE RECORDING UNIT

FROM the same designer as the now popular television receiver known as the "View Master" has come a tape recorder, which, as may be seen from the accompanying illustrations and circuit diagram, represents a high-standard of modern design. Details of the circuit are given with the diagram on page 18, and it will be seen that on the mechanical side it has a master three-position switching arrangement giving "record," "playback" and "off." A three-colour signal light is provided and operates with the switch, whilst a standard magic-eye indicator enables the recording-level to be suitably adjusted to give the right depth of recording. Fast rewind is available in both directions, as well as three speeds for recording and playback, with half track recording giving a playing time from 30 minutes to two hours. We have built one of these recorders from the standard kit and the following constructional details are offered. Two chassis are supplied—one for the power pack and one for the main section of the recorder, whilst the tape desk carries the heads and appropriate motors, together with part of the switching mechanism.

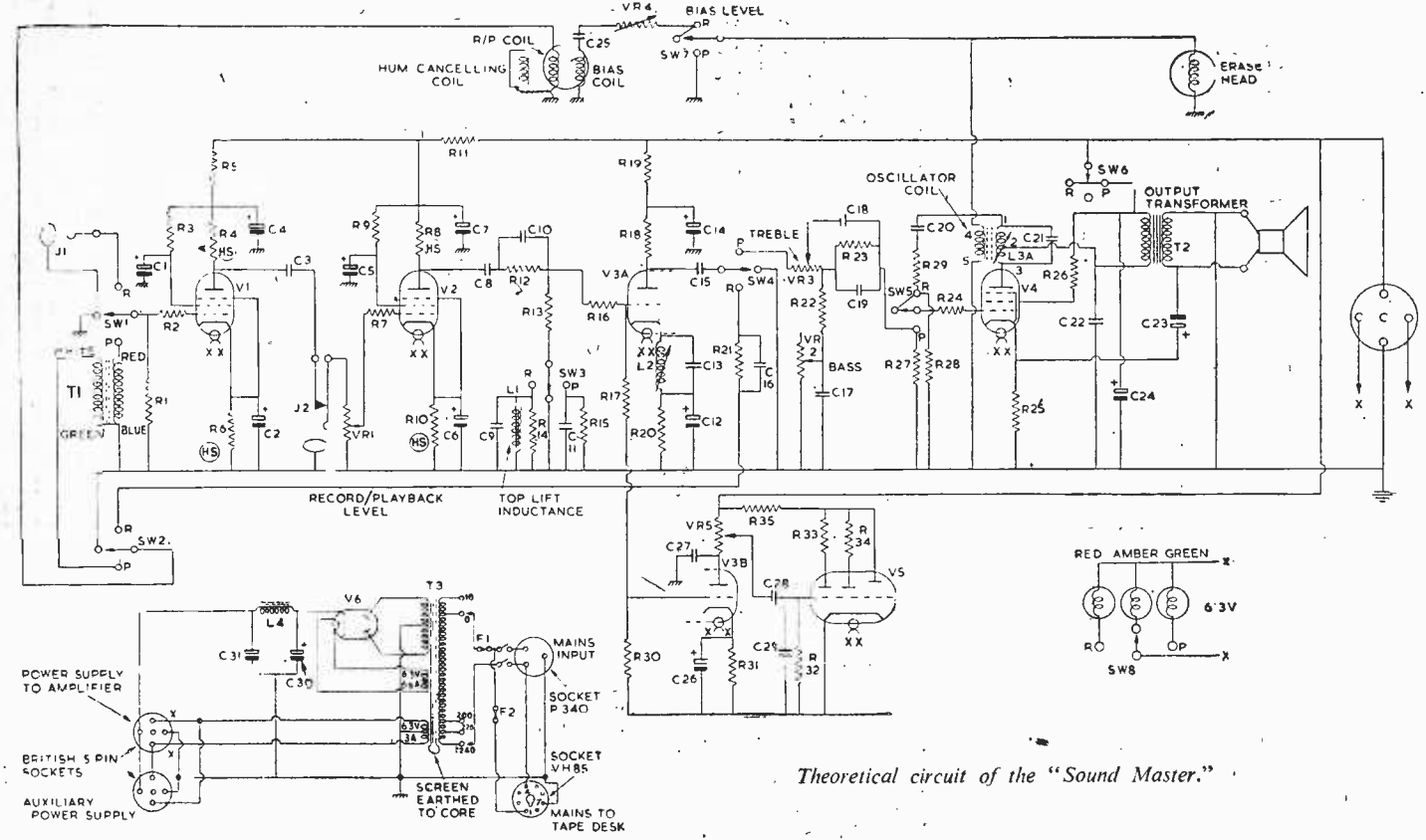
Construction

The work of construction of the amplifier section is carried out in four stages, and a two-colour broadsheet is supplied, with the four stages set out on both sides of the sheet. In stage 1 the heaters are wired, together with one or two other items, whilst a number of components are assembled. At stage 2 on the diagrams, the wiring and components which were dealt with in stage 1 are shown in a different colour, so that no ambiguity can arise, and wiring can proceed easily from point to point. From our experience in the assembly of the unit we can state that assembly and wiring are extremely simple, but no attempt should be made—especially by the inexperienced constructor—to jump ahead of the instructions—by wiring from the circuit diagram, for instance. When completed, certain parts of the wiring are not easily accessible, owing to the compactness of the recorder, and difficulties will be encountered if the instructions are not followed stage by stage.

In some of the earlier kits the switch assembly detailed in stage 3 may be found to have a shaft without a flat on its side. Before making a flat, the desk should be assembled and placed in position so that the exact position of the grubscrew on the universal coupling can be ascertained, and then a flat may be filed in the correct position. Failure to watch this point may result in the contacts on the various wafers bridging two contacts at certain positions. We understand that in the kits now being supplied a flat has been cut on the shaft in the appropriate position. In stage 3 a long earth bus-bar is run from one end of the chassis to the other, and this should be so positioned that it is immediately above the contacts on the lower end of the two tag-boards, so that access may be gained to some of the lower components in both assembly and testing. One further small point concerns the small jack which has to be screened in stage 4. If the jack is held by the fixing nut, with the solder-tag facing upward, a turned-over lug will be found on the left. It is this lug which is soldered to the small tin-plate screen which is made up as described in stage 4, and the contacts should then be well clear of the other side of the screening box. In all other respects the wiring and assembly will be found quite straightforward, and the only point to watch is that soldered connections



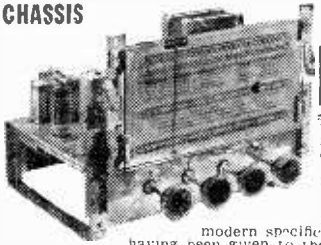
General view of the completed recorder.



Theoretical circuit of the "Sound Master."

Four valves plus rectifier and 'magic-eye' modulation indicator are used in the "Sound Master." One of the valves is a double-triode, but unlike some types of recorder all valves are used (with the exception, of course, of the output amplifier) on both recording and playback. Circuit correction is made on switching over from one to the other, and in addition a comprehensive tone-control network is provided so that any preferred balance may be obtained on playback. To facilitate operation one of the latest Bulgin multi-colour signal lamps is used, and this is shown on the lower right of the above diagram. Three bulbs have to be used, but one is able instantly to see exactly what function has been switched in. The power section shown in the lower left-hand corner is built on a separate chassis and this facilitates testing as well as construction. The 'magic-eye' (V5) enables the recording level to be set to avoid overloading.

A COMPLETELY ASSEMBLED "ALL-WAVE" SUPERHET CHASSIS



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

Brief specifications :—Model B.3.—Valve line up, 6BE6, 6BA6, 6AT6, 6BW6, 6X4. Waveband Coverage. Short 16-50. Medium 187-550. Long 900-2,000 metres. Controls (1) Volume with on/off : (2) Tuning (flywheel type) ; (3) Wave change and Gram ; (4) Tone (3 position switch operative on Gram and Radio).

Negative Feedback is employed over the entire audio stages. Chassis size, 11in. x 7½in. x 8½in. high. Dial size, 9¼in. x 4¼in. Price, complete and READY FOR USE, excluding speaker, £12/12/-. (Carr. and Pkg. 7/6 extra.)

MODEL B.3. P.P.—This model is the B.3. Receiver but incorporates two 6BW6 VALVES in PUSH PULL, resulting in really excellent quality reproduction up to approximately 6 watts. Price £15/15/-. (Plus 7/6 carr. and ins.).

MODERNISE YOUR OLD RADIOGRAM FOR £23

We offer this Autochanger complete with Model B.3 3-waveband as advertised together with 10in. p.m. Speaker for £23 plus 10/- carr. and ins., or with B3PP Model for £26/-/-, plus 10/- carr. and ins.

£9/17/6

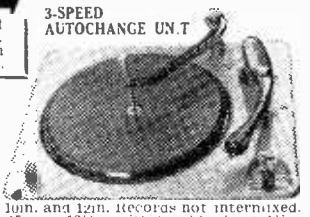
(plus 7/6 carr. and Ins.)
Normal price £13/10/0

- With separate Crystal-heads for STANDARD and L.P. Records.
- Incorporating Pick-up Weight Adjustment.
- Will autochange on 7in., 10in. and 12in. Records not intermixed.
- Minimum baseplate size 15in. x 12½in. with height above 4¼in. and below baseplate 5in.
- Brand new in maker's cartons, complete with mounting instructions.

A GENUINE SPECIAL OFFER!

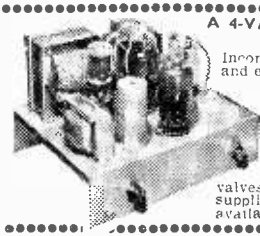
The **COLLARO** 3RC/521

3-SPEED AUTOCHANGE UNIT



"PERSONAL SET" BATTERY ELIMINATOR

A complete kit of parts to build a Midget "All-dry" Battery Eliminator, giving approx. 69 volts and 1.4 volts. This Eliminator is for use on A.C. mains and is suitable for any 4-valve Superhet receiver requiring H.T. and L.T. voltage as above or approx. to 69 volts. The kit is quite easily and quickly assembled and is housed in a light aluminium case, size 4¼in. x 12in. x 3¼in. Price of complete kit with easy-to-follow assembly instructions, 42/6. In addition we can offer a similar COMPLETE KIT to provide approx. 90 volts and 1.4 volts. Size of assembled Unit 7in. x 2½in. x 11in. Price 47/6.



A 4-VALVE QUALITY "PUSH-PULL" 6-8 watt AMPLIFIER for A.C. mains.

Incorporating Negative Feedback, Filter Input Circuit and employing 6V6s in Push-Pull. A simple arrangement is provided to enable either a magnetic-crystal or lightweight pick-up to be used, and is suitable for use with Standard or long-playing records. A tone control is incorporated, and the 10-watt output transformer is designed to match 2 to 15 ohm speakers. The overall size of the assembled chassis is 10in. x 8in. x 7½in. high, and full practical diagrams are supplied. Price, including drilled chassis and valves, of complete kit, £6/17/6. Price of assembled chassis, supplied ready for use, £8/12/6. Full descriptive leaflets are available separately for 1/-.

GENUINE REDUCTION

The Collaro Model 3RC/514, 3-speed non autochange Record Player. (Normal price £12/6/7.)

£6/19/6

(Plus 5/- carr. and ins.)

Incorporating the NEW ORTHO DYNAMIC HI-FI Magnetic Head filled with TWIN ALLOY STYLUS AND MATCHING TRANSFORMERS, TOGETHER WITH PICK-UP WEIGHT ADJUSTMENT. These Units are quite new and contained in maker's original cartons, complete with mounting template.

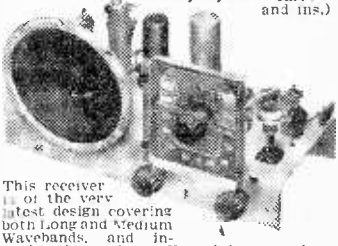
COMPLETE KIT for 12 WATT HIGH FIDELITY "Push-Pull" AMPLIFIER

Designed for A.C. mains 200 to 250 volts, employs 6 valves plus rectifier, with negative feed-back, and comprises a main amplifier chassis and a remote controlled Pre-amplifier and Tone Control Unit, incorporating four controls—bass, treble, main volume or mixing control, and a radio, gram, microphone selector switch. This control unit measures only 7 x 4 x 2in. The measured frequency range of the amplifier with this unit shows an excellent response from 14,000 cycles down to 20 cycles, the bass and treble controls allowing independent control of gain at both ends of the frequency range from zero to a gain of 50. It can be seen therefore, that ample correction is provided to suit any type of pick-up with any type of recording. Input voltage for maximum output is 70 mV. 6.3 volts at 2 amps. and 30 mA. H.T. is provided for tuning unit, etc. Price of complete kit, Amplifier and Control Unit including drilled chassis and valves £14. Complete specification and layout, 2/-. We can also supply completely assembled and ready for use at £17. Please add 7/6 carr. and insurance

THIS AMPLIFIER COMPARES WELL WITH THE WILLIAMSON AND SIMILAR DESIGNS AT A FRACTION OF THE COST.

A COMPLETE 4 VALVE T.R.F. CHASSIS

including a 5" P.M. SPEAKER and VALVES for only £6/9/6 (plus 7/6 carr. and ins.)



This receiver is of the very latest design covering both Long and Medium Wavebands, and includes the modern BVA miniature valves. The line up being 12BA6—12AT6—12A6—35W4. It incorporates Permeability Tuned Coils thus ensuring excellent selectivity and sensitivity. The overall size of the complete chassis including Speaker is 10in. x 4¼in. x 6¼in. An attractive Bakelite Ivory finished Cabinet, size 11¼in. x 5¼in. x 6¼in. is available for 16/6 (plus 2/6 carriage and insurance).

A DUAL CHANNEL PRE-AMPLIFIER and TONE CONTROL UNIT

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

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

STOP PRESS!!

A COMPLETELY ASSEMBLED CHASSIS OF A 3 WATT A.F. AMPLIFIER WITH SELECTIVE FEEDBACK for A.C Mains operation

£4/9/6 (plus 5/- carr. and ins.)

- Designed for good quality Gram. reproduction up to a maximum output of 3 Watts.
- The selective feedback circuit incorporates separate Bass and Treble Controls.
- New Valves are used, the line up comprising the new Mullard types EF40, EL41, EZ40.
- Suitable P.M. Speakers are available at 16/-, 18/9, 23/- and 34/4.

STERN RADIO Ltd.

109 & 115, FLEET STREET, E.C.4.

TELEPHONE: CENtral 5812/3/4

are made properly and firmly. When finally assembled, the slight vibration from the motors will result in frying noises and hum, should any connections be poorly made.

Tape Desk

A further sheet details the method of setting up the actual desk, and this has a professional-finished surface, carrying a plate giving playing times and footage indications for the spools, as well as an indicator plate for the switching, which has an interlocking device to avoid a recording being accidentally rubbed out when rewinding.

Power Pack

The power pack is fully described in the booklet and does not need a separate constructional sheet. It carries fuses as well as a four-pin socket for an output of power suitable for a radio unit or other device.

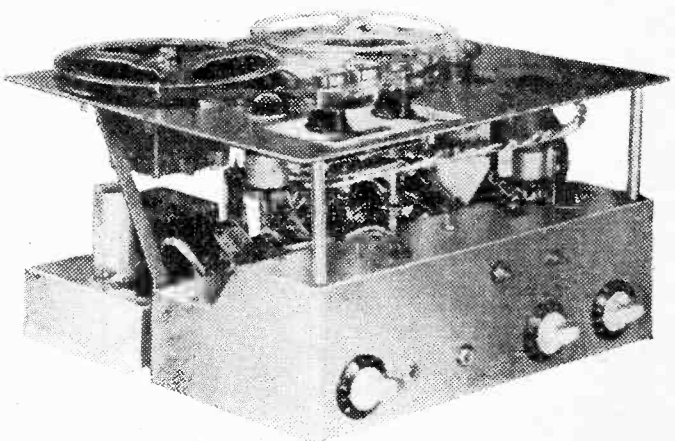
Assembly

When all wiring has been completed the three units have to be coupled together, the desk and the amplifier being bolted to each other. The universal coupling should first be slipped over the shaft of the lower switch and pushed well down so that the top of the shaft can be seen. The fixing screws should then be passed into the holes drilled in the desk and given a few turns into the supporting pillars and angle-bracket, but before locking them firmly make certain that the shaft from the lower switch unit is in line with that above it. Position these accurately before putting the coupler in position, and make quite certain that when the fixing screws are driven home the two shafts are in line. The coupling may then be slipped up to embrace both shafts, and the grub screws tightened. Turn the amplifier on its side and whilst the record-playback switch is operated make certain that the contact on the wafers comes to rest only between the jaws of a single contact. The various plugs may then be inserted and the unit switched on for a test—making quite certain, of course, as explained in the booklet, that there is no fault in the wiring which could result in damage. Full details are given for checking and testing the unit, and the constructor will find that the most interesting part of the work now arises—the making of test recordings from both microphone and radio, and the adjustment of recording levels and bass and treble controls to provide a really first-class reproduction.

As with any modern tape recorder there are two or three adjustments which are very critical if the best recordings are to be made. For those who are new to this type of instrument it may be briefly mentioned that there is an oscillator which produces an oscillation at a certain frequency, upon which the speech or music is superimposed. Obviously, therefore, this frequency may be critical in a given design, and the generated frequency must be kept in its proper place—away from the reproducing circuit, for instance. Switches will cut it out on playback, provided they are functioning properly. The oscillation is also used for the purpose of erasing, and this is automatically carried out on this instrument when recording takes place. If it is desired to erase a recording, but not to make a further recording in the same place, the instrument is simply switched to record, the gain control turned right off and the tape run through in the recording position. If the gain control is not turned off the general background picked up by the mike or mike circuit will be recorded, but if the oscillator is correctly adjusted and the gain control turned right back it should be possible to run the tape through in playback position, and then, after rewinding, to run it through again in playback position with the volume control turned full up, and there should be only the very slightest background from the speaker. If the oscillator is too strong a noisy tape will be produced after two or three recordings, whilst if not strong enough the quality of the recording will be poor. An oscilloscope is very valuable for setting up the optimum level of the bias and controlling level, but it is not by any means essential.

Adjusting the Levels

The best plan is to obtain a spool of tape and to use a few feet only in trying the effects of the two important controls, together with the gain control. This is VR1 in the circuit and it controls the strength of the signal going in to the amplifier either from a mike, the radio or from the tape (in the playback position). Obviously, therefore it is necessary to keep this sufficiently far back to avoid overloading (and this will depend upon the subject matter being recorded) whilst at the same time not having it so far back that background is unduly loud. But apart from this control, which any radio amateur will find simple to adjust as it is merely a volume control, the two pre-sets will well repay experiment. Record only a short length of speech, say two or three lines from a nursery rhyme, and then play it back. Carry out this process repeatedly, if possible, incorporating in the speech an indication of the setting.



Another view of the continued chassis.

The Beginner's Guide to RADIO

The Ninth Article of a Series. This Month Further Instruction is Given on Inductance and Capacity

By F. J. CAMM

WHEN the wire is stretched out straight its inductance is at a minimum, but if it is wound into a coil the inductance is much greater, while if an iron core is placed in the coil it will be at a maximum. If two or more inductances are joined in series their total effective inductance can be found by adding their several inductances together.

The symbol for inductance is " L " and thus with inductances (coils) connected in series, the total inductance in henries is :

$L_1+L_2+L_3$ ... ... etc.

Similarly, if the inductances are joined in parallel, their total inductance is :

$$\frac{1}{L}=\frac{1}{L_1}+\frac{1}{L_2}+\frac{1}{L_3} \quad \ldots \quad \ldots \quad \ldots \quad \text{etc.}$$

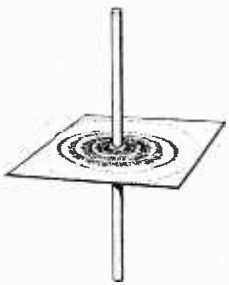


Fig. 35.—The field of force round a conductor. An insulated wire connected to a battery is passed through a piece of paper on which iron filings are placed. These will indicate the lines of force.

Thus, inductances in series and parallel follow the same mathematical rule as resistances in series and parallel.

In addition to the effect caused within the wire when a current is passed through it, there is another curious effect outside the wire. When a current of electricity flows along a conductor the surrounding ether is in a state of strain. This is a magnetic strain, that is to say, the wire is surrounded by magnetic lines of force in the form of concentric circles, and an idea of the size and position of these can be obtained by making the simple experiment illustrated in Fig. 35. An insulated wire connected to a battery is passed through a hole in a sheet of paper. Iron filings are then sprinkled on the paper, which should then be shaken very gently. It will be found that the filings will arrange themselves in concentric rings around the conductor. They are close together near the conductor, but become more widely spaced as they spread out from it, as explained last month.

A further experiment may be made to illustrate the properties of the magnetic field surrounding a conductor. A covered wire W_1 (Fig. 37) is connected to a source of direct current. The wire should be laid flat upon the table in a straight line. Parallel with this wire a second wire of the same gauge and length W_2 is placed and connected to a galvanometer G. If the switch S is closed the needle of the galvanometer will give a " kick " showing that a spurt of current flowed in this *secondary circuit*. Another " kick " will be observed when the switch is opened. So long

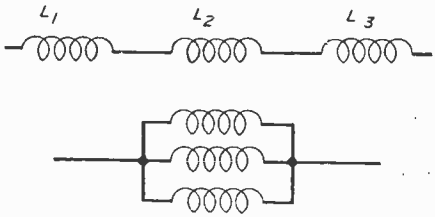


Fig. 36.—Top, inductances in series. Below, inductances in parallel.

as current is flowing steadily in the circuit connected to the source of direct current (the *primary* circuit) a current will not flow in the other, but there will be a momentary flow in the latter whenever the switch is opened or closed.

When current is switched on in the first circuit the field of force begins to build up in W_1 and the expanding circles " cut " the parallel wire of the other circuit as they spread outwards. In other words, the electrons in the secondary are set in motion by the expanding field of the primary thus producing a flow of current in the secondary. When the lines of

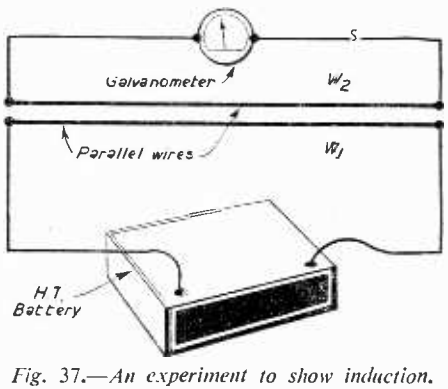


Fig. 37.—An experiment to show induction.

force are stationary, as they are when a steady current is flowing in the primary, nothing happens in the secondary, but as soon as the current is switched off the collapsing rings of force will again cut the secondary as they move inwards.

Now if you wind wires W_1 and W_2 in the form of coils, the effect will be more strongly marked. The spurts of current in the secondary are termed *induced current*. It is not necessary to switch the primary current on and off for by merely varying the primary

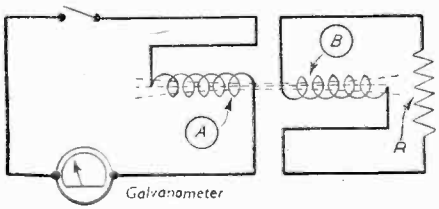


Fig. 38.—*Diagram illustrating what is meant by mutual induction.*

current corresponding variations may be induced in the secondary. Later on we shall see what use is made of this phenomenon.

Capacity

Any conductor possesses capacity, that is a capacity for storing up electrical energy, and this capacity depends upon the size and the shape of the conductor. If two oppositely-charged conductors, metal plates, for example, are brought close together the difference of potential between them is lowered by the inductive effect of one plate on the other. In order to bring the plates to the *potential difference* (PD) which existed before they were brought close together a higher potential difference will have to be applied. This is an arrangement whereby increased capacity can be obtained and the instrument, or component, used for this purpose is known as a *condenser*. Condensers may be variable or fixed.

Inductance and Capacity

Now take the case of a charged condenser. The negative charge coming from the battery to the negative plate of the condenser repels all electrons (they also being negative) and drives those that are free to its opposite surface. They cannot move farther away because the *dielectric* (air, paper or mica) or gap that they here encounter offers a very high resistance to their passage. But they exercise a tremendous attractive force upon the positive ions of the plate which crowd to its surface (see Fig. 39). The atoms in the air gap have their nuclei strained towards plate A and their electrons towards plate B. This is known as *dielectric strain*. Assume the two

Fig. 40.—*Condenser bridged with coil having inductance.*

plates of a condenser, like those in Fig. 39, are given a positive and negative charge. If we connect the plates together with a wire the surplus negative electrons on the negative plate rush violently along the wire to join the positive ions on the positively-charged plate. So great is the rush that too many electrons crowd on to the positive plate and, finding that they have no more positive ions on which they can join, they rush back again to their original plate. Here the same thing happens again and so a number of surges to and fro take place along the wire until equilibrium is restored. It is important to understand that all this takes place in an infinitesimal part of a second. If, as is shown in Fig. 40, the condenser is bridged with a coil having inductance, then the surges of electrons will occur at a lower rate. On their way from one plate to the other they, so to speak, lose time in building up lines of force around the coil. As these lines of force collapse energy is given back to the circuit and the plates become charged in the opposite direction.

Now inductance and capacity when they exist in a circuit affect Ohms Law as it relates to D.C. The formula $I=\frac{E}{R}$ no longer applies, and for purposes of calculation we must make use of Ohms Law for A.C., which is :

$$I=\frac{E}{2\pi fL}$$

where f = frequency
L = inductance in henries
$\pi = 3.1416$

The expression $2\pi fL$ is known as the *inductive reactance* (XL). For a circuit having inductance and resistance the formula is :

$$I=\frac{V}{\sqrt{R^2+(2\pi fL)}}$$

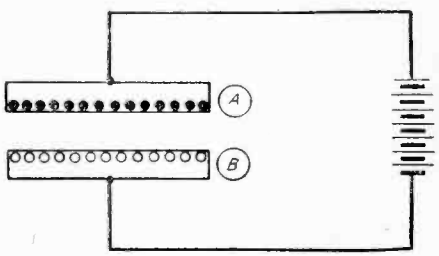


Fig. 39.—*Dielectric strain in charged condenser.*

The denominator of this formula gives *impedance*, which you will find in radio formulæ denoted by the letter Z. Impedance is always expressed in ohms.

Solenoid

A coil such as that formed by winding a layer of turns of wire on to a tubular former is known as a *solenoid*. If a coil of this kind is made and connected to a battery it will exhibit all the properties of a permanent magnet. It will attract iron and steel filings and, again like a permanent magnet, it has a north and south pole.

Ampere Turns, Flux and Density

It can be found by experiment that the strength of the electro-magnet, so called, depends upon the number of turns which it contains and the amount of current which they carry. This relationship is known as *ampere turns*. The flux is the number of lines of force passing through the coil and the flux density is the number of lines of force per square centimetre of the coil's section.

(*To be continued.*)

"GOTHIC" *Radio Installation*

DETAILS OF THE ROYAL TOUR LINER'S SPECIAL EQUIPMENT

AS part of the fitting out of the Shaw Savill liners *Gothic*, in preparation for the forthcoming Commonwealth tour of Her Majesty the Queen and His Royal Highness the Duke of Edinburgh, this 15,902-ton turbine vessel has been provided with special radio equipment by Marconi's Wireless Telegraph Co., Ltd., and The Marconi International Marine Communication Co., Ltd. This will supplement her existing Marconi Marine installation which, while adequate for the *Gothic's* usual needs, would not be comprehensive enough to handle the State and Naval correspondence of Her Majesty's Household on tour.

Requirements to be met on such an occasion are naturally far in excess of those of normal commercial voyages. Apart from a heavy volume of important State and Naval messages, considerable Press traffic will have to be handled including the transmission of photographs by radio. Provision has also had to be made for "live" broadcasts, direct from the *Gothic* by the BBC, while for news and entertainment purposes on board the ship herself, extensive sound-reproducing and recording facilities have been provided.

The two Marconi companies have co-operated with the Admiralty and Shaw, Savill and Albion Co., Ltd., to meet these many and varied requirements. The nucleus of the special equipment is a high-power radiotelephony and radiotelegraphy transmitter, the SWB11X, installed by Marconi's Wireless Telegraph Co., Ltd. The SWB11X is of a type designed for installation on land for long-range communication, and that on board the *Gothic*, originally installed for the projected Commonwealth tour of 1952, is the first of its kind to be fitted on board ship. This is also believed to be the first occasion on which a transmitter of this power—7 kW.—has ever been installed in a merchant vessel. It will handle picture transmission in addition to morse and speech.

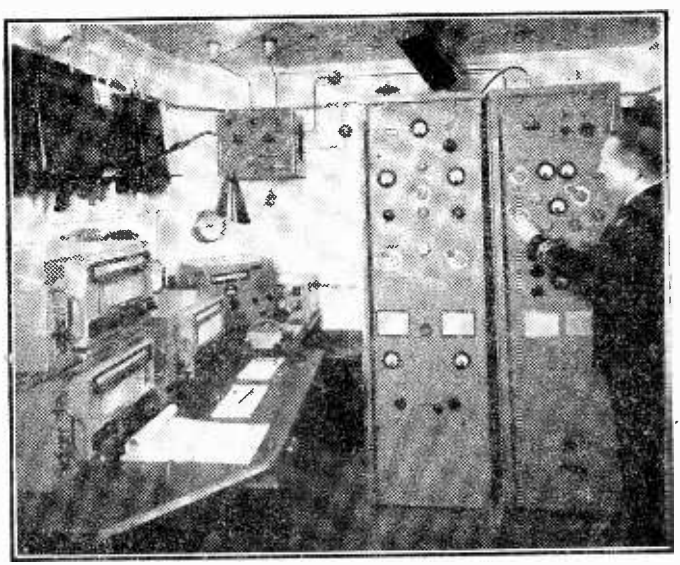
Three Marconi receivers are provided to work with this transmitter—one Type OC13 for transmission, checking and monitoring purposes, one Type CR150/3 as a traffic receiver, and a Type CR150/5 to provide cueing facilities at the various BBC commentary points. Godfrey Talbot, well-known BBC commentator, will be sailing in the *Gothic*.

This complete communication unit—the SWB11X and its three receivers—provides for hand-speed or high-speed wireless telegraphy as well as long-range ship-to-shore telephony, and facilities are available for the transmission and reception of inverted speech if required. The transmitter equipment, which is housed in a separate space with special ventilation and heat-dissipation arrangements, will, except for frequency changing, be operated by remote control from the forward wireless room, and while on radio-telephony can be modulated by the microphone at any one of the BBC commentary positions. Mr. A. J. G. Corbett, an engineer of Marconi's Wireless Telegraph Co., Ltd., will sail with the vessel and will be responsible for the maintenance of this part of the installation.

Simultaneous Working

The *Gothic's* normal Marconi Marine radio equipment has also been considerably augmented for the Royal tour. Her "Oceanspan" main transmitter has been removed and replaced by a "Worldspan," the most powerful in the range supplied by The Marconi International Marine Communication Co., Ltd. The "Worldspan," which has been specially adapted to transmit high-speed wireless telegraphy, will be used for the normal radio working of the ship and will also handle any overflow of Press traffic when the SWB11X is in use on transmissions of a higher priority. On the receiving side one "Mercury" and two "Electra" receivers have been installed in addition to the "Yeoman" already fitted, providing full coverage of all the marine communication frequencies so that reception can continue on several channels simultaneously.

(*Concluded on page* 54)



Mr. C. H. Roberts, Chief Radio Officer of the Shaw Savill liner Gothic *(chosen for the Royal Commonwealth tour), adjusts the vessel's Marconi Marine "Worldspan" transmitter. Other equipment shown in this section of the radio room consists of two "Electra" receivers, the remote control panel of the aerial splitter unit, and "Mercury" and "Yeoman" receivers.*

On Your Wavelength

By Thermion

An Early Experiment

LARGE numbers of letters have been received in connection with our 21st Birthday Number, and understandably most of them revive nostalgic memories of the early days of radio. I was delighted to receive a letter from my old friend Colin H. Gardner, now an important official of the Mullard Company, in which he reminds me of an experiment with radio equipped racing cars which he conducted at Brooklands in 1922. Mr. Gardner was at that time a member of the Wireless Society of London and when the late S. F. Edge, driving a Spyker car on which he created the record-breaking double twelve hours run, he accompanied him and succeeded in radioing messages from the car whilst careering round the track at a speed of over 80 miles an hour. As far as I know this was the first occasion when radio messages were so transmitted and the event must be recorded as a pioneer effort.

The full story is told in a periodical of the period in the following words :

"When the idea of using wireless on Mr. Edge's car was first thought of, the British Spyker Company, after approaching a number of firms, eventually arranged with the Electrical Disposals Syndicate, in co-operation with Messrs. Alfred Graham and Co., to install wireless in the automobile that was to carry out the double twelve hours record-breaking run. The actual fitting of the transmitting apparatus in the vehicle naturally presented little or no difficulties, but the problem that remained to be solved was the question of fitting an aerial on the vehicle.

"In this direction practically entirely new ground had to be covered, for obviously no apparatus could be attached to the racing car that would in any way set up wind resistance and retard the speed of the vehicle.

"Although the arrangements for the experiment had to be completed in almost a matter of hours, it was necessary to carry out a series of tests involving ingenious methods of trailing an aerial behind a car travelling at over a mile a minute.

"The first method adopted was to attach a gas-filled bladder to an aerial, the theory being that the sphere would trail behind the car and hold up the wire attached at the opposite end to the automobile. At low speeds this proved a success but as the car accelerated its pace, the bladder was thrashed violently on to the track, with the result that it burst.

"A specially-designed glider, constructed by Messrs. Vickers, consisting of lightly-built planes, was then substituted for the bladder. This proved a failure, however, as the fact that a vacuum is formed behind a fast-moving car was overlooked. This had the effect of causing the glider to drag on the track, as there was not sufficient "air lift" to retain it in the atmosphere. . . . A solution was eventually discovered almost at the last moment. The aerial terminal was connected to an insulated wire trailing behind the car on to the track. The earth terminal was connected to the car itself and in this way a condenser was formed, the car acting as one plate, the earth as the other and the tyres being the dielectric.

"It was found that radiation power approached 300 milliamperes. The radiating circuit was in reality a closed oscillatory circuit."

I wish I could find space for the whole of the story. It is an example of how perseverance plus technical skill can solve an apparently insoluble problem.

Gardner is as keen as ever on radio and unlike some amateurs whose enthusiasm waxes and wanes, he has been continuously experimenting for over thirty-five years.

Conscience Doth Make Cowards . . .

IT was suspected that large numbers of people in the Brighton and Hove area were operating radio and TVs without the usual formality of taking out a licence. Accordingly the Head Postmaster sent the radio detection van round the district. The surprising result was that in four days 821 wireless listeners suddenly decided to take out licences and 621 viewers did the same! In normal times the issue is 30 sound and 20 TV licences per week.

If this is typical of the whole country the BBC is being deprived of a large amount of revenue.

New Electronic Development

OVER the famous Royal Liver Building, at Liverpool, is the famous clock. It was installed in 1911 but it has never chimed. It was found that the bells intended for it would be too heavy for the 200ft. high tower. An electronic bell system made by the famous firm of Gent and Company of Leicester, has now been installed. The chiming notes are generated by wires about a foot long and the resulting vibrations are amplified and the clock now, like Big Ben, audibly records the passing of the hours. The synchronisation of the chiming mechanism in the clock is controlled by a master clock which is more accurate than Big Ben.

Radio and TV Fans

I often wonder how many of my readers build TV as well as radio receivers and my wonder is caused by a visit I paid the other evening to a friend of mine who has been building receivers for the past quarter of a century. He was building his first TV, but told me that he could never desert sound radio in which his main interest was the short waves. He said that he was building the TV, first because he could not afford to buy one and, secondly, because his family wanted it. A third and minor reason was that whilst the family were looking in he would be able to spend a few hours in his shack!

Operating Battery Sets From Mains Supplies

By F. G. Rayer

UNITS which enable batteries to be dispensed with, so that battery-operated receivers can be powered from the mains, are becoming popular. This popularity has probably arisen, in part, from the increased use of small "All-Dry" portable receivers. The life of the batteries used in these sets is short. When the receiver is employed indoors it is, therefore, well worth while to bring into service a mains unit. During the winter batteries may be dispensed with entirely. Such receivers can

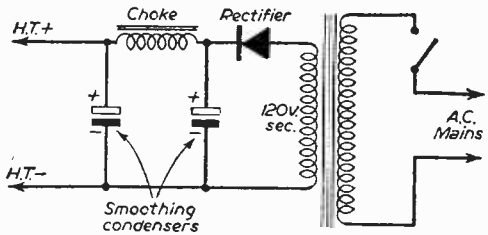


Fig. 1.—H.T. section of eliminator circuit.

then be operated economically from the mains—a great and obvious advantage.

Even with larger receivers it is economical to use mains supplies, if available. The initial cost of a suitable unit need not greatly exceed that of a H.T. battery, and it should give many years of service at extremely low cost.

A number of different circuits exist, and each can be used with success. Some have very low first cost; others have various advantages, as will become apparent. They may also be used with the older type of receiver using a two-volt accumulator, and this should in many cases give a new lease of life to a receiver which has been put on one side.

Such circuits can generally be divided into two sections—one supplies H.T. current; the second provides filament current. It is, accordingly, proposed to deal with these separately. In a completed unit, both H.T. and L.T. eliminator circuits will usually be employed, as will be explained.

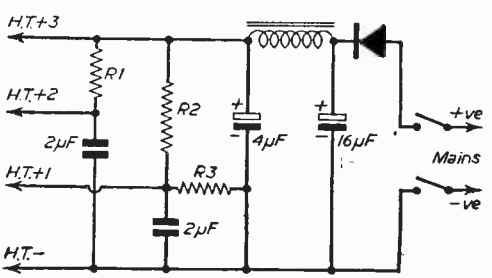


Fig. 2.— Intermediate voltages and direct operation.

H.T. Eliminator

With A.C. mains supplies it is best to use a transformer, as shown in Fig. 1. This steps down the 200-250 volt mains, and also isolates the receiver from the mains, so that no shocks will normally be experienced if bare leads, etc., are touched. Such transformers are advertised by various suppliers, and usually have a secondary rated at about 120 volts 30 mA. Such a current rating is ample for any normal battery set, since few such receivers consume more than 10 to 15 mA.

The rectifier is a metal half-wave type of similar rating. The Type SB2, rated at 125 volts 40 mA is suitable. The current rating of the rectifier actually used is not important, provided it equals or exceeds the consumption of the receiver. If used with a 120 volt secondary, its voltage rating should be from 120 volts upwards. Larger rectifiers, if to hand, can be used—e.g., one of the popular 250 volt 60 mA types.

The choke is not critical, since the current rating of even the smallest choke is not likely to be exceeded. Its D.C. resistance may lie between 100 to 500 ohms or so, and its inductance may be from 10 to 20 Henrys, with a current rating equal to, or greater than, the consumption of the receiver. A choke such as used in small mains sets is suitable.

The condensers may be anything from 4 to 16μF with a voltage-working rating of 125 volts upwards. The usual type of 8 plus 8 μF 250 volt condenser is satisfactory.

When first put into service, the H.T. voltage output should be measured with a high-resistance meter, with the receiver switched on and working. If the voltage is too high, a resistor may be wired in series with the choke. Its value may be found by trial, calculated from Ohm's Law, or assumed to be approximately 1,000 ohms for every 10 volts to be dropped, with the usual three or four valve receiver.

The receiver should be operated with a H.T. voltage of approximately the usual figure. With "All-Dry" sets normally using a 90 volt battery, the H.T. voltage should be kept down to this figure.

(*Continued on page* 29)

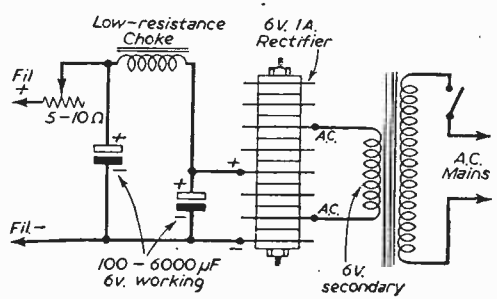


Fig. 3.—L.T. circuit for 1.4-2.0 volts.

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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.

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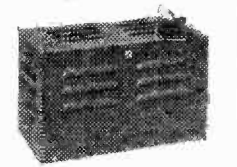

For use on 200-250 volt A.C. mains. Wired and complete with valves. In steel case, black crackle finished, size : 12 x 5½ x 7 in. LASKY'S PRICE. **79 6**. Carriage 5/- extra.
Power pack as above, complete with 6½in. loudspeaker. PRICE **£5/5/0.** Carriage 5/- extra.

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(*Continued from page* 26)

With small receivers of comparatively low gain (e.g., two and three valve sets) the choke may be omitted without hum becoming troublesome. A resistor of 1,000 ohms upwards should be used to replace it in the circuit.

For Direct Connection

The transformer may be eliminated by connecting the rectifier directly to the mains, as shown in Fig. 2. A double-pole toggle switch is then desirable. The receiver will be connected directly to one mains lead, *via* H.T. negative, so no direct earth must be used. Risks of shock can be reduced by ensuring that the H.T. negative line goes to the negative mains-supply lead. Receivers used with this circuit should, for preference, be totally enclosed, with no metal parts

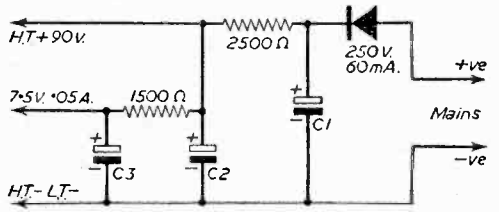


Fig. 4.—Simple "All-Dry" receiver power circuit.

which can be touched. Apart from this disadvantage the circuit is a useful one.

The voltage at H.T. 3 will normally be about 180 to 210, and needs to be reduced. This is accomplished by adding resistor R1, as shown. If further tappings of lower voltage are required, they may be obtained by adding further resistors, a condenser of about 2 μF. going from each such tapping to H.T. negative. If a screen-grid circuit has to be supplied, as in some old receivers, a potential divider consisting of two resistors (R2 and R3) is preferable.

Such voltage-dropping circuits can also be used with Fig. 1. They are necessary in old sets with three or more H.T. plugs. In Fig. 2, R1 would normally be about 8,000 ohms, and R2 and R3 50,000 and 25,000 ohms, to give 120 and 60 volts tappings, from 200 volt mains. In cases of doubt, variable resistors may be used, or the actual voltage-drop required may be calculated.

The circuit in Fig. 2 is that which must be used with D.C. mains, the rectifier being omitted.

1.4 and 2 volt Supply

The circuit in Fig. 3 employs a full-wave metal rectifier, and can supply up to 1 amp. With many receivers, the filament consumption will not exceed .5 amp ; a .5 amp rectifier can then be used. It is not necessary that the mains transformer supply be exactly 6 volts. A 6.3 volt heater transformer can be used.

The smoothing choke *must* have a low D.C. resistance, or the voltage drop in it will be too great. Such a choke may be wound upon an old core, employing 200 to 300 turns of 18 to 20 s.w.g. wire. In one case the secondary of an old speaker matching transformer proved to be satisfactory, without any modification to the component.

The amount of smoothing required depends upon the gain of the receiver, and its consumption. With simple receivers using few valves, the choke may be omitted. The higher is the current consumption of the receiver, the larger should the smoothing condensers be. However, their capacity is in no way critical. If it is subsequently found that hum is troublesome, then they can be increased in capacity, or other condensers wired in parallel with them.

The output voltage is finally adjusted by means of a wire-wound resistor, the set being switched on and working. Where the unit replaces a 2-volt accumulator, the output should be adjusted to this figure. With "All-Dry" sets operated from a 1.4 volt dry battery, the voltage should lie between 1.25 and 1.4 volts. A voltage of 1.3 is recommended. It should in no circumstance exceed 1.4 volts. Measurements should be taken with an accurate *high-resistance* meter. It is also possible slowly to increase the voltage until the receiver appears to function with normal volume, but this method should be employed with care.

Simplified Dual-purpose Circuit

Some "All-Dry" receivers have valves wired in series for 7.5 volt operation, and the filament current is only .05 amp in these circumstances. This figure (50 mA.) lies within the range of the usual type of rectifier circuit employed in mains equipment. Accordingly, an ordinary choke, smoothing condensers and rectifier can be used. A variable resistor should be included in the filament positive lead, and slowly reduced in value until the filament current is 50 mA.

Fig. 4 shows a circuit in which the choke is replaced by a resistor which both helps to smooth the supply, and drops the voltage to a value suitable for the filaments. This circuit, with the values shown, may be used on 210 to 230 volt mains. The three smoothing condensers may each be 16 μF, unless the receiver gives high gain. Larger capacities are then desirable. C1 and C2 may be 32 μF, and C3 100 μF upwards. A double-pole toggle switch is required in the mains leads. The resistors should be 8 to 10 watt types.

Valve Rectifiers

If a valve rectifier is to hand, this can be used, and circuits are shown in Fig. 5. That at "A"

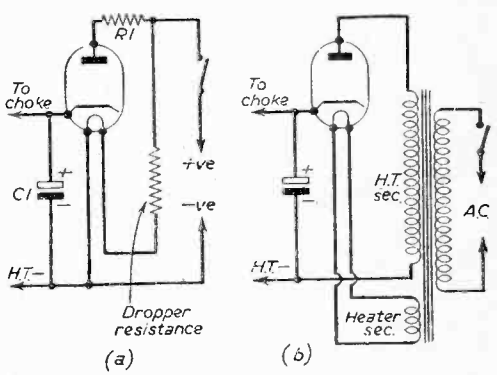


Fig. 5.—Using a valve rectifier.

is for the type of valve with a high-voltage, low-current heater—e.g., .1 to .3 amp., 25 to 50 volt types such as used in A.C./D.C. equipment. The heater resistor is the usual mains-dropper or line cord. That at "B" is for the usual 4 volt, 6.3 volt, or similar type of rectifier, heater current being derived from a secondary on the mains transformer.

Such circuits are particularly suitable for H.T. supply, or when the filament current is not excessive. If the filament current is high it will lie outside the rating of most rectifiers, which is within the 150 to 250 mA. limit. (This is .15 to .25 amp.) This point should therefore be watched, if an attempt is made to derive filament current from such a circuit. "All-Dry" sets with filaments in series (.05 amp.) may readily be powered from a unit of this type.

Trickle Charger Circuit

This, given in Fig. 6, has the merit of simplicity, especially if an accumulator is to hand. The accumulator is charged when the receiver is not in use, a charging current of .5 to 1 amp. being satisfactory. This is more troublesome in some respects than using a L.T. eliminator, but enables the set to be used at once in localities where no mains are available, when desired.

"All-Dry" sets requiring a 1.4 volt supply may be operated from a 2-volt accumulator with a reduction in running costs. A wire-wound resistor must be included in one lead, to drop the unrequired .6 volt. This resistor should be 2 ohms for sets with a consumption of .3 amp., 3 ohms for .2 amp., and 4 ohms for .15 amp. It can be made from a length of resistance wire.

Finally, proper care should be taken with the mains side of all eliminator wiring. Good-quality flex, with proper insulated and covered connections, should be used. The units can then be safe. Where both L.T. and H.T. eliminator circuits are used, the mains transformer may have two secondaries

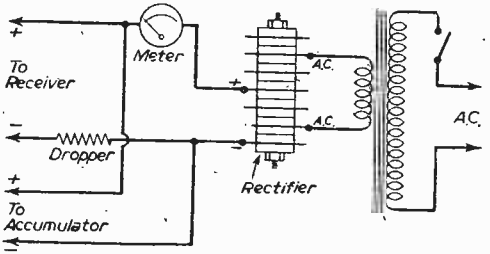


Fig. 6.—Trickle charger with dropper for 1.4v.

of appropriate rating, or separate transformers can be used, with primaries wired in parallel.

Care should be taken not to apply an excessive filament voltage to any receiver, or the valves may be damaged.

An Independent Sideband Receiver

IN short-wave radio communication systems, during recent years, an increasing use has been made of the single-sideband (s.s.b.) method of operation. This technique has played a particularly important part in the development of long-distance, point-to-point radio links, thus helping to extend the scope of international trunk networks in this field of application. Single-sideband (s.s.b.) working has many distinct advantages over the more usual double-sideband (d.s.b.) method. For example, the signal-to-noise ratio is notably improved, and there is increased freedom from non-linear distortion due to multipath transmission. Other outstanding advantages of the s.s.b. method are the high degree of flexibility it offers and the standardisation of transmitting and receiving equipment that it permits.

A further step forward in the development of international telecommunication networks has now been made possible through the introduction, by the Equipment Division of Mullard Ltd., of an independent sideband receiver, Type GFR552. The circuit and chassis layout of this equipment closely follows that of the Mullard receiver GFR551, which was based on a British Post Office design (Receiver, Radio No. 22). It has been designed for continuous use on long-distance circuits passing telephone and telegraph traffic, and it provides for the simultaneous and independent reception of four telephone channels of 3 kc/s bandwidth, or two channels of broadcast quality of 6 kc/s bandwidth. Alternatively, each sideband can be used to accommodate several voice frequency telegraph channels. It will thus be realised that the independent sideband method of operation not only offers the same advantages as normal single-sideband operation, but has the added advantage of increased traffic-handling capacity. These factors are of vital importance in the progressive advance of world-wide telecommunication networks.

Special features of the receiver include a high order of oscillator stability, and freedom from cross-modulation that might give rise to cross-talk between channels or intermodulation between wanted and unwanted signals. When used for s.s.b. reception, the receiver offers two further important advantages. In the first place it is free from non-linear distortion that occurs in normal d.s.b. type receivers when signals are subjected to selective fading conditions. In the second place, either the upper or lower sideband can be selected for demodulation, depending upon which is the more free from adjacent channel interference.

A summary of the technical features of the GFR552 receiver is given below. More detailed technical information can be obtained from the Equipment Division, Mullard Ltd.

Frequency Range. 4-30 Mc/s.

Noise Factor. Better than 7 db over the band.

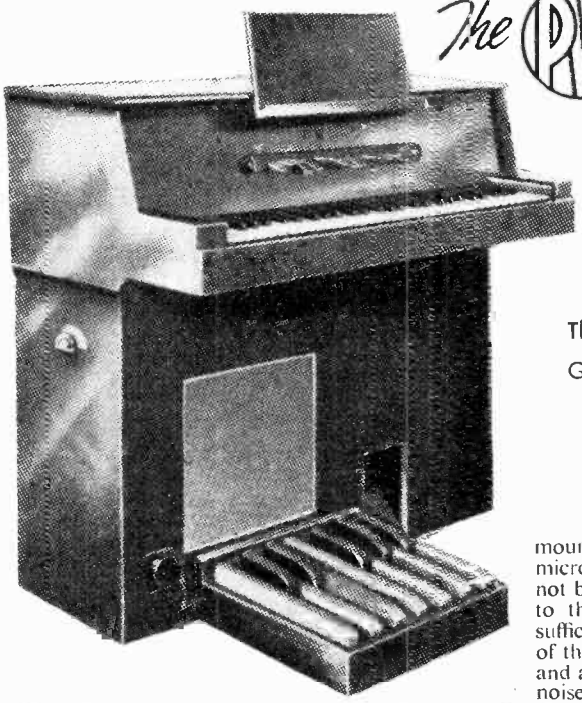
Signal-to-noise Ratio. 25 db for 4 microvolts peak sideband input over the band.

Selectivity. The response is flat within 2 db for sideband frequencies between 100 c/s and 6,000 c/s. At 10 kc/s from the carrier frequency the response is −60 db relative to the pass band.

A.F.C. The a.f.c. system operates effectively with a pilot carrier level of −26 db relative to 1 microvolt (which corresponds to a peak sideband level of 1 microvolt and a signal-to-noise ratio of 15 db).

Non-linear Distortion. Third order intermodulation products which might result in cross-talk between sidebands do not exceed −50 db relative to the sideband levels.

Output. Variable up to +14 db relative to 1 mW into 600 ohms.



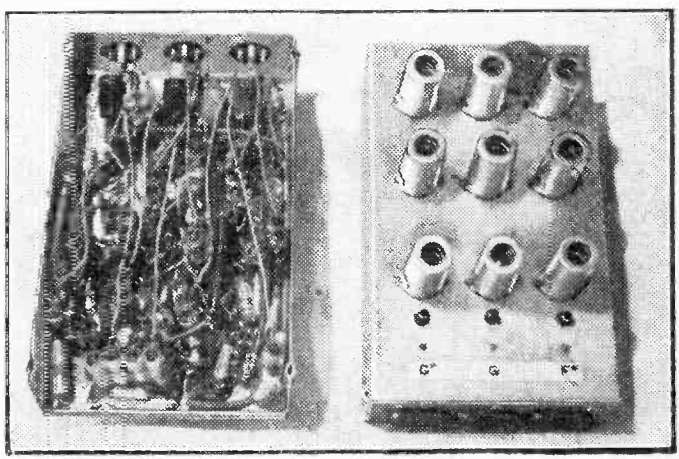
The PW FULL-COMPASS Electronic ORGAN

This Month Details are Given of the Note Generator Chassis and the Sub-power Assembly

By W. J. Delaney (G2FMY)

(*Continued from page 754 December issue*)

AT the foot of the next two pages will be found the wiring diagram of the pre-amp unit shown in Fig. 13 last month. The power for this unit is obtained from an octal plug-and-socket arrangement, the socket being mounted on a small metal bracket screwed to the wooden cover over the keyboard described earlier. This is later connected via a further socket to the main amplifier and power supply. On the left of Fig. 14 will be seen three multi-core leads projecting from the chassis with the inner ends lettered. Owing to the complication of the wiring these leads have not been taken to their respective positions in the diagram, but their terminations are similarly lettered so that no difficulty should be experienced in seeing the points to which they are joined. In the original, five-way coloured multi-cable was employed, this being of the screened type—this latter is essential. Alternatively, the ordinary double- or twin-screened cable may be used, but this will take up more space. The grommets are essential to avoid noises due to metallic contact, which will give a scraping noise through the speaker. The projecting leads should be cut to the following lengths: the upper group (a to e), 2ft. 6in.; the next group, 1ft. 6in., and the lower, of which only four leads are used, about 1ft. long. Note the use of terminal or socket strips to provide firm anchorage. If possible, the EF37A octal socket should be mounted on a square of $\frac{1}{8}$in. to $\frac{1}{4}$in. rubber to avoid microphony. The same type of cable (the screening not being essential here) is used for the power supply to the socket A and about 9in. to 12in. will be sufficient. The screened twin lead, which should be of the red and black coded type, should be 12in. long and again the chassis should be grommetted to avoid noise. Note also the use of an earthing busbar which was found desirable to avoid unwanted couplings. If it is found later that any changes are called for in the tone circuits (depending upon personal taste, particular use, etc.), these may be made across the actual switch contacts, although the fact that any component added here will be unscreened may lead to a little background hum. Check over the wiring, and when certain that everything is in order attach the bottom screening plate and attach the socket A bracket to the front left of the wooden keyboard cover, placing the pre-amp chassis next to it. Final connecting details will be given later.



Two views of the note generator chassis. Four of these units are required.

Note Generators

The next part of the work is the note generator chassis, and this calls for a little difficulty in obtaining suitable values for some cases. The circuit of each "unit" is given in Fig. 16. The required note is generated, as described earlier, by the oscillator formed by the first half of the first ECC83. The components shown in broken lines are the essential oscillator components which are made up separately and inserted in each chassis as required. As there are 12 notes to an octave, 12 of these generators are needed and the octaves are generated by the remaining

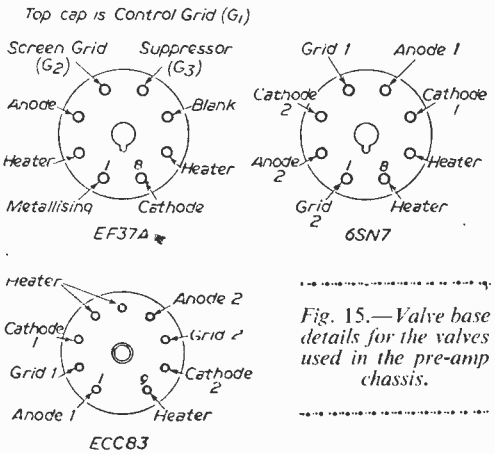


Fig. 15.—Valve base details for the valves used in the pre-amp chassis.

triodes on the circuit, thus calling for 12 similar circuits. To facilitate construction it was found best to make these up in groups of three, which could be accommodated easily on a 10in. by 6in. chassis, the final form taken being as shown on page 31. Here one of the chassis is shown from above with valves and screens in position, whilst another is shown upside down to reveal the wiring. It will be seen that an indicating strip is attached to the chassis and that the rows of three are devoted to a single note, the output from each stage being brought to the front runner and terminated on a standard five-pin valve socket. The socket is shown on the right of the diagram in Fig. 16. Power for the generator bank is supplied to each chassis through a four-pin standard valve socket mounted at the top of the chassis seen on the right of the illustration on page 31, and shown on the left of Fig. 16. Note carefully the way the H.T. supply is split—the H.T. for the oscillator triode coming from the slider of R34 in Fig. 14, which is in the anode circuit of the vibrato oscillator. This enables the vibrato

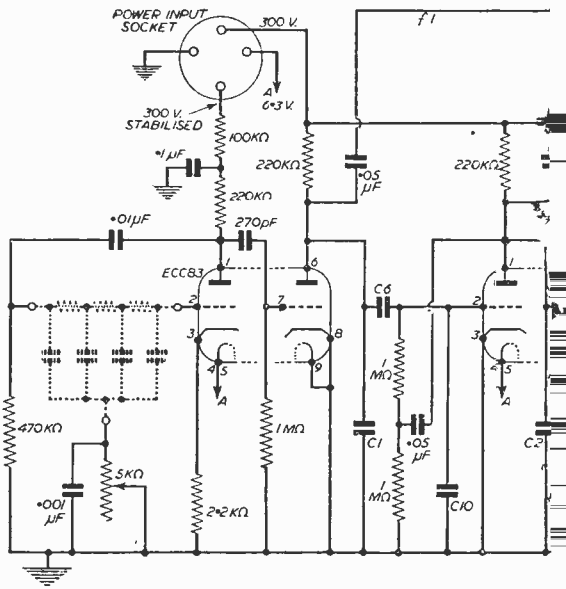


Fig. 16.—Circuit of note ge

effect to be produced by variation of the H.T. applied to the oscillator.

The chassis for the generators is cut and drilled as shown in Fig. 17, and although a chassis with runner on all four sides may be used, I used Denco chassis

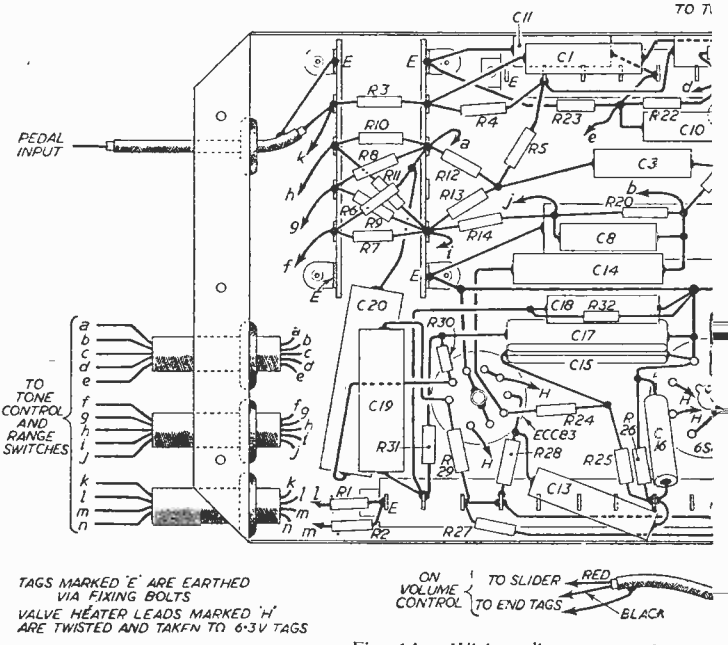
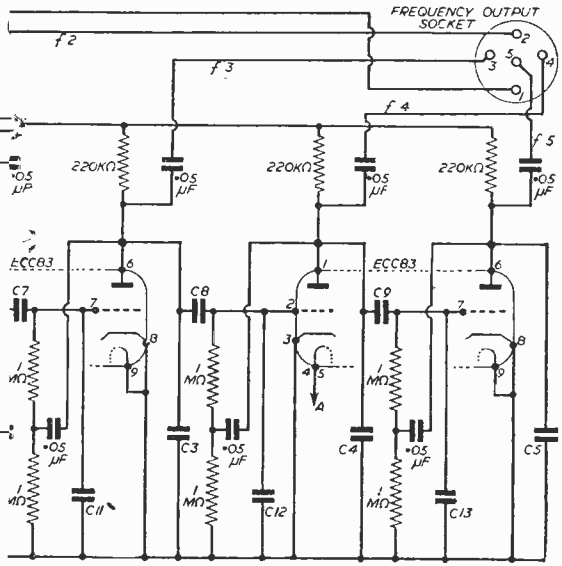


Fig. 14.—Wiring diagram of the pre



ierator for one note—five octaves.

which have two side runners only, afterwards attaching the front runner carrying the three output sockets; this gives better access to the underside of the chassis during wiring. A list of parts and the wiring diagram for a single unit of this part of the instrument will be given next month, although in the meantime for those who wish to be getting together the necessary items, it may be mentioned that the 5 kΩ resistor, which is mounted in holes C and D, is a standard Egen pre-set resistor attached by a 6 B.A. bolt through hole D, with the adjusting knob projecting through hole C. Valveholders are standard McMurdo Silver B9A with

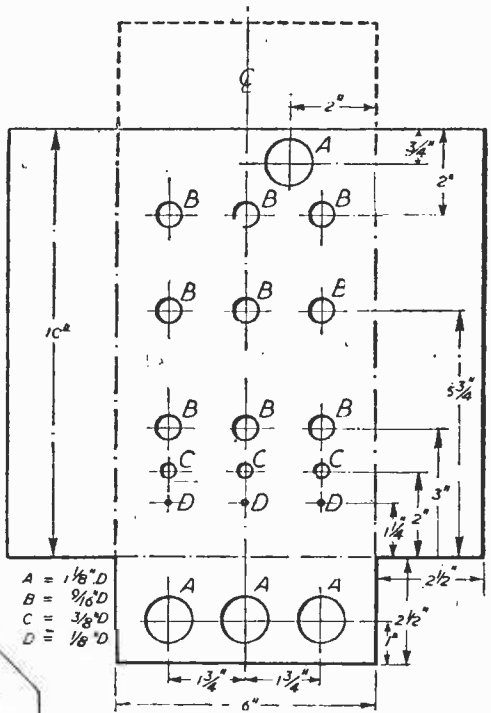
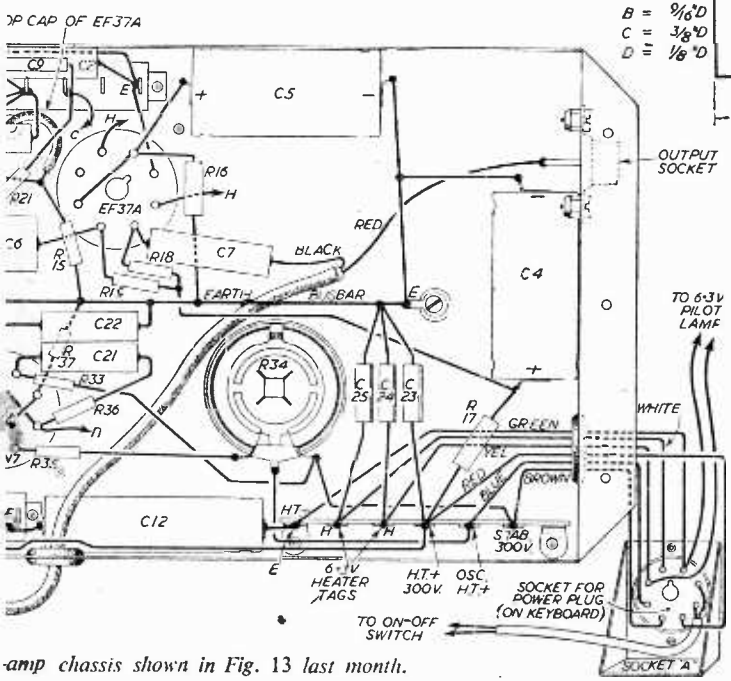


Fig. 17.—Chassis cutting and drilling data for the units shown on page 31.



-amp chassis shown in Fig. 13 last month.

skirt and screening can, whilst the output and power sockets are Bulgin types V.H.76 for the four-pin and V.H.77 for the five-pin. All resistors shown in Fig. 16 are of the Dubilier B.T.S. ½ watt type, and it should be remembered that this circuit has to be repeated 12 times, so that in the case of the 1 MΩ resistors, for instance, 108 are needed. The .05 μF condensers should be of the T.C.C. sleeved type, CP37S, rated at 500 volts working. The other values, with the exception of the .1 (a standard T.C.C. type CP46S) and the .001 (a S.M. type 701 S.M.B., also of T.C.C.) will be discussed next month.

Power Supply

It will be appreciated that the 36 ECC83's used in these four chassis will take a considerable heater current, and it is hardly to be ex-

pected that a single mains transformer could be used for this as well as the remaining H.T. and L.T. supplies. Accordingly, a separate heater supply is provided and in the original a shelf was placed towards the top of the main organ body, upon which the chassis is stood. (See page 599 of the October issue.) To the right of these will be seen a small unit which is a distribution point for power for the pre-amp as well as the generator chassis. This unit is merely a small wooden baseboard about 6in. square upon which are mounted a bracket similar to that carrying the socket A in Fig. 14, a Bulgin 10-way tagboard type T.98 and a mains transformer, having four 6.3 volt 3 amp heater windings. This was supplied by the Radio Supply Co., of Leeds, but is not a standard item. The circuit of this unit is shown in Fig. 18, and the practical wiring plan in Fig. 19.

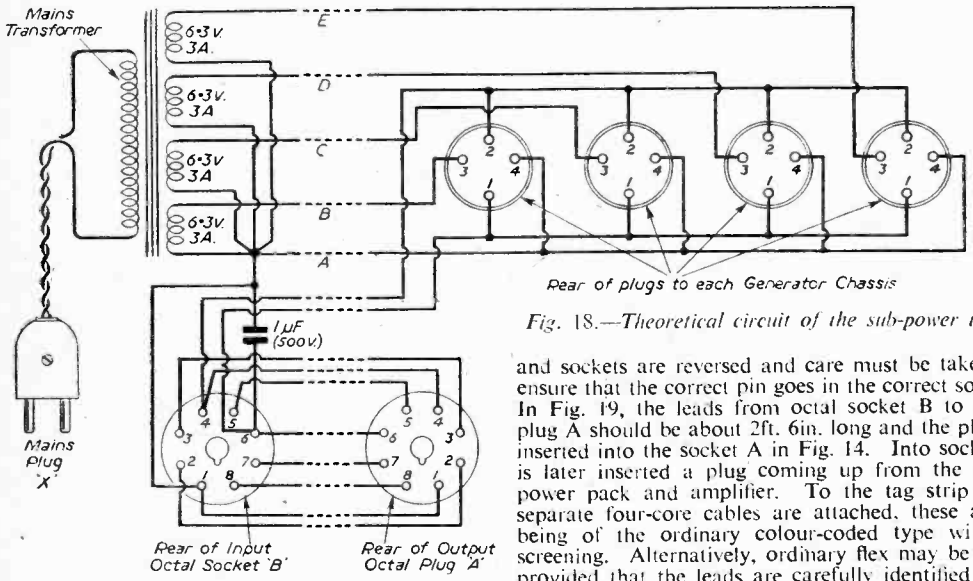


Fig. 18.—Theoretical circuit of the sub-power unit.

One side of each of the heater windings is connected to a common point, whilst the other points are wired as shown. Note particularly that all pin numbering is as seen from the end of the pins or sockets where the actual connections are made. Obviously, plugs and sockets are reversed and care must be taken to ensure that the correct pin goes in the correct socket. In Fig. 19, the leads from octal socket B to octal plug A should be about 2ft. 6in. long and the plug is inserted into the socket A in Fig. 14. Into socket B is later inserted a plug coming up from the main power pack and amplifier. To the tag strip four separate four-core cables are attached, these again being of the ordinary colour-coded type without screening. Alternatively, ordinary flex may be used provided that the leads are carefully identified as a mistake may result in valves being ruined.

BLUEPRINTS

Will readers please note that there is no blueprint yet available for this model. The blueprint advertised in our Blueprint Service is for the Monophone (single note) instrument described in 1952. Our Blueprint Service Page is held over this month, but copies of it can be obtained free on request.

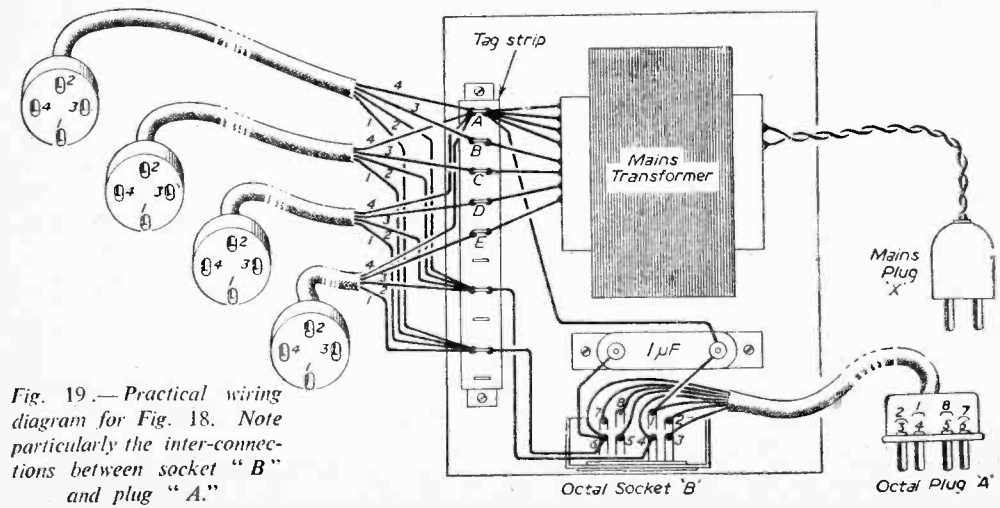


Fig. 19.—Practical wiring diagram for Fig. 18. Note particularly the inter-connections between socket "B" and plug "A."

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4 B.A. ¾in. Brass Bolts	4 3
6 B.A. ½in. Steel Bolts	1 6
6 B.A. ¾in. Steel Bolts	1 9
4 B.A. ½in. Steel Bolts	1 9
4 B.A. ¾in. Steel Bolts	2 -
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Headphones. Light-weight American make, type HS30, 27/6 pair. British-made types: high resistance, 14/6; low resistance, 6/6.

40 Volt 2½ Amp Step Down Transformer totally enclosed in metal box; primary 200-240 50 c.p.s; secondary easily rewindable to other voltages; ideal safety unit for operating children's toys or domestic gadgets, 17/6 each.

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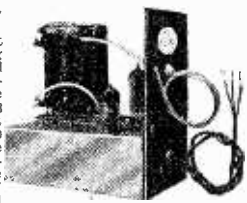
Mains Operated Bells. Use these in connection with our low-priced thermostat and you can make a frost or fire alarm for less than 10/-. Plenty of other uses, price only 5/6 each.

½ h.p. Motors by very famous makers, standard 50 c.p.s., 200-230 v. mains-operated. Delivery expected before Xmas, price around £3/10/-. Write or call for more details.

NEW ITEMS THIS MONTH

THE ELPREQ E.H.T. GENERATOR



This is a made-up unit working on the blocking oscillator / overwound amplifying stage principle. It is of moderate power consumption (6.3 volt .8 amp. filament and approx. 50 mA H.T.) and contains three of the latest BVA all-glass valves. Output obtainable ranges from 6 KV to 9 KV with normal H.T. rail input, but somewhat higher outputs can be obtained with higher H.T. supply. Valve rectification is employed in the output stage. The core of the overwound transformers is kept insulated from chassis in order to give additional protection against possible flashovers. This unit is particularly suitable for those who, during the course of their T.V. construction, have come to appreciate the advantages of separate E.H.T. supply, but should also prove invaluable as experimental or stand-by high-voltage source. Effective screening (not shown in the illustration) is provided and the dimensions are 6¼ x 4¼ x 7in. Price 69/6, post, packing, etc., 5/-.

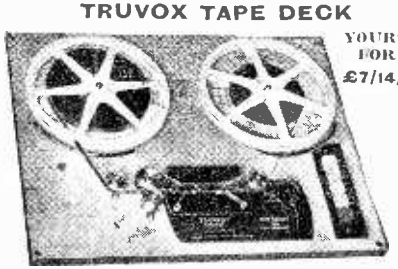
THE ELPREQ "SELECTIVE FEED-BACK" SMALL RECORD REPRODUCER

To accommodate the wishes of many of our old customers we are releasing this month a record reproducer. For a very small outlay this instrument is capable of a performance usually only associated with a number of famous reproducers of the high-fidelity class.

The amplifier is fitted with independent bass and treble control, both connected through different feedback loops so that no "cut" at all in the ordinary sense is applied. The variation which can be achieved by applying various degrees of negative feed-back in the higher and lower ranges of the sound strata will accommodate all individual tastes.

We strongly recommend a 12in. speaker in order to make the fullest use of the instrument's potentialities. Booklet and set of components available at once at £2 19/6, post, etc., 2/6. Booklet separate, 1/6. 12in. Speaker to suit, £3 - -, post free if bought with amplifier.

TRUVOX TAPE DECK



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3. Push-button control, electrically and mechanically interlocked.
4. Separate push-button brake. Patented electric type.
5. "Fast-forward" and "fast-rewind" without tape wear, one minute for a full reel.
6. Silent drive eliminating "wow" and flutter.
7. Half-track working, and two tape speeds giving 60 minutes each track at 3¾in. per second or 30 minutes each track at 7½in. per second.
8. Visual playing-time indicator.
9. With a suitable amplifier, the equipment covers a frequency range from 50-10,000 c.p.s. at 7½in. per second.
10. The deck will take all standard reels, plastic or paper-based tapes, up to 1 200 ft. capacity.

We have a good stock and will be pleased to supply. Price is 22 gns., or if you wish send only £7/14/- deposit, the balance can be spread over 12 months. Non-callers please add 7/6 carriage and insurance.

MORE NEW BARGAINS

CO-AXIAL CABLE

70 to 80 ohms for T.V. by one of our leading manufacturers, medium thickness. Price 8d. per yard cut to your length.

L.F. CHOKES

50 H 30 mA.	6/6
50 H 20 mA.	6/6
30 H 20 mA.	6/6
20 H 10 mA.	5/6
15 H 80 mA., fully shrouded ...	15/-
10 H 150 mA., fully shrouded ...	18/-
10 H 100 mA., fully shrouded ...	15/-
10 H 75 mA.	4/9
10 H 60 mA.	4/9
5 H 250 mA., fully shrouded ...	20/6

Please add 1/- post & pkg.

COILS

T.R.F. Long and Medium wave, complete with circuit diagram, 5/6 pair. Superhet, long wave, 900-2,000 metres; medium wave, 185-550 metres; short wave, 16-50 metres, with aerial and oscillator coils, that is, set of six. Coils with circuit diagram, price 10/6.

VACUUM THERMOCOUPLE

Of interest especially to scholastic establishments and available at a very low price is vacuum thermocouple made originally for the Government. Unused, fitted with standard Octal base, Type No. WY2252. Regret no other details available. Price 5/-, 54/- doz.

ENERGISED TYPE L.S.

6½in. Rola, field resistance 700 ohms 12/6. Add 1/- per speaker for packing and insurance.

NEW 5-AMP THERMOSTAT (Miniature)

Useful for the control of appliances such as convectors, gluepots, vulcanisers, hotplates, etc. This thermostat is adjustable to operate over the temperature range 50-550 deg. F., fitted with heavy (5 amp. A.C.) silver contacts, size 1¼in. long x ¾in. wide. Price 8/6, post 6d.; 1 amp. type, 3/6; 2 amp. type, 5/6.

BEDROOM-NURSERY MAINS MIDGET RADIO

Xmas is not far off, but if you act promptly you will have enough time to make several of these little A.C. Mains radios. All the parts —bakelite cabinet, valves, knobs, back—in fact, everything will cost you only £3/15/- (plus 2/6 postage) which we think you will agree is not too much to spend on your dear ones. The set is economical to run, too, for it uses only three valves in a special reflex T.R.F. circuit which gives ample power combined with good tone. Incidentally, if you wish to give the sets to young children, why not decorate the cabinet with a few suitable transfers; these can usually be obtained from local handicraft-shops. Circuitry and construction data free with the parts, or available separately at 1/6.

COASTAL RADIO BEACONS

SOME INTERESTING DETAILS OF THE LATEST NAVIGATIONAL AIDS

By S. Simpson

IT is rather surprising to find that, whilst the basic theory of radar is quite well-known to most of us, so little is known regarding that other essential navigational feature of our maritime traffic —the radiobeacons.

These small, auto-controlled transmitters are to be found in most of our coastal stations, whether they be lightships or lighthouses far out at sea, or pleasantly placed coastguard stations complete with cabbage patch and first-class view of the golf links. In all cases, ashore or afloat, the beacon is under the supervision of the principal keeper and his staff.

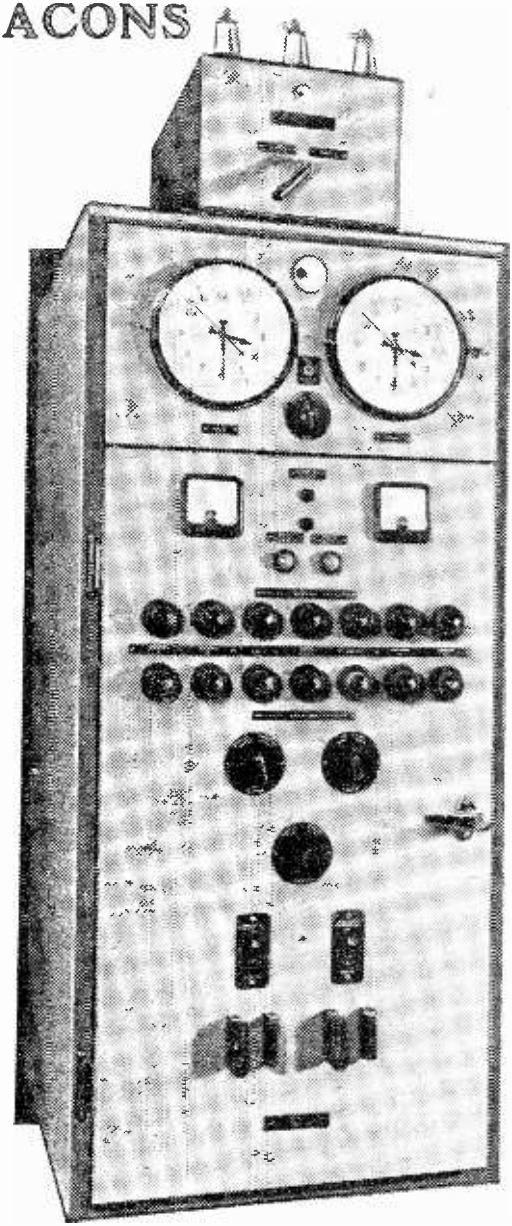
What purposes do these beacons serve? Firstly, they are constant position markers which, day and night, are available to the navigators of our seagoing and coastwise shipping. Secondly, from them, bearings can be taken which will determine the position of passing vessels. Again, they may serve, on request, as calibrators for the direction-finding equipment on board ship. Perhaps their greatest value, however, is their ability to get their identification through no matter what state of visibility exists. Neither rain, snow nor fog can stop the beacon.

The network of radiobeacons around our shores is quite complicated and is still growing. Air traffic is now adding to the number and complexity of the system and because of the growing need to share frequencies, strict precautions must be observed in the operation of these transmitters. For that reason, and also to assist in the identification of the station, definite times of transmission are alloted to each beacon. The identification is achieved mainly by the code letters which precede and terminate the beacon "dash," but a third aid to station naming is the audio-frequency note which modulates the beacon carrier and which differs between the various groups nto which the entire beacon system is divided.

Transmitter Details

The equipment behind the beacon service is essentially simple to operate. One cannot have complicated apparatus on a lightship riding out an Atlantic gale! The transmitter is crystal-controlled and radiates on low power in specially selected bands. The aerial may be a mast radiator, end-fed through a matching unit which is itself fed from the distant transmitter by coaxial feeders, or it may be a simple T-erection on board ship or ashore; much depends on the location of the "light."

As mentioned earlier, timing is a vital factor in the radiobeacon service. The radiation of each beacon signal is automatically controlled by a robustly-built time-switch driven by an electrically-operated master clock of very high accuracy. On shore the master clock may be a special type of pendulum movement, hand-made by craftsmen who are selected for this work because of their natural aptitude and the years of experience behind them. At sea, and in the very exposed lighthouses, chronometers, impervious to vibration, are the rule. The accuracy of a pendulum movement is in the region of two to three seconds loss or gain per week; a wider divergence is usual in



A Beacon Control Cabinet
(Photo by courtesy Marconi's W/T Company.)

chronometers but in either case, resetting of the master clock to G.M.T. or B.S.T. is readily achieved by the operation of one small switch, a duty undertaken by the personnel of the "light" at frequent intervals and which takes approximately eight seconds to carry out.

The design of these master clocks makes them highly dependable and self-maintaining but, as the service has now become a vital factor in the safety of shipping

and prolonged breakdown cannot be tolerated, a duplicate of the complete time equipment, including batteries, is provided and can be brought into service at a moment's notice by operating the switches on a central control panel such as that shown below.

Identification Codes

Although the transmitter can be manually keyed when necessary, the identification coding and long dash are normally automatically keyed by an arrangement of cam-operated contacts. The motor which drives the cams is switched on by the master clock at the precise second allocated to the "light" and the speed of keying is set to occupy exactly the predetermined time as stated on the identification data issued for the station. Again, duplicated equipment is available at the switches on the control panel.

In some stations the transmission occurs once in each six minutes throughout the 24 hours and, although it is hardly to be expected that an attendant will be in a position to observe the transmitter making every call during his watch, yet it is vital that the station be restored to full service at the earliest possible moment should a breakdown occur. Immediate warning of trouble is, therefore, imperative, and so the radiobeacon carries its own automatic alarm device. This ingenious contrivance depends for its operation on a definite percentage of the full radiated power reaching it, and in some "lights" even the modulation depth cannot fall below a pre-set level without causing alarm bells to ring in all important quarters of the station. The master clock itself is safeguarded against failure and will ring a bell within five seconds of stopping—an alarm clock with a difference!

Who maintains the beacons? Much of the work can be done by the staff of the "light" and nowadays, part of the qualifying examination for the keepers includes radio theory. Major overhauls, however, are carried out by maintenance engineers of the various authorities concerned, and emergency service which is beyond the scope of the lighthouse personnel receives attention from the standby staff ashore.

And so it goes on, day in, day out. Somewhere, a keeper glances up at a "radiation" lamp which will light only if the beacon is normal; somewhere out at sea, a radio officer hears the code he expects at the moment he expects it and it is reasonable to assume both would agree that the radiobeacons are providing a very essential service among the danger points that skirt our island.

News from the Clubs

LIVERPOOL AND DISTRICT SHORT WAVE CLUB

Hon. Sec.: Arthur D. H. Looney, 81, Alstonfield Road, Knotty Ash, Liverpool, 14.

CLUB activity has increased over the last two months and some very interesting lectures and contests have been held, also a recent visit was made to the Clarence Dock Power Station, which supplies a large area of the North-West with power.

Recent lectures have included "Stubs and Matching," by G3ETH. "The V.H.F.," by G3DA (a very renowned V.H.F. man) and "Pages from my Note Book," by G8BM.

The "Aims of Industry Film Unit," gave a full-length programme on November 17th and on November 20th the club held their annual "Hamfest," at the Mecca Café, Liverpool, 1, when the Malcolm Cohen Trophy was awarded to G3CK for having won the mid-summer D.F. contest. At a recent constructional contest, first place was given to G3ETH for his QRP CO-PA top-band Tx; second place to Mr. Etheridge for his oscillascope and third place to Mr. G. Robbins for his 150-watt Tx; the judges, Messrs. Kendrick, G3CSG; Roberts, G3EGX; Blocksidge, G2FNI, of the Wirral Amateur Radio Society, had quite a job to pick these three placings out of a total of 14 entries, all of high class work. At the A.G.M. of the club G6KS, Mr. H. Caunce, was elected president; Mr. I. Griffiths, G3ELL, was elected chairman and the club were happy to announce that they were now able to offer a reduced subscription rate from 10/- to 7/6 per annum for seniors and from 5/- down to 3/- for juniors.

All amateurs and listeners who may visit Merseyside will be accorded a warm welcome any Tuesday evening at 8 p.m.

MIDLAND AMATEUR RADIO SOCIETY

Hon. Sec.: D. Hall, 144, Hill Village Road, Sutton Coldfield.

THE annual dinner of the above society was held on October 10th, 55 guests and visitors attended and the event was much enjoyed by all.

On October 20th, a lecture on V.H.F. and U.H.F. equipment was given by a member, Ron Rew, G3HAZ, and was very successful.

Plans are now being made to make the annual Christmas meeting a festive occasion, and visitors are cordially invited to attend.

Meetings are held on the third Tuesday in the month at 7 p.m. in the Imperial Hotel, Birmingham.

ECCLES AND DISTRICT RADIO SOCIETY

Hon. Sec.: E. Richardson, 10, Stanley Avenue, Eccles.

THE society continue to meet every Monday evening at 7.30 p.m., at Eccles Abbey House Club, Abbey Grove.

The club has recently had several enjoyable "2 Mtr." contacts on a transmitter/receiver, designed and built by one of its members and hopes for many more in the near future.

The top-band rig has been silent now for many weeks but, all being well, will be on the air again at the time of publication.

Slow morse and other help is always available to new members in need of it and visitors are allowed a month free of obligation before deciding whether or not to join.

Regards are extended to our past members.

A programme is being arranged for the winter months.

CLIFTON AMATEUR RADIO SOCIETY

Hon. Sec.: C. H. Bullivant (G3DIC), 25, St. Fillans Road, S.E.6.

IN response to a number of requests by members, the newly elected committee have given priority to the provision of Constructional Evenings. A work bench has been presented to the club by G3GYZ and a number of other members have donated useful tools. Ted Smith is in charge of operations and members have been busy of late installing additional light and power points and generally getting things ship-shape.

Arrangements are well in hand for the Christmas Hamfest, which this year is being held on December 11th. During the Hamfest judging will take place of the annual Constructional Contest when members will again be exhibiting gear constructed by them over the past year.

On October 23rd an ever-popular Junk Sale was held, whilst on November 6th there was a film show comprising films sponsored and kindly lent by British Insulated Callender's Cables, Ltd. Among the films shown were "Railway Electrification, Liverpool Street-Shenfield," "750ft. Television Mast at Sutton Coldfield," and "Building Britain's Grid."

Membership remains at a high level, but new members and visitors are always welcome. Meetings are held every Friday at 7.30 p.m. at the clubrooms, 225, New Cross Road, S.E.14.

BARNSLEY AND DISTRICT AMATEUR RADIO CLUB

Hon. Sec.: P. Carbutt (G2AFV), 33, Woodstock, Road, Barnsley.

ON Saturday, October 17th, 1953, the Barnsley and District Amateur Radio Club celebrated its foundation 40 years ago on August 21st, 1913, at the Royal Hotel, Barnsley, with a dinner at the King George Hotel, Peel Street, Barnsley.

The president of the club, Mr. G. Wigglesworth, who is a founder-member of the club, was introduced by Mr. H. Eyre, the chairman of the club, and gave a brief history of the club, which was originally called the Barnsley and District Amateur Wireless Association, and at the same time introduced to the gathering Mr. J. H. Naylor, who was another founder-member, and Mr. H. Wilde, who was a member of the club before the 1914-18 war.

Mr. W. Farrar, of the Pontefract Radio Club, proposed the toast of the club, and the remainder of the evening was spent in a convivial way with ample opportunity for reminiscence.

The club meets on the second and fourth Fridays of each month at the King George Hotel, Peel Street, Barnsley.

Volume Controls

Midget Ediswan type. Long spindles. Guaranteed 1 year.

LESS Sw. S.P. Sw. 3/- 4/-
D.P. Sw. 4/9

ALL VALUES.—10,000 ohms to 2 Megohms.

80 ohm CABLE COAX

STANDARD ¼in. diam. Polythene insulated.
REDUCED PRICE
9D. A YARD
NOT Ex. Govt.
COAX PLUGS, 1/2 each.
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LINE CONNECTOR. 1/2.
OUTLET BOXES. 4/6.

BALANCED TWIN FEEDER per yd. 6d.) 80 **TWIN SCREENED FEEDER** per yd. 1/-) ohms **50 OHM COAX CABLE,** 8d. per yd. ¼in. dia.

TRIMMERS, Ceramic. 30, 70 pf. 9d.; 100 pf. 150 pf. 1/3; 250 pf., 1/6; 600 pf., 1/9.

RESISTORS.—All values: ½ w., 4d.; 1 w., 6d.; 1 w., 8d.; 2 w., 1/-; 4 w. 1/6, 2/-; 2/6, 1/6.

WIRE-WOUND RESISTORS.—Best Makes Miniature Ceramic Type—5 w., 15 ohm to 4 K., 1/9; 10 w., 20 ohm to 6 K., 2/3; 15 w., 30 ohm to 10 K., 2/9; 5 w. Vitreous, 12 K to 25 K., 3/-.

WIRE-WOUND POTS. 3 WATT, FAMOUS MAKES
Pre-set Min. TV Type. Knurled Slotted Knob. All values 25 ohms to 30 K. (50 K. and 100 K. Carbon Track), 3/- each.
Standard Size Pots, 2¼in.
Spindle. High Grade
All Values. 100 ohms to 50 K., 5/6; 100 K. 6/6.

O/P TRANSFORMERS.—Small pentode. 3/9. Heavy duty 70 ma., 4/6. Ditto, tapped, 4/9.

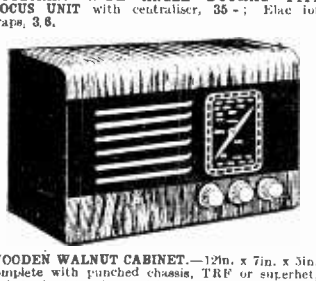
L.F. CHOKES 10 h. 65 ma., 4/6. 20/25 h. 100/150 ma., 12/6. 5 h. 250 ma., 15/-. 15 h. 100 ma., 10/6.

LYNX, choke, 3 h. 250 ma., 13/6.

MAINS TRANS.—Made in our own workshops to high grade specification. Fully inter-leaved and impregnated. Heater Trans., tapped prim., 0-200 v./250 v., 6.3 v 1½ amp., 7/6; ditto 6.3 v. 3 amp., 10/6; ditto 12 v. 3 amp., 7/6. 350-0-350, 80 ma., 6.3 v. 4a., 5 v. 2a., ditto 300-0-300, ditto 250-0-250, 21/-. Viewmaster, auto type, 35/-. Teleking, 30/-. Lynx, 30/-. Coronet, 30/-. Super Visor, 30/-.

SOUNDMASTER SPECIALS.—Mains Trans., 35/- L.F. Choke, 10/6. O/P Trans., 5/6. Envelope, 6/6.

GOODMANS WIDE ANGLE DUOMAG TYPE FOCUS UNIT with centraliser, 35/-; Elac ion traps, 3/6.



WOODEN WALNUT CABINET.—12in. x 7in. x 5in. complete with punched chassis, TRF or superhet, dial, back-plate, drum, drive, spring, pointer, etc., 25/6, plus post 2/-.

TYANA.—Midget Soldering Iron. 200/220 v. or 220/250 v., 16/9. **TYANA TRIPLE THREE.**—Complete with detachable bench stand. 19/6. IDEAL FOR RADIO CONSTRUCTORS.

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.

TAG STRIPS.—2- or 3-way, 2d.; 4- or 5-way 3d.; 6-way, 4d.; 9- or 10-way, 6d.

GROUP TAGBOARDS.—(2¼in. wide.) 5-way, 9d.; 9-way, 1/-; 14-way, 1/6; 28-way, 2/6.

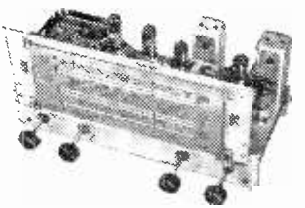
TERMINAL BLOCKS — Moulded bakelite, 2-way, 9d.; 4 w., 1/6; 6 w., 2/3, etc., up to 12 w., 4/6.

MARY ANN Vacuum Cleaner Flexible Hoses, plated ends, 1¼in. diam. fitting 10/6. 12ft. appliance lead, switched-connector and combination adapter 6/9.

TV. AERIALS.—Full range popular types in stock. Aerialite etc. All channels. Indoor loft type Inv. T., 13/6. Outdoor single dipole, 37/6. H type with chimney lashings, etc., 92/6. X type Dublex, 7ft. mast and chimney lashings, etc., 88/6. Fringe models available. Ask for quotation.

50FT. RADIO AERIALS.—Aerialite, 4/-; 18in. Earth Rods, 4/-.

TOGGLE SWITCHES EX-GOVT. "On-Off." 9d. Erwin M'core solder 60/40, 16G, 5/6 ½ lb.; 4d. yd.; T.C. wire 18 to 22 s.w.g., per yd., 2d. PVC Connecting wire, 10 colours. Single or Stranded 2d. yd. B7G Valveholder and Screening Can., 1/6. V'holders, octal, pax., 4d.; moulded, 6d.; EF50, B7G, 9d.; B8A, B9A, 1/-; B12A (CRT), 1/3, etc. 2 K. 5 w. H.D. w/w Pots, 4/6. 10 K Colvern w.w. Pot, 1in. spindle, 3/6. **SCREENED GRID CAPS** int. oct. or Mazda, 6d. each. **FUSES.**—1¼in. all values 60 ma. to 10a., 6d. **ALADDIN FORMERS** and cores, ¼in., 8d.; ⅜in., 10d. **SLOW MOTION DRIVES.**—Epicyclic ratio 4 : 1, 2/3. **INT. OCTAL PLUG** (8-pin), 1/-. **200/250 Volt. SELECTOR SOCKET** (2in. x 1in.), with Plug, 1/-. **EXT. SPEAKER VOL. CONTROL.** 10 ohms wirewound long spindle, 3/-.



ALL WAVE RADIOGRAM CHASSIS

THREE WAVEBANDS — FIVE VALVES
LATEST MULLARD
S.W. 16 m.—50m. ECH 42, EF41.
M.W. 200m.—550m. EBC 41, EL 41, EZ40
L.W. 800m.—2,000m.

Brand New and Guaranteed, with 10in. P.M. Speaker. A.C. 200/250 v. Four position Wavechange Switch, Short-Medium-Long-Gram. Slow Motion Tuning. Speaker and Pick-up connections. High Q iron-dust cored coils, 465 kc/s I.F. Latest circuit technique delayed A.V.C. and Negative feedback. Output 4.2 watts. 3 ohms output transformer on chassis. Chassis size 14½ x 5½ x 2¼in. Glass Dial—10in. x 4¼in., horizontal or vertical type available, lit by 2 Pilot Lamps. Colour Black, Station names, L.W. Green, M.W. Red, S.W. White. Four Knobs supplied. Walnut or Ivory to choice, aligned and calibrated.

PRICE. £10/15/0. Carriage and Insurance, 4/6. (Without 10in. Speaker, £9/15/0. Carr. & Ins., 4/6.)

BARGAIN OFFERS

RECOMMENDED FOR ABOVE CHASSIS
GREAT REDUCTIONS

Brand New Collaro Autochanger. 3-speed Model. 3RC521. Twin High Fidelity Heads. For 7in., 10in. or 12in. Records. Sprung Mounting. Superb Quality. List £16/10/-. Our Price 9½ gns. post free.

Ediswan 78 r.p.m. Single-player Gram Unit. High Impedance Magnetic Pick-up. Press lever start for 10in. or 12in. records, auto stop. Listed 7 gns. Our Price £4 10.

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NEW BOXED — ALL GUARANTEED

1A5	5/6	6J7	8/6	12Q7	10/6	EF39	9/-
1R5	8/-	6K6	7/6	12SH7	5/6	EF50	Equip
185	8 -	6K7	6/6	15D2	9/6		5/6
1T4	8 -	6K8	9 -	35L6	10/6	British	7/6
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6AG5	7 6	6SL7	9/-	CV6	3/6	HVR2a	7/6
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6AT6	10 6	6U5(VG9)	8 -	DK91	9/-	PY80	11/6
6B8	7 6	6V6	8/-	DF91	9/-	PY81	11/6
6BE6	10 6	6X5	9/-	DAF91	9/-	PY82	10/6
6BW6	10 6	6AK5	10/6	DL92	9/6	PEN25	8/6
6C4	7 6	7S7	9 6	DL94	9/6	8P61	8/6
6C6	7 6	8D3	10 6	E1148	4/6	8U2150	7/6
6D6	7 6	9D2	5 6	EA50	2/-	U22	9/6
6F6	9 6	12A6	7 6	EB34	1 6	VP23	7/6
6F12	10 6	12AT7	10 6	EB91	7 6	VR116	6/6
6G6	6 6	12AX7	10 6	EBC33	9/6	ECL80	12/6
6H6	3/6	12K7	10/6	EC91	7/6	25L6	10/6
6J5	7/6	12K8	10/6	EF36	7/6	25Z6	10/6

Huge Stock B.V.A. Valves at 1951 low tax prices

SPECIAL PRICE PER SET:
1R5, 1T4, 1S5 and 3S4 ... ... 80/-
6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5 ... ... 37/6
VIEWMASTER. 12 valves, £6/10/-. With EY51, £7. **TELEKING.**—17 valves, £9/10/-. **LYNX.**—17 valves, £9. **CORONET.**—4 valves, 45/-. **"J.B." DIAL ASSEMBLY,** Type 8LB, 28/6.

LINE CORD.—2a., 100 ohms per foot, 3a., 60 ohms per foot. 2-way 1/6 a yard, 3-way 1/8 a yard.

SLEEVING.—Various colours, 1, 2 mm. 2d.; 3, 4 mm., 3d. yd.; 6 mm., 5d. yd.

MAINS DROPPERS.—(3in. x 1¼in.). Adj. sliders .3 amp. 750 ohms. .2 amp. 1,000 ohms, ea. 4/3.

WAVECHANGE SWITCHES.—2 p. 2-way, 3 p. 2 way, 2/6; 2 p. 6-way, 4 p. 2-way, 4 p. 3-way, 3/6

CRYSTAL DIODE.—Very sensitive. G.E.C., 3/6. B.T.H., 2/6. **H.R. PHONES** (8, G. Brown), 15/6 pr.

P. and P., 6d. £1 orders post free. Lists 3d.

T.R.S. RADIO COMPONENT SPECIALISTS

THO 1665

Buses 133 or 68 pass door.

307, WHITEHORSE ROAD, WEST CROYDON.
Mail Order: 71, MEADVALE ROAD, EAST CROYDON

CONDENSERS.—New stock best makes. .001 mfd. 6kV. T.C.C., 5/6. Ditto 12.5 kV., 9/6; .002 Muirhead 8 kV., 2/6; 2 pf. to 500 pf., 6d.; .001, .005, .01, T.C.C. 500 v., .01 Sprague 500 v., .02 N.S.F. 500 v. Tub., .1 mfd. 350 v. Micamould Tub., 9d.; .05 N.S.F. or Dubilier, .1 mfd. Hunts 500v., 1/-; .25 mfd. 500 v. Hunts, 1/6; .5 mfd. 500 v. Hunts, 1/9.

SILVER MICA CONDENSERS.—10%.
5pf. to 500 pf., 1/-. 600 pf to 3,000 pf., 1/3.
DITTO 1% (2 day service).
1.5 pf. to 500 pf., 1/9. 515 pf. to 1,000 pf., 2/-.

ELECTROLYTICS ALL TYPES NEW STOCK.

Tubular Wire ends
4/500 v. Hunts, 2/-
8/450 v. B.E.C., 2/6
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16/500 v. Dubilier, 4/-
8+8/500 v. Dubilier, 4/6
16/350 v. B.E.C., 3/-
32/350 v. Dubilier, 4/-
32/500 v. Dubilier, 5/-
32+32/500 v. Dub., 7/6
50/150 v. Dubilier 4/-
25/25 v. Dubilier 1/9
50/12 v. T.C.C., 1/9
50/25 v. Dubilier, 1/9
50/50 v. T.C.C., 2/-

Can Types, Clips, 3d. ea.
16/450 v. T.C.C., 3/6
16/500 v. Dubilier, 4/-
32/350 v. B.E.C., 4/-
64/350 v. T.C.C., 6/6
250/50 v. B.E.C., 8/6
8+16/450 v. B.E.C., 5/-
8+16/500 v. Dubilier, 5/6
16+16/450 v. B.E.C., 5/6
16+16/500 v. Dubi., 6/-
32+32/275 v. Dub., 4/6
32+32/350 v. 4-25/25 v. in same can B.E.C. 6/6
60+100/350 v. Hunts., 11/6

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; K3/100 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, 260-0-260 v. 80 m/a., 6.3 v. 3 a., 6.3 v. 1 a., 12/6. Oscilloscope Transf. Prim. 0-230 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/- CHARGER TRANSFORMER.—0-200/250 prim. sec. 0-9 v.-15 v. 1½ amp., 13/6.

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/-.

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

BRIMISTORS.—CZ1 for .3 a. heater chains, 3/6. CZ2 for .15 a., or .2 a., 2/6.

COPPER ENAMEL WIRE.—¼ lb. 16 to 20 s.w.g. 2/-; 22 to 28 s.w.g., 2/6; 30 to 40 s.w.g., 3/6.

SWITCH CLEANER Fluid, squirt spout tin 3/9.

5in. RADIO SCREWDRIVERS.—Sheffield made blade, 2¼in. x ¼in. Ins. handle, 5,000 v., 4½d.

TWIN GANG STANDARD SIZE.—With feet. .0005 mfd., 8/6 Ditto midget, 7/6. .375 pf. midget twin gang, 6/6. **BARGAIN** .0005 mfd. twin gang, slightly soiled, 5/6.

RESISTOR TAG PANELS.—Clearance Bargain from Brand New Units. A fair mixture of ½, 1, 1 and 2 w. and w/w resistors (average number 45-50). Sold by weight—one price while they last, 3/- per lb., P. & P. 9d. Satisfaction guar. or money refunded.

"REGENT" LIGHTWEIGHT XTAL HAND MICROPHONE.—Super quality, high sensitivity, chrome finish. Listed 2 gns. Our price, 29/6. **BRAND NEW AND BOXED.**

LOUDSPEAKERS P.M., 3 OHM.
3in. Plessey, 12/6. 5in. Plessey, 13/6, 6½in. Goodmans, 14/6. 8in. Lectrona, 15/6. 8in. Goodmans, 17/6. 10in. Lectrona, 25/-. 5in. G.E.C. Energised 700Ω field with trans., 19/6.

BARGAIN VALUE I.F. TRANSFORMERS

465 Kc/s Slug tuning. Miniature. Circular Can, 2¼in. by 1¼in. diam. Fits octal V-holder cut out. High Q. and good bandwidth, By Pye Radio. Two mounting feet.

BRAND NEW 6/9 PAIR

Surplus Double-diode-triode Valves

A SUMMARY OF EX-SERVICE VALVES, WITH EQUIVALENT TYPE NUMBERS

By E. G. Bulley

THESE valves are available at very reasonable cost on the surplus market, and are suitable for the experimenter and constructor. The double-diode-triode valves were designed to perform a multiple of functions, and are used mainly in superhet receivers where they perform a combined function of an A.V.C. rectifier, second detector and the first audio frequency amplifier stage.

A.V.C. is important because it provides automatic regulation of the various stages, and by so doing the amplification of the receiver is controlled so that, regardless of the incoming signal strength, the same volume is maintained.

This control over the various stages is accomplished by utilising the rectified D.C. voltage which is developed by the received signal across the resistance in the detector circuit. This voltage, therefore, varies the bias on the R.F. and I.F. stages. However, this will be more fully explained later in this article.

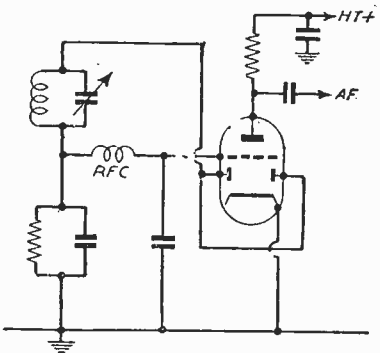


Fig. 1.—Typical half-wave detector—Diode anodes strapped together.

The valve itself usually comprises a common cathode or filament, dependent upon whether it is an indirectly or directly heated valve.

Some types do, however, have separate cathode systems for the diode and triode sections. Nevertheless, the triode and diode sections of the valve are completely independent of each other, and are suitably screened from each other within the valve. The purpose of such screening is to prevent mutual interaction, and so in effect the valve is really a triode and two diodes in one envelope, or in other words three valves in one. The complete independence of operation allows great flexibility in circuit arrangements and design.

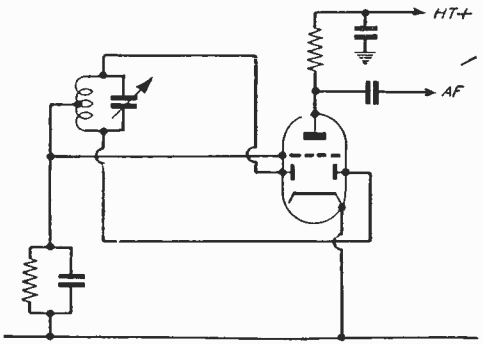


Fig. 2.—A full-wave detector circuit—this is actually a modified form of Fig. 1.

Double-diode-triode valves can be used in various circuit arrangements such as half- or full-wave detector circuits, followed by the triode audio amplifier; half- or full-wave detector with amplified and instantaneous A.V.C., or half-wave detector with delayed A.V.C. However, in half-wave detection, one diode anode can be used or alternatively both diode anodes can be strapped together.

TABLE 1

Type	Fil. Volts	Fil. Current	Anode Volts	Slope mA/V.	Impedance	Amp. Factor	Remarks
BRITISH							
AR8	2.0	.5 amp.	150	1.2	21 KΩ	25	D.H.
VR44	2.0	.1 amp.	150	1.2	23 KΩ	28	D.H.
NR48	6.3	.2 amp.	300	2.0	15 KΩ	30	I.H.
VR101	6.3	.65 amp.	250	3.0	—	—	I.H.
NR68	6.3	.3 amp.	300	1.2	58 KΩ	70	I.H.
VT194	6.3	.3 amp.	300	1.2	58 KΩ	70	I.H.
AMERICAN							
VT92	6.3	.3 amp.	250	1.2	58 kΩ	70	I.H.
VT103	6.3	.3 amp.	250	1.1	91 kΩ	100	I.H.
VT88A	6.3	.3 amp.	250	1.9	8.5 KΩ	16	I.H.
VT88	6.3	.3 amp.	250	1.9	8.5 KΩ	16	I.H.

Circuits

Typical circuits using such valves are shown in Figs. 1, 2 and 3. The latter is, perhaps, the most common of its application.

In the latter-mentioned circuit the rectified output from V1 is passed to two resistances, namely R1 and

Basing Details Base Std. 5pin

Type	Pin 1	2	3	4	5	T.C.
VR44	A	D1	F−	F+	D2	Grid

R2; V1 is the R.F. stage of the receiver. A voltage is developed across these resistances, the whole being applied via R3 to the grids of the previous R.F. stages. A part of the voltage developed, however, is also fed to the grid of V1 via resistance R4.

The amplifier part of the valve, namely the triode section, is cathode biased by resistances R5 and R6. These resistances actually determine the value of the applied carrier voltage at which the diode will commence to pass current. One will, therefore, appreciate the fact that the A.V.C. on the preceding stages will not operate until such time as the carrier voltage applied arrives at a specific value. The cathode bias is conventional and is delayed by the time constant of resistances R3 and R4 and the condensers C1 and C2. R6 actually determines the delay voltage and does to a certain extent depend upon the output valve of the receiver.

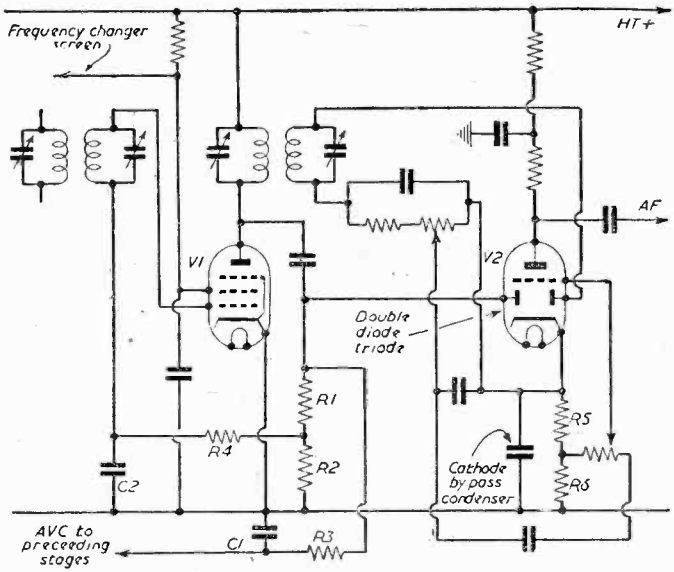


Fig. 3.—Typical circuit using a D.D.T. valve.

TABLE 2 (*continued—see also page* 41)

	Pin 1	2	3	4	5	6	7	8	T.C.	Base
AR8	F—	Blank	A	Blank	D2	Met.	D1	F+	Grid	Int. octal
NR48	Met.	Heater	A	D1	D2	Blank	Heater	Cathode	Grid	Int. octal
VR101	Blank	Heater	A	D1	D2	Blank	Heater	Cathode	Grid	Int. octal
NR68	Blank	Heater	A	D2	D1	Blank	Heater	Cathode	Grid	Int. octal
VT194	Blank	Heater	A	D2	D1	Blank	Heater	Cathode	Grid	Int. octal
VT103	Met.	Grid	Cathode	D1	D2	A	Heater	Heater	—	Int. octal
VT92	Met.	Heater	A	D1	D2	—	Heater	Cathode	Grid	Int. octal
VT88	Met.	Heater	A	D1	D2	—	Heater	Cathode	Grid	Int. octal
VT88A	Met.	Heater	A	D1	D2	—	Heater	Cathode	Grid	Int. octal

Diode detection has the advantage of being not easily overloaded, because the higher the input signal the smaller the distortion. Furthermore, as no R.F. voltages are applied direct to the grid of the triode section, a larger output is obtained without undue distortion bearing in mind that the valve has fixed bias.

Diode action can be best clarified as follows: the diode anode is used as a half-wave rectifier, with a permanent D.C. voltage applied between the cathode and the second diode anode; this applies negative bias to the latter.

The peak carrier signal that is developed across the primary of the I.F. transformer must be less than the D.C. voltage if the A.V.C. is not to take place, thus allowing the receiver to operate at maximum sensitivity. But as soon as the signal voltage exceeds the D.C. voltage, the second diode anode rectifies, and thereby causes a negative bias to be applied to the preceding valve.

One will appreciate, therefore, that the sensitivity of the receiver is kept at a maximum, but from that point onwards should the signal strength increase in value the sensitivity is reduced and the overloading of the output valve prevented.

Valves available upon the surplus market are listed in Table 1, their electrical ratings being included. Table 2 gives the basing details.

Amateur Wireless Licences

AS from the 1st January, 1954, prospective Amateur Licence holders will no longer be given their morse test at any Head Post Office.

The tests will be conducted on request at:

(a) G.P.O. Headquarters, St. Martins-le-Grand, London, E.C.1.

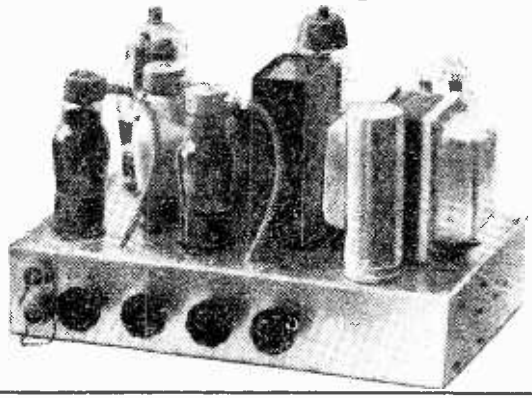
(b) Post Office Coast Stations, i.e., Burnham, Cullercoats, Humber, Land's End, Niton, North Foreland, Oban, Port Patrick, Seaforth, Stonehaven and Wick.

(c) Radio Surveyor's Offices, i.e., Belfast, Cardiff, Falmouth, Glasgow, Hull, Leith, Liverpool, London, E.C.3, Newcastle-on-Tyne and Southampton.

In order to meet the need of applicants who cannot conveniently reach the above places, tests will also be held, provided there are sufficient candidates, twice a year (January and September) at the following Head Post Offices: Birmingham, Cambridge, Derby, Leeds and Manchester.

R.S.C. 25 Watt "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.
Outputs for 3 or 15 ohm speakers
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. 420 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 5/- 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 0.4 a to 1 a. Price, complete with circuit, wiring diagrams and instructions, only 43/9. 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 11ins.

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	6SN7GT	11/9	D1	1/9
3S4	9/9	6V6G	8/9	EF36	5/11
5Y3G	8/9	6V6GT	8/9	EB34	9/9
5U4G	10/6	6X5GT	8/9	EF91	9/9
5Z4G	9/6	12D2	2/11	EL32	6/11
6AL5	9/9	807	6/11	MU14	9/6
6F6G	7/11	9D2	2/11	MS Pen	5/9
6AM5	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	VU120	2/11

ELECTROLYTICS (Current production. Not ex-Govt.)

Tubular Types			
8 μF 350 v	1/9	16 μF 450 v	2/9
8 μF 450 v	1/11	24 μF 350 v	2/11
8 μF 500 v	2/9	32 μF 350 v	2/11
16 μF 350 v	2/3	32mfd 450 v	4/9
16 μF 450 v	2/9	32 μF 500 v	6/11
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
8 μF 450 v	2/3	32-32 μF 350 v	4/11
8 μF 500 v	2/11	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. 6in. 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, tropicalised ... 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 ... 3/11

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 (1½in.) 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
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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, 6-0-6 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; 0-4-6.3 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
All with 200-230-250 v 50 c/s, Primaries: 0-9-15 v 1.5 a, 14/9; 0-9-15 v 3 a, 16/9; 0-9-15 v 6 a, 22/9; 0-4-9-15-24 v 3 a, 22/9.

SMOOTHING CHOKES
250 mA 7-10 H 200 ohms, Fully Shrouded 16/9
250 mA 3-5 H 50 ohms 11/9
100 mA 15 H 350 ohms 6/11
80 mA 10 H 350 ohms 5/6
60 mA 10 H 400 ohms 4/11

E.H.T. TRANSFORMERS
2,500 v 5 mA, 2-0-2 v 1.1 a, 2-0-2 v 1.1 a, for VCR97, VCR517, ACR2X, etc. ... 35/-
5,000 v. 5 mA 2 v 2 a 39/6

OUTPUT TRANSFORMERS
Midget Battery Pentode 66 : 1 for 3S4, etc. 3/9
Small Pentode 5,000, 8,000 30 Ω ... 3/9
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Multi-ratio 40 mA, 30 : 1, 45 : 1, 60 : 1, 90 : 1, Class B Push-Pull ... 5/6
Push-Pull 10-12 watts 6V6 to 3Ω or 15Ω 15/9
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15Ω 16/9
Push-Pull 15-18 watts to match 6L6, etc., to 3Ω or 15Ω Speaker 22/9
Push-Pull 20 watts, sectionally wound, 6L6, KT66, etc., to 3, or 15Ω 47/9
Williamson type exact to Author's spec. 85/-

Terms C.W.O. or C.O.D. NO C.O.D. under £1. Post 1/1 extra under £1. 1/9 extra under £3. Open 9 to 5.30, Sats. until 1 p.m. List 6d. Trade List 5d. S.A.E. please with all enquiries.

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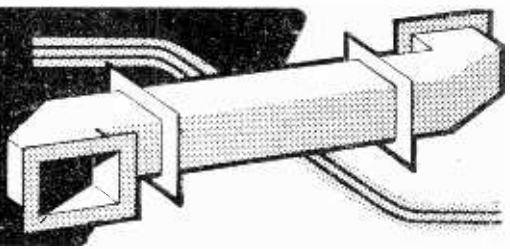
Transmission Lines and Wave Guides



By F. E. Apps

THE ability to transfer from a point of generation to a point of radiation (as for instance, to an aerial system) or from a point of reception to a point of investigation, with as low a loss as possible, is of the utmost importance in radio, television, radar or any electronic apparatus. The usual connections as in ordinary electrical practice do not suffice, as the losses entailed therein would be very high. This is due to the fact that the frequencies used are not in the 50 cycle range but go much higher. They do range, indeed up to 1,000 and 2,000 Mc/s. When frequencies reach as high a figure as this, many more factors come into consideration, all of which can, and will, cause very high loss and even prevent propagation of the wave or frequency desired. It was due to these losses that research work was undertaken to find a method in which these losses were either reduced or practically eliminated.

Up to a few years ago it was noticed that these losses could be considerably reduced by using a transmission line, but on further research into the very-high-frequency band, even these transmission lines failed. The object of this article is to show how a transmission line does its job on ordinary radio or television frequencies, but fails when very-high-frequencies are concerned.

From that point we will then proceed to analyse the wave guide, which is the present known answer to propagation of the very-high-frequencies where the transmission line no longer acts.

Transmission Lines

A transmission line, which should be non-resonant, is a means of transferring a wave from one point to another with as low a loss as possible. This loss will only be low if the impedance of the line matches the terminal load impedance. If the line impedance varies from the terminal load impedance, then a reflected wave is set up which is superimposed on the original wave. This in turn sets up standing waves along the line. This causes losses, and the way to eliminate them is to see that the impedance of the line is equal to the terminal load impedance, thus eliminating reflected waves. Note that reflected waves will act in opposition to the original wave. Thus, if a reflected wave has 50 per cent. of the original wave, then the transmission line can only carry 33 per cent. of the original load.

Types of Transmission Line

There are three types of transmission line that are now commonly used. They are :

(1) 2 parallel wires, air spaced.
(2) Solid coaxial cable.
(3) Parallel wires in flat strip separated by insulating material.

A transmission line may be represented as a circuit (see Fig. 1).

The impedance of a transmission line, or to use the more usual term, the characteristic impedance of the various types of transmission line may be found as under :

(i) Parallel wires air spaced.

$$Z_o = 120 \log_e \frac{d}{r} \text{ ohms.}$$

where d = centre to centre distance.
r = radius of wire.

(ii) Solid coaxial.

$$Z_o = \frac{60}{\sqrt{e}} \log_e \frac{b}{a} \text{ ohms.}$$

where b = outer radius.
a = inner radius.
e = dielectric constant.

(iii) Parallel wires in flat strip insulated.

$$Z_o = \frac{120\pi d}{\sqrt{e}\,w} \text{ ohms.}$$

where d = distance separation.
w = width.
e = dielectric constant.

These formulæ show that Z_o or the characteristic impedances are between 50 to 500 ohms for lines of ordinary proportions.

If the transmission line is terminated in its own characteristic impedance, then there will be no reflected waves and the current and voltage will be uniform all along the line. Should the end of the

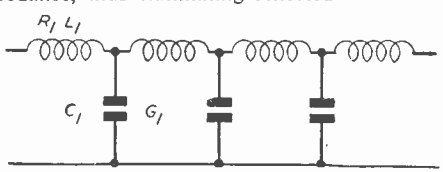


Fig. 1.—In this circuit the inductances have resistance R_1, and self inductance L_1, and the capacitors have capacity C_1 and conductance G_1.

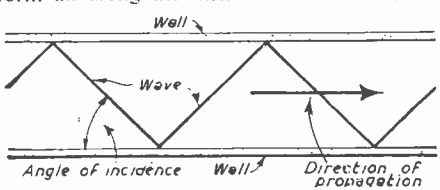


Fig. 2.—Showing how a wave is reflected from the walls of the wave-guide.

line be either open-circuited or short-circuited, then reflected waves will be set up to 100 per cent. of the propagated wave, and standing waves of high amplitude will appear on the line. There will then be no resultant from the line, but volt loops and nodes and current loop and nodes will be found along the line spaced $\lambda/2$ apart.

If the line is terminated in some R value other than the characteristic impedance Z_o of the line, then there will be some reflection, varying according to the difference between R and Z_o. The terminal resistance must be a purely resistive load, i.e., non reactive.

Thus, if a line is terminated on a resistance R, reflecting waves will appear, and also some of the energy will be dissipated in R as heat. If the energy be $V_1I_1=Z_o$, let the reflected wave be $V_2I_2=-Z_o$, then the voltage and current at R during the reflected wave are such that

$V=V_1+V_2$ and $I=I_1+I_2$.

Now as $V=IR$.

Then $V_2=V_1\dfrac{R-Z_o}{R+Z_o}$

also $I_2=I_1\dfrac{R-Z_o}{R+Z_o}$

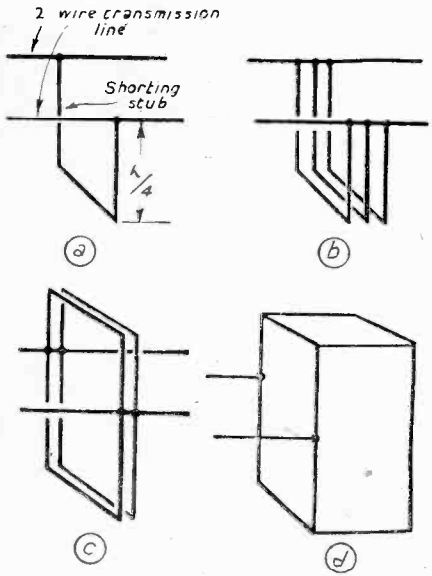


Fig. 3(a).—This stub has no effect on the line since the open end is of high impedance. (b) More stubs added to line. (c) More added edge to edge. (d) If the number of stubs is increased indefinitely and placed into contact, a metal tube, $\lambda/2$ high results.

Reflection takes place unless $R=Z_o$. If this is so, I_2 and V_2 disappear, there is no reflection, and the energy is absorbed at the same rate as it is propagated.

It will be noticed that a transmission line, chosen correctly for its current carrying capacity, its breakdown voltage value and its characteristic impedance for the correct terminal impedance, can be the means of transferring waves from one point to another with very low loss. Of course, some losses are unavoidable; for instance, copper loss (in the conductor) and insulation loss, especially in solid coaxial. This latter, however, is kept well down as manufacturers are now using very low loss insulating materials such as polyethelene.

The reason why transmission lines fail on the very-high-frequencies will be seen as we investigate the working of a wave guide.

A transmission line may be of a considerable length (up to 1,000ft.) without appreciable loss, if the terminal load be correct. Any difference between the terminal load and the characteristic impedance of the line will mean standing waves whose amplitude will determine the length of line that can be used.

Wave Guides

As a transmission line is, at low and ordinary radio frequencies, so is a wave guide to the very-high-frequencies. In other words, it is a means of transferring the energy from one point to another with as small a loss as possible.

A waveguide is normally either a rectangular metallic or cylindrical tube through which very-high-frequencies may be passed. The wave passes longitudinally through the tube by means of reflection between the walls of the tube, Fig. 2. Although the wave impinges on the walls of the tube, very little is absorbed, as it does not penetrate. In fact, the losses in a waveguide are mostly due to skin effects only. Owing to this non-penetration, the outer wall of the tube may be earthed, if desired.

From Fig. 3 it may be clearly seen how a waveguide, more or less, came from a transmission line of two parallel wires.

Energy is introduced into a waveguide by a coupling which may be either inductive or capacitive. This is generally effected by means of a loop or a capacitor plate inserted in the end of the tube.

Dimensions of a Waveguide

This is of the utmost importance as otherwise it will be a wave stopper instead of a waveguide.

The Height. This should be at least $\lambda/2$ (see Fig. 3). *The width* depends on the voltage breakdown and also, of course, on the characteristic impedance. With reference to the height, it can be seen that a waveguide can only be used for very high frequencies, that is, very low wavelengths to keep its dimensions within reason. Owing to its dimensions a waveguide has a definite cut-off frequency below which no energy will be transmitted. This is determined by the cross section of tube.

A waveguide, unlike a transmission line, does not radiate, and confines its energy in between its walls. Owing to the reflected path it travels (Fig. 2), the velocity of the propagated wave is slower than through air.

Mode of Propagation

The relationship between the electro-magnetic, and the electro-static fields, and their separate propagation within the waveguide, determines the mode of propagation.

There are several modes, in fact they are very complex, but generally they are classed in only two groups:—

1. *Transverse magnetic.* In this case there is no magnetic field in the direction of propagation, only electrostatic.

2. *Transverse electrostatic.* This is the reverse of the previous group.

CABINET as illustrated, 11¼ x 6½ x 5¼in. in walnut or cream, complete with T.R.F. chassis, 2 wave-band scale, station names, new waveband, backplate, drum, pointer, spring, drive spindle, 3 knobs and back. **22 6.** P. & P. 3 6.

As above with Superhet Chassis, **23/6.** P. & P. 3 6.

As above complete with new speaker to fit and O.P. trans., **35/-.** P. & P. 3 6, with Superhet Chassis **36/-.** P. & P. 3/6.

Used metal rectifier, 230 v. 50mA. **4/6**; gang with trimmers, **6/6**; M. & L. T.R.F. coils, **5/-**; 3 obsolete Ex Govt. valves, 3 v/h and circuit, **6 6**; heater trans., **6/-**; volume control with switch, **3/6**; wave-change switch, **2/-**; 32 x 32 mfd., **4/-**; bias condenser, **1/-**; resistor kit, **2/-**; condenser kit, **4/-**.

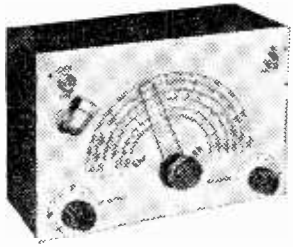
M & L Superhet coils with circuit, **6.6**; iron cored 465 IFs, **7.6**; min. gang, **5/6**; volume control with switch, **4/-**; wave-change switch, **2.6**; heater trans., **7.6**; 4 v/h, **1/6**; 4 obsolete Ex Govt. valves, metal rectifier and Xtal diode with circuit, **14/6**; 25 x 25 mfd., **1/-**; 16 x 16 mfd., **3 3**; condenser kit (17), **7/6**; resistor kit (14), **3'6.**

Used 4 valve plus metal rec. A.C. mains, 230 250 superhet. Valve line up 6 K8, 6K7, 6Q7 and 6F6. Medium and long wave, in mahogany cabinet, size 14¼ x 9 x 7½in. These have been checked and are in first-class working order, and have a first-class performance, 6½in. P.M. speaker, P. & P. 5/-. **£3/19/6.**

Used 5 valve A.C. mains 200/250 3 wave-band superhet. Complete in outstanding walnut cabinet, size 22 x 14 x 10½in. Valve line up, 6K8, 6K7, 6B8G, 6F6 and U50 rec., 8in. P.M. speaker. In first-class working order. **£7/19/6.** P. & P. 12 6. We have a few of these in A.C./D.C., price as above.

All dry A.C. mains battery unit, 200/250 v. Metal case size 8 x 5 x 3in., by famous manufacturer incorporating Westinghouse metal rectifiers, 3 500 mfd., 16+24 mfd., mains trans., 3 smoothing chokes, output 90 v. 10 mA., 1.4 v. .25 amp. P. & P. 2/6, **39/6.**

COMPLETELY BUILT SIGNAL GENERATOR. Coverage 110 Kc/s-320 Kc/s., 300 Kc/s-900 Kc/s., 900 Kc/s-2.75 Mc/s., 2.75 Mc/s-8.5 Mc/s., 8.5 Mc/s.-25 Mc/s., 17 Mc/s.-50 Mc/s., 25.5 Mc/s.-75 Mc/s. Metal



case 10 x 6½ x 4½in., size of scale 6½ x 3½in., 2 valves and rectifier, A.C. mains 230 250 v. Internal modulation 400 c.p.s. to a depth of 30%. Frequency calibration accuracy plus or minus 1%. Modulated or unmodulated R.F. output continuously variable 100 milli-volts. Post and packing 4/-. **£4/5 0.**

Pr. 200/250 v., secondary 3. 4. 5. 6. 8, 9. 10, 12. 15, 18, 20, 24 and 30 volt at 2 amps., **13.-.**

Drop thro' 280-0-280, 200 mA., 6 v. 5 amps., 5 v. 3 amps., **27.6.**

Heater Transformer. Pri. 230-250 v. 6 v. 1½ amp., **6/-**; 2 v. 2½ amp., **5/-**, 2, 4 or 6 v. at 2 amps., **7 6**; 2 v. 2½ amp. and 6 v. 0.6 amp. E.H.T. insulated, **8 6.** P. & P. each 1/-.

R.I. MAINS TRANSFORMERS, chassis mounting, feet and voltage panel. Primaries 200 250.

300-0-300 60 mA. 6.3 v. 1 a., tapped at 4 v. 6.3 v. 2 a. tap 4 v., **13 6.**

350-0-350 75 mA. 6.3 v. 3 a. tap 4 v. 6.3 v. 1 a., **13 6.**

350-0-350 120 mA. 6.3 v, 3 a, tap 4 v., 5 v. 2 a. tap 4 v., **25 -.**

350-0-350 70 mA. 4 v. 5 a. 4 v. 2.5 a., C.T., **18/6.** P. & P. on the above transformers 2/-.

500-0-500 125 mA. 6.3 v. C.T. 4 a. 6.3 v. C.T. 2 a. 5 v. C.T. 2 a., **27 6.**

500-0-500 120 mA. 4 v. C.T. 4 a. 4 v. C.T. 4 a. 4 v. C.T. 2.5 a., **27 6.**

500-0-500 250 mA. 4 v. C.T. 5 a. 4 v. C.T. 5 a. 4 v. C.T. 4 a., **39 6.**

P. & P. on the above transformers 3'-.

32 mfd., 350 wkg.	2/-
16 x 24 350 wkg.	4/-
4 mfd., 200 wkg.	1 3
40 mfd., 450 wkg.	3/6
16 x 8 mfd., 500 wkg.	4/6
16 x 16 mfd., 500 wkg.	5 9
8 x 16 mfd., 450 wkg.	3/9
32 x 32 mfd., 350 wkg.	4/-
32 x 32 mfd., 350 wkg. and 25 mfd., 25 wkg.	6/6
25 mfd., 25 wkg.	11d.
250 mfd., 12 v. wkg.	1/-
16 mfd., 500 wkg., wire ends	3/3
8 mfd., 500 v. wkg., wire ends	2 6
8 mfd., 350 v. wkg., tag ends	1 6
50 mfd., 25 v. wkg., wire ends	1 9
100 mfd. 350 wkg.	4'-
100+200 mfd., 350 wkg.	9/6
16+16 mfd., 350 wkg.	3/3
Ex-Govt. 8 mfd. 500 v. wkg., size 3½ x 1½, 2 for	2/6
60+100 mfd., 280 v. wkg.	7 -
16 x 32 mfd., 350 wkg.	6/-
50 mfd., 180 wkg.	1/9
65 mfd., 220 wkg.	1/6
8 mfd., 150 wkg.	1.6
60+100 mfd., 280 wkg.	8.6
50 mfd., 12 wkg.	11d.
32+32 mfd., min., 275 wkg.	4'-
50 mfd., 50 wkg. 8 mfd., wkg., wire ends	1 9
Miniature wire ends moulded 100 pf., 500 pf., and .001 ea.	7d.

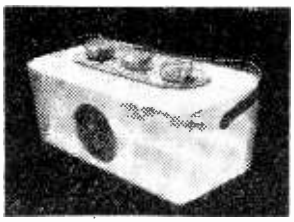
CONSTRUCTOR'S PARCEL, comprising chassis 12½ x 8 x 2in., cad. plated 18 gauge, v/h., IF and trans. cut-outs, backplate, 2 supporting brackets, 3 waveband scale, new wavelength station names, Size of scale 11½ x 4½in., drive spindle, drum, 2 pulleys, pointer, 2 bulb holders, 5 paxolin international octal valve holders, 4 knobs, and pair of 465 IFs, **16 6.** P. & P. 1.9.

R. & A. 8in. M.E. Speaker field coil 1,600 ohms O.P. trans. 5,000 ohms. imp. **18 6.** P. and P. 2'-.

5in. M.E. field coil 750 ohms with O.P. trans., **17/6.** P. and P. 1'-.

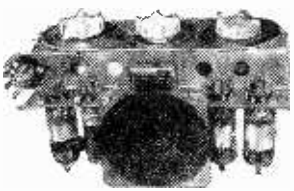
Constructor's Parcel, comprising chassis 8in. x 4in. x 1½in., with speaker and valveholder cut-outs, 5in. P.M. speaker with transformer, twin gang with trimmers, pair T.R.F. coils long and medium, iron cored, four valveholders, 20 K. volume control and wave-change switch, **23/-.** Post and packing,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

Germanium crystal diode, 2 3. post paid.



PERSONAL PORTABLE CABINET in cream-coloured plastic, size 7 x 4½ x 3in. Complete 4-valve chassis. Scale and 3 knobs. Takes miniature 90 v. and 7½ v. batteries, **9/-.** P. & P. 1.6.

3in. P.M. SPEAKER to fit above, **10'-.** Miniature output transformer, **5 -.** Miniature wave-change switch, **1/6.** Miniature 1-pole 4-way used as Volume and Off, **1'6.** 4 B7G valveholders, **2/4.** Midget twin gang .1in. dia., .1in. long and pair medium and long-wave T.R.F. coils .1in. long x .1in. wide; complete with 4-valve all-dry mains and battery circuit, **8/6.** Condenser Kit, comprising 11 miniature condensers, **3/6.** Resistor Kit, comprising 15 miniature resistors, **4/6.** The above receiver (less valves and batteries) could be built for approximately **51/-.** P. & P. 2/6. Valves to suit above **10'-** ea. Point to Point Wiring Diagram. **1'-.**



View of chassis as it would look when assembled with valves inserted.

Extension speaker cabinet, in contrasting walnut veneers, size 15 x 10½in. Will take 6½ or 8in. speaker. **17 6.** P. and P. 2 -.

Volume Controls, Long spindle less switch, 50K, 500K, 1 meg., **2/6** each. P. and P. 3d. each.

Volume Controls. Long spindle and switch, ¼, ½, 1 and 2 meg., **4** - each; 10 K. and 50 K., **3/6** each. ½ and 1 meg., long spindle double pole switch, miniature, **5'-.** P. and P. 3d. each.

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

Valveholders. Paxolin octal, **4d.** Moulded octal, **7d.** EF50 ceramic, **7d.** Moulded B7G **7d.** Loctal amphenol, **7d.** Loctal pax., **4d.** Mazda amph., **7d.** Mazda pax., **4d.** B8A, B9A amphenol, **7d.** B7G with screening can. **1 6.**

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

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

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

P.M. SPEAKERS	with trans.	less trans.
3½in.		13/6
5in.	16 6	12 6
6½in.	16/6	12/6
8in.	18 6	15'-
10in.		19/6

Post and packing on each of the above, 1/6 extra.

Crystal pick-up with Sapphire Trailer Needle, with volume control, **23 -.** P. and P. 1/-.

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

TRANSMITTING TOPICS

THE CARE AND FEEDING OF P.A. STAGES

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

TO obtain the best results from the P.A. stage, particularly if modern high-slope tetrode or pentode valves are used, the amateur must ensure that operation is in accordance with the valve ratings. Not only this, but the "feeds" of bias voltage, screen voltage and R.F. grid drive must all be correctly adjusted to ensure optimum performance. Furthermore, the tank circuit of the P.A. must be correctly proportioned for the operating conditions, so that correct output matching is ensured and the R.F. generated is efficiently transferred to the aerial system.

All the above seems a formidable list of requirements, and it is a tribute to the modern valve designer that a reasonable performance is often obtained despite lack of attention to one or other of the above factors. However, due attention to all these requirements will make the difference between indifferent results of "a sort" and the optimum performance. Also, of course, valve life may be very short when running at maximum inputs if the operating conditions are not as they should be.

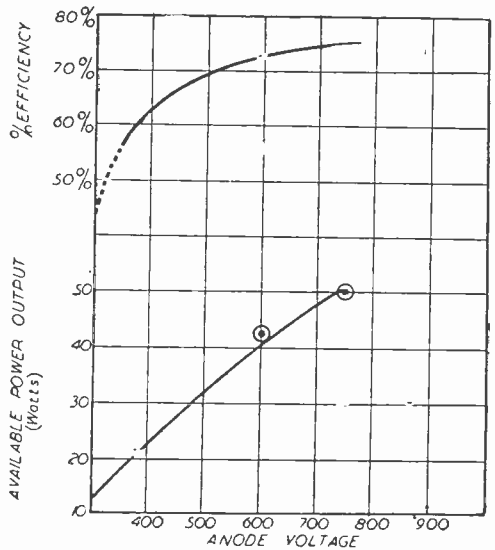
As an illustration, take the popular 807. This is rated at 30 watts maximum dissipation, and at a P.A. efficiency of say 66 per cent. it looks as if the maximum input feasible is some 90 watts. While in fact the 807 has been known to be pushed to 100 watts input, or even 150 watts input, this is a very risky procedure. In fact, the RCA maximum rating is for 75 watts input, at an anode current of 100 mA., and a voltage of 750. This is apparently well under the possible 90 watts we might expect to run.

Two Factors

It must be understood that there are two factors limiting the input to the P.A. valve. One is the maximum current permitted, the other is the maximum anode voltage. As it happens, the 807 is so rated, that under the usual P.A. conditions of an efficiency of around 66 per cent., it is in no danger of exceeding its rated anode dissipation. In fact the efficiency at the "full rating" of 75 watts could fall to 60 per cent. before the anode dissipation limit is reached. Yet the reader may say, the official RCA figures show an efficiency of just over 66 per cent. for 75 watts input. The temptation, therefore, is to try to squeeze the 807 to give more output than the rated maximum. In fact it looks as if an input of some ninety watts could be tolerated.

However, the ratings placed upon a valve by the manufacturer have a very good justification. It should also be understood that no single rated maximum should be exceeded, even if the valve is still within its other ratings. For example .the 807 is limited to 100 mA. of anode current. If this rating is exceeded, the life of the valve will be shortened, as the cathode will be overloaded. This will eventually result in a premature loss of emission, so that the merry life becomes a short one. Thus under no circumstances is it permissible to exceed the current rating. This is particularly true of Class C P.A. stages, as the peak emission is many times greater than the average D.C. Thus, with 100 mA. D.C. feed, the actual emission on peaks may be up to as much as 700 mA.

The maximum H.T. voltage rating is somewhat different, as this is usually set with a generous margin to offset the possibility of internal valve flashover. Other factors, such as electrolysis of the glass, also



◉ Listed output power in ARRL Handbook

Fig. 1.—807 *efficiency and power output curves.*

have a bearing on this point. However, as valves may vary considerably in their resistance to flash-over, it is sometimes possible to "get away" with increased H.T. voltage. In fact voltages up to 1,000 have been used with 807 type valves. However, the amateur who risks an increase in voltage can never be certain that a sudden flash-over in the valve may not ruin it. Moreover, it is only on C.W. that one is likely to achieve this increase of H.T. voltage. Under anode modulation conditions the

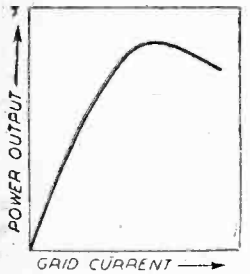


Fig. 2.—"Overdriving" a tetrode P.A. stage.

peak voltages are far higher, so that an 807 is limited to 600 volts H.T. under anode modulation conditions, and even here the peak voltage across the tube is nearly 2,500 volts at 100 per cent. modulation! Finally, the above ratings are the so-called "intermittent" ratings as in amateur operation. For continuous use still lower ratings are used. British manufacturers in fact prefer to quote only the continuous ratings for the 807.

Reduced Ratings

Leaving the question of overdriving, we may turn to the other question of operation at reduced ratings. Very often as in portable rigs, or for topband use, one only needs to operate at reduced inputs. The question then arises as to whether a "large" valve operated at reduced ratings is efficient, or whether a smaller valve is not better under these conditions. A heated correspondence on the use of the 807 on topband with 10 watts input recently enlivened the pages of the R.S.G.B. Bulletin!

To simplify this question, we may say that if one uses the 807 at reduced powers, then it is better to reduce the anode current rather than the anode voltage. In fact the efficiency of any P.A. stage will fall off as the anode voltage is decreased. However, as figures are seldom available on this interesting point, the efficiency to be expected from an 807 at various anode voltages has been calculated by the usual procedure for Class C stages. The graph of Fig. 1 tabulates the results. It will be seen that the efficiency drops rapidly at low anode voltages, but that down to 400 volts the efficiency is good. However, as the actual output of a P.A. stage depends upon the tank circuit efficiency, a curve showing the actual R.F. output to be expected with a normal tank circuit is included. This assumes that the full current rating of 100 mA. is drawn. In practice, therefore, the H.T. should be kept up to at least 350 volts, and preferably 400 volts or more, and the input reduced by reducing the actual anode current. The best way to do this, is to maintain the R.F. drive conditions as for full output and to reduce input by reducing the screen voltage. This will enable the anode efficiency to be well maintained, provided the tank circuit capacity is optimum for the final operating conditions.

Screen Ratings

Finally, in the 807 it is fatal to exceed the screen ratings. A point to watch therefore is the grid drive, as excessive grid drive may cause an excessive screen current to flow, even if the screen voltage is within rating. Too much grid drive causes no increase in R.F. output, and, in fact, due to the increased screen dissipation, may cause an actual decrease in R.F. output (see Fig. 2). This applies generally to tetrode and pentode P.A. stages.

New Range of 1.4v Valves

A NEW range of miniature (B7G) battery valves recently introduced by Mullard Ltd. should prove of considerable interest to designers of battery-operated receivers in which low battery drain is important. The filament consumption of these new Mullard valves has been reduced to half that of previous comparable types, being 1.4V, 25mA for the frequency changer, I.F. amplifier, and A.F. amplifier, and 1.4V, 50mA for the output valve.

The range comprises the DK96 Frequency Changer, the DF96 I.F. Amplifier, the DAF96 Diode A.F. Pentode, and the DL96 Power Output Valve. Apart from the filament current ratings, these valves are similar in construction and appearance to the popular miniature 7-pin all-glass valves to be found in most modern battery sets. They are designed primarily for use in receivers in which the filaments are connected in parallel, but they may be used in a 50mA series chain with two 25mA filaments in parallel or one shunted by a resistor.

Types Available

Brief technical descriptions of the new series are given here:

TYPE DK96. A self-oscillating heptode frequency changer similar to type DK92 in its mode of operation. The conversion conductance is 0.3mA/V.

TYPE DF96. A variable-mu H.F. pentode suitable for use as a controlled I.F. amplifier. It has a mutual conductance of 0.75mA/V for a total cathode current of 2.2mA, and is fully controlled by −5.5V at the grid.

TYPE DAF96. A short grid base pentode for A.F. amplification, combined with a single diode for use as a detector. The A.F. gain is 65 in a typical circuit.

TYPE DL96. An output pentode having two filament sections which may be connected in series or in parallel. It will deliver 200mW into a 13 K.ohm load, the total H.T. drain being 5.9mA.

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).

Three-speed Autogram

SIR,—I built your three-speed autogram some time ago and as you have asked about beginners, etc., I should like to say that this was only the third set I have tried. Each of my previous two attempts had been expensive, due to burn outs, etc., but I thought I could try this and obtained a blueprint. I must confess that at times I felt very doubtful, but I persevered and eventually had it finished, and after only a very few minor problems (dry joints mainly) it worked and I have found a new field for entertainment in records. Although I get quite a few foreigners the L.P. records have proved my most interesting buy, and I find that I spend much more time listening to record reproduction than radio—especially as I have a television. Thanking you for the design which I feel is equal to, if not better than, many commercial models I have heard.—REG WATTS (Hendon).

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

Ex-Service Equipment

SIR,—Whilst visiting a surplus store recently I asked for an item which the assistant apparently had not heard of, and a customer who was looking over some of the "junk" asked me what particular design I wanted it for and, on telling him, he offered some valuable hints and assistance as a result of which I bought something else. His short talk gave me more information than I thought it would be possible to obtain in such a short time, and the modification of a surplus unit which I was using has proved invaluable. I should like to take this opportunity of thanking him (he told me he was a reader, but I forgot to ask his name and address), and it occurred to me that it would be a good idea if all interested amateurs could meet or exchange information in this way. Could we not have a special page for information on surplus equipment, say offers to exchange or buy circuit data, etc.? I am sure this would prove of great value.—H. G. PARSONS (Edmonton).

[*We have had similar requests almost every week since the war, but the numbers of readers who are interested are so great that we should have to devote the entire issue to requests of this nature. We are sorry, therefore, that we cannot publish requests for data on surplus equipment, and can only deal with information arising from articles in these pages on modifications and use of such equipment. We are also unable to supply information as to sources of supply of surplus equipment and can only refer readers to advertisements appearing in these pages.*—ED.]

Correspondent Wanted

SIR,—Reading the letter of J. Oliver in the December issue of PRACTICAL WIRELESS inspired me to write to you and tell you of "another beginner's" activity.

I have been studying radio for about four years and during that time I have been a staunch reader of PRACTICAL WIRELESS and PRACTICAL TELEVISION. I am at the moment building the "modern" high-power "Quality Amplifier" described in the March, 1953, edition of this journal.

If J. Oliver (or anyone else about 15 to 16 years of age) is interested I would be pleased to correspond with him or them.

In closing I can only add that PRACTICAL WIRELESS is a really first-class radio periodical which helps me considerably with my hobby. Keep it up, you're doing a grand job.—JOHN WILLIAMSON (139, Hollyhedge Road, Benchill, Wythenshawe, Manchester).

Recording

SIR,—I wonder why "Quality Amplifier" enthusiasts don't advocate the use of an 6N7 (10 watts) output valve.

And while I am on the subject of "wonder," who is going to be the first man to tape-record a complete television programme, including vision.

It should not be impossible to feed back into your TV that certain programme that you asked your wife to record while you did that bit of overtime at the office.—"DREAMER" (Manchester).

Medium Wave Reception

SIR,—In these columns in P.W., December, 1953, B. Dwyer, of Leicester, writes suggesting higher power on the BBC's Light Programme transmitters. I should like to make a note of reception of the BBC Light Programme in Gibraltar.

Using AR88's, and cut dipole aerials, we can receive the Light Programme, at a very good strength from the time it opens until it closes. From about 6 o'clock GMT, it can be received loud and clear on a normal five-valve superhet, using the curtain rail as an aerial. The programme is generally received on 1,500 m., but is also at the same strength on 247 m., but suffers heavy interference from Radio Tangier on this wavelength. Reception is spoiled now and again by excessive atmospherics, but generally it is as good as in U.K. On this performance, I shouldn't think an increase in power was indicated.

Wishing your excellent magazine every success for the future.—R. J. TAYLOR (Gibraltar).

Interference

SIR,—Much has been said of late about the suppression of interference on television equipment, but what about the real S.W. D.X. fan? I spend most of my available listening time in long-range reception—on headphones, with a short and ultra-short wave receiver. Much of the time I am forced to remove the 'phones owing to the din created, not only by neighbouring TV. receivers but also from what I have found to be electric lamps. On more than one occasion I have heard a hissing background, drowning all signals, which has ceased on switching off a light in another room. Changing the bulb has removed the trouble, and it therefore appears that there is a wide field of research for those who are out to remove interference troubles. Have any other readers experienced this type of trouble, or interference from any other hitherto unsuspected source?—J. R. GARNETT (Edmonton).

Amateur Transmitters

SIR,—I am now a regular reader of your great magazine and enjoy every page of it, thanks very much indeed for the pleasure it gives me out here.

I have been very interested in short-wave radio since leaving school, and I agree very much with Mr. C. Roberts and Mr. H. Cole on giving the novices a band.

Why on earth can't they let amateurs use a five-watt crystal-controlled transmitter on a novices band?

They have them in America; it seems to me England is the last again in giving a bit of pleasure to its amateurs.

It's as Mr. Roberts points out, anybody can use a radio telephone for a business, but when the amateur asks for a band to use a fixed frequency crystal-controlled transmitter of five watts, he is snubbed.

Here's thanks to Mr. Hector Cole and Mr. C. Roberts for bringing it up. I would like to hear the Postmaster-General's excuse for not giving the novices a waveband.—G. WILKINS (Egypt).

SIR,—The qualification that amateurs must be able to send and receive in the morse code at not less than 12 words per minute is not made by the P.M.G. The qualification necessary under international regulations (International Telecommunications Convention, 1932) is that the person in charge of the station (amateur) must be in a position to act upon instructions in the morse code, issued by Government and commercial stations.

Amateur radio is a grand and glorious hobby, but this fact alone would hardly merit the privilege we have of using a valuable and comparatively wide range of frequencies. The main reason is that the amateur is a source of skilled radio personnel in time of war. Another asset is that amateurs provide communications in emergencies.

Amateur radio has been the principal, and in many cases the only, means of communication in many hundred storm, flood, fire, earthquake, tornado and blizzard emergencies.

For Mr. H. Cole's information, many times the modulator tubes of portable transmitters have been removed, so that a few more hours of morse code are obtainable from an accumulator.

Learn the morse code, Mr. Cole and others. The privilege of operating an amateur radio station is well worth many hours of hard work.—Plt. Off. K. V. O'ROURKE (R.A.F., Worksop, Notts). G310F ex ZL3KD, VK2AVO, VK5DJ, VK6KV.

Early Readers

SIR,—I have been interested in some of the letters lately about old readers, and although I am now past active construction I happened to see a copy which my nephew had bought and thought perhaps you would be interested to know that I am still using a Fury Four for odd listening periods. True it has now passed from its old domestic status to my ex-workshop, but I spend many odd periods here tuning-in round the dial and trying to compare its performance with what it gave when new. Haven't conditions changed on the air since those days? It seems to me, from memory, that there were either fewer stations or more space between them, or is it that the many years of broadcasting, atomic experiments, etc., have saturated the ether with power and it is now more conductive?—K. ROBERTS (Watford).

Manufacturers Please Note

SIR,—Before the war you used to make periodic appeals to manufacturers to supply items in constant demand by the home constructor, and I know that in many cases your advice was taken. One very common complaint was the non-marking of certain components, and I note that this is still being carried out. I have two or three volume controls, carrying no maker's name and no value. One has obviously had the value printed on in ordinary printing ink, but has become rubbed off. Why cannot they be embossed? Variable condensers, too, carry no indication of the capacity, and with the variable spacing and size of plates the user is lost as to the size.—D. SIDDON (Manchester).

"GOTHIC" RADIO INSTALLATION

(*Continued from page* 24)

The Marconi Marine sound-reproducing system on board has been considerably extended and now comprises three receivers—one "Oceanic" and two "Electras"—with an amplifier rack assembly, special wire-recorder, and a double-turntable gramophone unit. A choice of any of three different entertainment programmes will be available at certain loudspeaker positions, while items of special interest which may be received at inconvenient times as the *Gothic* moves out of the G.M.T. zone can be recorded on the wire-recorder and rebroadcast over the system as required. Forty-eight loudspeakers are installed, fitted unobtrusively into the decorative scheme of the rooms in which they are situated.

Aerial-splitter equipment, specially designed by Marconi's for the *Gothic's* installation, enables any or all of the ship's receivers to be operated from the main reception aerials, and incorporates automatically operated safety circuits, designed to protect the receivers while transmission is taking place.

The Marconi Marine electronic aids to navigation already installed on board the *Gothic* have been retained. They consist of "Radiolocator" radar, with compass stabilisation, a "Lodestone" long-range direction-finder, and a "Visagraph" echometer installation which shows the depth of water beneath the vessel either by a light flash on a scale graduated in fathoms or in the form of a permanent contour graph of the seabed along the *Gothic's* course.

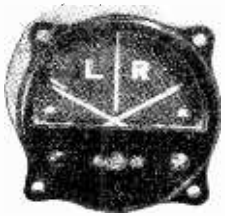
CLYDESDALE prices Slashed

R1155 RECEIVER UNIT
Communications, D.F. and "Ham" 20, 40, 80. Five Ranges 18-7.5 Mc s., 7.5-3 Mc s., 1,500-600 kc s., 500-200 kc s and 200-75 kc s. Complete with 10 valves. SM Drive, ME tuning, BFO, etc., in metal case 16½ x 9 x 9in. External Power Supply required.

Appearance as new ASK FOR No. P/E6 **£8 19 6** Ea. CARRIAGE PAID

Appearance rough ASK FOR P/H898 **£5 19 6** Ea. CARRIAGE 7 6 extra

Circuit 1 3



VISUAL INDICATOR TYPE 1. Ref. 10Q/2.
Dual reading Left Right DF meter for R1155. 2½in. Scale, Overall dim. : 3¼ x 2½in. In used condition.

ASK FOR P/H862A **12/6** Each POST PAID

Ex R.N. GAUSS INDICATION AND RANGE METER. AP58150.
Made by E.T.E.I., Ltd., for use with a Fluxmeter.
Measuring head for 0.625 in gap. Dim. overall : 3¼in. x 2in. x 1½in. with leads in wood box 6½in. x 3½in. x 2in.

ASK FOR P/E345. **4/6** Each POST PAID

AUDIO FREQUENCY OSCILLATOR.
A.C. mains operation 230 v. 50 c s. input with 6 valves 3/6J5G, 2 EL32, 5Z4G, 2 mains transformers, etc., 3 Audio Ranges 100-1,500 cps. calibrated dial, motor tuning. 20 v. A.C. motor fitted. The whole built in an enclosed metal cabinet with shock mounts. Dim. : 21in. x 15in. x 10in. Finish Grey. Used, good condition.

ASK FOR P/H793. **£7/19/6** Each CARRIAGE 7 6 EXTRA

POWER MODULATION UNIT for the W.S.38 Transmitter.
An A.C. Mains Power Unit with built-in Modulator. Input 110-250 v. A.C. 50 c s. Mains providing H.T. and L.T. Output. 3 Transformers. L.T. 4 v. 4 a., 3.25-0-3.25 v. 8 a. HT (1) 200-0-200 v. 50 mA. HT (2) 500-0-500 v. 200 mA. and 500-0-500 v. 200 mA., fully rectified and smoothed. valves 3 6C5, 2 807, 2 AV1 (FW4/800) built in a varnished wood case with carrying handles. Dim. : 22in x 16½in. x 14½in.

ASK FOR P/H43. **£6/17 6** Each CARRIAGE PAID

WAVE FORM GENERATOR Type 26.
With valves VR55, 2 VR54, VR116 3 VR56, 6 VR65, 2 relays, plus conds., etc. Input 80 v. 2,000 c s. A.C. In metal case 12in. x 7½in. x 11½in.

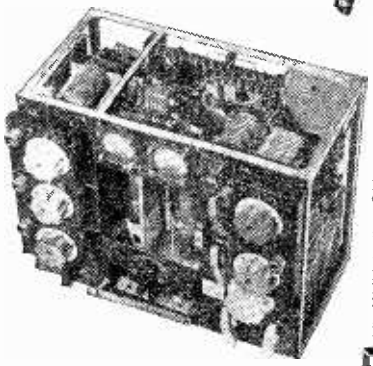
ASK FOR P/H884. **21/-** Each CARRIAGE 2 6 EXTRA

DRIVER TRANSFORMER for ET-4336 Transmitter.
Ref. No. 110K/117 part XT-3202. Centre tapped primary, inductance 3.4 henries. Two secondaries, inductance 14 henries each. Ratio whole pri. to one sec. 1-2 approx. Dimensions 4½in. x 3½in. x 3½in. Wgt. 6 lbs. 4 hole fixing.

ASK FOR P/E562. **18/6** Each POST PAID

RECEIVER UNIT TYPE 25. Ref. 10P/IL.
Part of TR1196. Range 4.3-6.7 Mc s. with valves 2/VR53 (EF39), 2 VR56 (EF36), VR55 (EBC33), VR57 (EK32), 2 I.F.T. 460 kc s., etc., in metal case 8½in. x 6½in. x 6½in.

ASK FOR P/H299. **35/-** Each POST PAID



T1154B TRANSMITTER UNIT
Medium High powered for C.W.-M.C.W.-R/T. 3 Ranges 10-5.5 Mc s. 5.5-3 Mc s. 500-200 kc s. Complete with 4 valves, etc., in metal case 14 x 16½ x 8½in. External Power Supply required.

ASK FOR P/E5A **39/6** Each CARRIAGE 7 6 EXTRA

Circuit 2 3.

ELECTROSTATIC KILOVOLTMETER.
Range 0.2 kV. 2½in. round mid. Case, drilled flange.

ASK FOR P E333. **27/6** Each POST PAID

FOR EXPORT ONLY.
WIRELESS SET NO. 38 MK.11.
Range 7.7-9 Mc s. 5 valves and all accessories. Complete (less batteries) and unused in original wood case. 4 complete units per case.

ASK FOR P H519 4. **£20** per case of 4 sets.

F.O.B. GLASGOW.

500 MICROAMP METER. Ref. ZN2106.
For WS-18 Transmitter.
2in. round, clip mounting case. Res. 500 ohms.

ASK FOR P E303. **15/-** Each POST PAID

WALNUT-FINISH WOOD RADIO CABINET.
Dim. : Internal 8½in. x 15½in. x 7½in approx. External 9½in. x 17in. x 8in. approx.

ASK FOR P H394. **12,6** Each POST PAID

Or Cabinet as above with 3 waveband glass dials, expanded metal L.S. Grill. 3 knobs 1½in. dia. fluted type.

ASK FOR P H945. **17,6** Each POST PAID

PLASTIC RADIO CABINET.
Dim. : Internal 11in. x 6½in. x 4½in. approx. External 12in. x 7½in. x 6½in. approx.

ASK FOR P H720. **12/6** Each POST PAID

MORSE PRACTICE BOARD ONLY.
Comprises Key, buzzer, and phone terminals on board 6½in. x 4½in. x 1in. with battery clamps.

ASK FOR P E1X. **5/6** Each 9d. POST EXTRA

EGG INSULATOR TYPE 116, 10B/153.
Standard, medium, large, insulator finished in brown. 3in. long, 2in. max. dia.

ASK FOR P E192. **1/9** Each POST PAID

Box of 4 for 5 6. Gross lots for £7 4/.

AERIAL SYSTEM TYPE 62.
U.H.F. Antenna on streamlined moulding with VR92 (EA50) untuned detector stage. Overall dim. : 13½in. x 4½in. x 2½in. Antenna 22.5 cm.

ASK FOR P. H496. **3/6** Each 9d. POST EXTRA

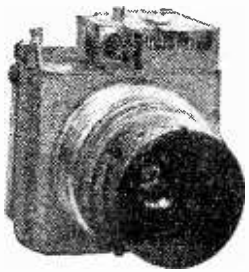
Circuit 1/3 each.

POWER UNITS for T1154/R1155 UNITS Types 33 or 33B. Input 24v. D.C. 16 a. Output 1,200 v. D.C. 200 mA.
ASK FOR P/E7A.
Types 25 or 35A. Input 18 v. D.C. 12 a. Outputs 7.2 v. D.C. 13 a. and 225 v. D.C. 110 mA.
ASK FOR P/E8A.
Each a Motor Generator Unit, smoothed, etc., in metal case 16 x 7½ x 6in.
LOOSE STORED.

ANY UNIT **42/6** Each CARRIAGE PAID

LOOP AERIAL TYPE 17 10D 16950.
NOT designed for R1155, but could be used. NO Housing, scaled 0-350 degrees. Wgt. 2½lb.

ASK FOR P.H938 **21/-** Each POST PAID



F.24 AIRCRAFT CAMERA in Transit Case.
Lens 5in., F/4 with internal iris diaphragm stops to F/11, fixed focus set at infinity, screw in housing projects 5½in. Focal plane shutter speeds 1/60th to 1/1,000th of a second and time, fitted in film magazine designed for 5½in. wide film, picture size 5½in. x 5½in. Shutter release and rewind spindle fits standard spanner. Hand operated as it stands. Net. wgt. 17 lbs. Packed in fitted transit case 42 lbs. Dim. : body 6½in. x 9in. x 9½in., overall incl. lens housing 11½in. x 9in. x 9½in. Provision for external motor drive (not supplied). Lens housing grooved for fitting to aircraft camera port. A precision Air Survey Camera could be adapted for Laboratory, Industrial or Portraiture uses.

ASK FOR P/H302. **£4/19/6** Each CARRIAGE PAID

14 INCH F.5.6 LENS for F 24 CAMERA.
Complete with Iris, Filter, Mount and Extension in Transit Case.

ASK FOR P/H563. **£6/19/6** Each CARRIAGE PAID

AERIAL ROD
15in. lengths, copper plated steel tube, ferruled to interlock and an Aerial of desired length. 3/16in. dia.: Ask for X H709. ½in. dia.: Ask for X/H710.

EITHER SIZE **4,6** Doz. Lengths. 6d. POST EXTRA

RADAR REFLECTOR AERIAL MX-137/A.
Spider Web mesh Aerial in original moisture proof carton, with assembly instructions

ASK FOR P. E175. **4/11** Each 9d. POST EXTRA

STAINLESS STEEL AERIAL WIRE.
7/.015in. reels of approx. 1,600ft. made by Temco.

ASK FOR P. E143. **25/-** per Reel CARRIAGE PAID

DINGHY TELESCOPIC MAST.
Aluminium Telescopes from 14½in. to 7½ft. Seven sections, base dia. 1in. Wgt. 4 oz.

ASK FOR P. H489. **4/6** Each 6d. POST EXTRA

AMPLIFIER for 200-250 A.C. in handsome radio cabinet 15in. x 11in. x 7 in., provision for 6½in. speaker. 3 v. (inc. rect), 3 W., high gain with o.p. trans. Wired ready for use. **£4.12.6.** (carr. 7/6).
SPEAKER 6½in. P.M. 2-3 ohm for above. 12/6 (carr. 1/6 without amp.).
RECEIVER at **£9.18.0** (carr. 7/6). 4 v. (inc. rect.) plus crystal diode. For 200-250 A.C. in cabinet above, for high quality reproduction of M.W. local and L.W. stations.
RECEIVER (ex-Govt.) R1124D, with all valves. **17/6** (carr. 5/-).
AUTO-CHANGER. Collaro 3-speed, 3RC521 with twin heads. **£8.10.0** (carr. 7/6).
VARIABLE CONDENSERS, 2-gang, **6/-** ; 3-gang, **3/6**.
HEADPHONES (H.R.), **15/-** pair.
SPEAKERS. Post 1/- each. P.M. 2-3 ohm, 10in., **20/-** ; 8in., **17/6** ; 6½in., **13/-** ; 5in., **12/6** ; 4in., **11/-**.
VOL. CONTROLS. 1 M. 2-pole sw., **4/-** ; ½ M. 1-pole sw., **3/-**.
TAPE RECORDER AMPLIFIER, suits all tape decks. Leaflet on request. **£12.12.0.**
STEEL CHASSIS, size 7½in. x 5½in. x 1½in., with 2 int. octal valveholders ; transformer (300-0-300). Rectifying valve AZ31. Slightly used at **20/-**.
T.C.C. 32-32 mf. 450 v. can type. **5/-**.
DUBILIER, 40-40-30 mf. 275 v., can type. **2/-**.
R.F. CHASSIS by famous manufacturer. Over 30 Condensers and Resistors, 3 coils, 3 Ceramic B7G holders. 5/- (1/- P. & P.).

SATISFACTION OR MONEY BACK.

All goods new except R1124D and Chassis.

GLADSTONE RADIO,

GLADSTONE PLACE, NEWTON ABBOT, DEVON

G.L. ELECTRONICS

AMPLIFIERS.—A.C. 3 v. 4 w., £5.
TAPE.—Rec./play amp. 4 w., 12 gns.
TAPE.—45/- Push Pull 10 w., 18 gns. Tape head fams play or erase ½ track head set, 5/- ; clamps, 7/6.
CHARGER.—Transformer and rectifiers, 6 12 v. 2 a., **27/6** ; 6/12 v. 4 a., **37/6**. Eliminator 120 v. 60 ma., **17/6**. Grey steel cases above **7/6**.
TRANSFORMERS.—Pri 200/230/250 v., 300-0-300 v. 60 ma., 5 v., and 6 v., 17/6. 350-0-350 v. 100 ma and 6 v., 22/-.
OUTPUT TRANSFORMERS.—3/8/15 ohm 6 k, 8 k, 10 k (state which). P. P. 15 watts, **15/-** ; 25 watt, **21/-**.
CHOKES.—200 ma., 8 hry., 200 ohms, 10/6. Send S.A.E. for full lists.

16, PATTISON ROAD, LONDON, S.E.18.
(Woolwich 0387)

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Have you built the enormously successful "Coronet" A.C.4 yet ? This 21st Birthday Receiver was designed by Mr. F. J. Camm around the famous Roding R.L.30 Unit, which he chose because he wanted reliability, optimum performance and first-time success for the Home Constructor—*without any test gear !*

L. J. H. of Glasgow, writes : "Your parts are first-class, and the results I have obtained are amazing . . ."

We can supply from stock our :

- COIL PACK RL30. 49/9.
- RL IF TRANSFORMERS 16/- pr.
- JB SL8 ASSEMBLY 27/6.
- JB .0005 2-GANG **14/-**. (or **£5.5.11** complete.)
- *Aligned, sealed and matched as specified for this receiver. Also:*

½ meg. v/c, w/sw., **6/6** ; V/holders, **9d.** ea. ; Mains Connector, **3/9** ; Knobs, **11d.** ea. ; MULLARD valves ECH35, **21/3** ; EF39, **17/3** ; EBL31, **21/3** ; GZ32, **19/11**. Resistors, 2,000 ohm., **2/-** ; 1 W, **8d.** ; ½ W., **6d.** Condensers paper type, 1/-; S.M **9d.** ; CE32B, **2/9** ; CE26L, **4/9** ; CE37LA, **12/-** ; clips, **4d.** each. Chassis, ready punched, **12/6** ; Mains Trans., **32/-** ; Sundries, **8/2** complete ; SL8 p/bulbs and holders, **3/4** set. Cabinet **£3.**

HAVE YOU GOT YOUR COPY ? 2/9 will bring you BY RETURN our NEW HOME CONSTRUCTOR'S HANDBOOK containing DETAILS for Construction, LARGE *blueprint* circuits, COMPLETE parts lists, and TECHNICAL descriptions of ALL our famous circuits. (See previous ads.) ONE COPY GIVEN FREE WITH ALL ORDERS OVER £3 FOR PARTS FOR THE "CORONET."

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SPECIAL OFFER

GUARANTEED EX-W.D. VALVES

6V6G, GT, 5U4G, 6/6G, Y63=6A8, EF55, at **8/6** ; 6K7M, 6SA7M, 5Y4, 6Y5, 6AG5, at **7/6** ; 6K7G, 6J5M, at **6/6** ; EF50, 12Y4, at 5/- ; 6J5G, VU120A, at **4/6**.

F.H.T. TRANSFORMER.—5-6 Kv., with U22 Rectifier, **37/6** Plus 2/- P.P.

FRAME TRANSFORMER.—Ratio 10 to 1. MATCHES ALLEN or DENCO wide angle Defl. Coils, size 3in. x 3in., **10/-**, P.P. 1/-.

AIR-SPACED FIL. TRANSFORMERS.—In 230, out 2v. 2 a., **11/6** ; in 230, out 6.3v. 2 a., **15/6** ; in 230, out 2v. 3v.-6.3v. 2 a., **24/-**.

HUNDREDS OF BARGAINS IN RADIO AND TV COMPONENTS. Send stamp for list.

JACKSON'S RADIO SUPPLIES

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All Valves Guaranteed. 24 Hours Service.

6X5	7/6	35Z4	9/6	6SN7	9/6
954	2/-	35L6	9/6	6L6	10/6
EA50	2/-	2X2	4/6	50L6	8/6
SP41	3/6	425PT	6/6	5U4G	8/6
SP61	3/6	LP2	4/6	807	8/6
MSPEN	5/-	KT24	4/6	ECL80	11/6
VR137	4/-	HP4101	5/6	EF80	11/6
6K7	5/6	DDL4	5/6	12K8	9/6
EF50 (Syl.)		6U5	8/6	12K7	9/6
	7/-	IT4	8/-	KT33C	10/6
VR116	4/6	IR5	8/-	EB91	7/6
5Z4	8/6	3S4	8/-	EF91	9/-
VU39	8/6	1S5	8/-	41MTL	6/-
6Q7	9/-	6V6	8/-	MH4	5/-
Y63	8/6	6K8	9/6	12Q7	9/6
42SPT	6/-	EBC33	8/6	EL32	8/6

★**G.E.C.** crystal diodes, 2/-.
★**Pye** plug and sockets, **6d.** pair.
★**Chokes**, 10 henry 150 m.a., 5/6, plus 6d. post.
★**Co-axial Cable**, 80 ohm per ft., **9d.** yd. (not W.D.).
★**Twin Transparent Flex**, **18/6** per 100 yds.
★**RM1**, 3/11 ; RM2 S.T.C., 4/6 ; RM4, 15/-.
★**Egan** V/C, W/S, 1 meg.-½ meg., 4/-.
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★**SPEAKERS.**—3in. Rola, **13/6** ; 3½in. Elac, **11/6** ; 5in. Elac, **12/6** ; 6½in. Plessey, **12/6** ; 8in. Plessey, **13/6**. Post 9d. per speaker.
★**Standard Twin Gang Cond.**, .0005, **5/6**.
★**Condenser Panel**, 22 ½ watt resistors, 3 Westectors, 18 condensers, **4/9**.
★**Filament Transformers**, 6.3 at 1.5 amps., 6/9. Post 6d.
★**Toggle Switches**, bakelite, S.P., 8d.
★**Colvern W.W. Pots**, 1K., 2K., 2/-.
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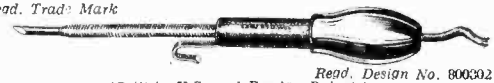

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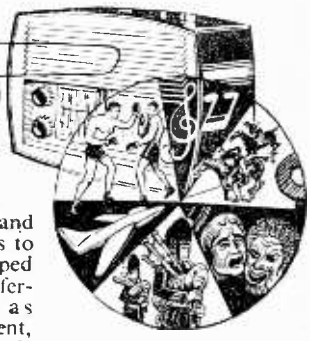

By MAURICE REEVE

Music

MUSIC has been honoured by the BBC with some of the best talks that any subject has provided. Someone like Sir Walford Davies was so outstanding that he proved irreplaceable. High up in the list I would put Anthony Hopkins, of whose current series of six "Studies in Musical Taste" four have, at the time of writing, been given on Wednesdays in the Home Service.

Mr. Hopkins talks well, knows his subject thoroughly and can illustrate his points at a piano adequately (his pianistic illustration of how Schumann and Liszt might have written the slow movement of Beethoven's Pathetic Sonata was brilliant, extremely funny and well qualified to a place in the current revue at the Royal Court Theatre). That we can't always concur with his conclusions doesn't detract from the merits of his arguments and general performance. For instance, in the talk on Transcriptions, he wrongly took Godowsky's "Renaissance" collection as being particularly vile examples of the arranger's "art" instead of the same master's "53 Studies on Chopin's Études" which, the originals being already perfect, he drags through the mire and traduces beyond recognition. Many of the "Renaissance" are quite charming. Being wholly opposed, or seemingly so, to all arranging and transcribing, he failed to mention Godowsky's magnificent Strauss paraphrases, or any of Liszt's masterpieces, etc. He also gave quite the wrong slant to Busoni's arrangement of the Bach Chaconne, illustrating one passage with a gramophone record, made by a famous pianist who shall remain nameless, which perpetrates one of the vulgarest departures from the text imaginable. I hope Mr. Hopkins realised this, though he didn't mention it.

The talk on Beethoven was an eloquent defence of that master's supremacy in matters musical, but he may not have been quite fair to Rachmaninow in the first of the series. A very enlightening, capable and rewarding assignment.

Talks

Another series on quite a different subject and of a totally different character, but none the less useful and amusing, was "Straight from Conference." The "conference" was, in fact, two conferences, the annual jamborees of the Labour and Conservative Parties, which this year were both held at Margate in following weeks. Mr. John Strachey, for Labour, and Mr. Ted Leather, for the Conservatives, attended as BBC representatives as well as normal party delegates. They discussed with each other for half an hour each evening the goings-on of the day. The cut and thrust and verbal sally were very amusing and all in the friendliest spirit. It was as if a Blackpool and a Bolton Wanderers fan had met to "chivvy" each other on last season's memorable cup final. Which, of the two great parties, turns out to be Blackpool and which Bolton remains to be seen. It can be hoped that their future conferences will be as conveniently adjacent, making repetitions of this programme possible.

Plays

The two best plays of the month were Somerset Maugham's "The Sacred Flame" and Aubrey Dexter's "Tea With the Willises," both in the Saturday Night Theatre series. They made an interesting pair and gave food for thought as to how Mr. Maugham, the master of sweat and sex in the South Seas, would have handled Mr. Dexter's Malay planter (a tea type, presumably, from the play's title) whose wife has an affair, Maugham-like, with the fellow who eventually buys the plantation and enables the Willises to return home.

There are the usual diatribes about what a splendid country Malay is if you are willing to give it everything you've got before you begin to take from it, etc. And the triangle part was well contrived. But it partly lacked the sweaty atmosphere and opulence of, say, "East of Suez" or "Rain," to name only two. Marjorie Westbury was most effective as Mrs. Willis, a big role which covers a wide range of emotion.

Maugham's "The Sacred Flame" poses, in very dramatic form, the ethical problem of whether hopeless cripples should be put out of their misery or their life prolonged to its uttermost limits. In the play, Maurice Tarbet is wrecked in an air crash and can no longer be an effective husband. His wife falls in love with a mutual friend and is going to have a baby by him. Maurice's mother poisons her son, after Nurse Wayland has been deeply implicated, in the belief that no considerations of sentiment should be allowed to stand in the path of a young woman's natural fulfilment. A nice point! and one, the rights and wrongs of which, I shall not touch on here.

Like all Maugham, it is superb theatre. The biggest part in the play is that of the nurse who, in love with the wrecked Maurice, has the accusative finger firmly pointing at her until near the end. I have never listened to Joan Hart to better advantage than as Nurse Wayland. It is a grim part which allows of none of the usual femininities which Mr. Maugham's women characters usually abound in. Miss Hart gave it great dramatic force. Ian Lubbock, Eric Anderson, Gladys Boot, Virginia Winter, Dennis Goucher and Gordon McLeod were the excellent cast.

Scrapbook

"Scrapbook for 1933," first produced in 1948, was, of course, the mixture as before. Kay Hammond and John Clements in "Henry V" didn't seem to quite come off. Perhaps they were a bit too sophisticated in the modern theatrical sense. "Pompey the Great," by John Masefield, was fine stuff.

News from the Trade

New Magnetic Recording Tape

THE M.S.S. Recording Co., Ltd. are now producing a magnetic recording tape (type A.M.15) of high quality, medium coercivity, particularly suitable for use with low-speed recording machines operating at 7½in. and 3¾in. per second. The very smooth finish of the tape is claimed to guarantee a high performance and to cause minimum wear on recording and play-back heads. The retail price is 37s. 6d. for a 1,200ft. spool.

Development work on the new tape was initiated by British Insulated Callender's Cables, Ltd. and, two years ago, they were producing a paper base, low coercivity, tape for high-speed recording machines but as M.S.S. were then setting up experimental laboratories at Hythe End, near Staines, Buckinghamshire, it was agreed that they should undertake further development work.

This agreement involved the setting-up of special chemical laboratories, for which M.S.S. designed and built the necessary equipment in their own workshops. As soon as the laboratories were ready, attention was concentrated on the development of magnetic materials and their application to various bases, and to the technique of producing tape of outstanding finish and uniformity.

As a result of this intensive research the new tape is now being produced. The output will be limited at first, but will be rapidly increased as soon as possible. Research and development work will still continue.—M.S.S. Recording Co., Ltd., 21, Bloomsbury Street, W.C.1.

Brief Specification of the "Playboy" Radiogram

A NEW auto-radiogram of the table type is announced by Peto Scott. The following is a brief specification :

Automatic 8-changer table radiogram.

Three-speed (mixer) changer.

5-valve radio with three pre-set stations (two medium-wave, one long-wave).

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For use on 200/250 volt 50 cycles A.C. mains only. Price : £23 1s. 0d. plus £7 8s. 0d. Purchase Tax.—Peto Scott Electrical Instruments, Ltd., Addlestone Road, Weybridge, Surrey.

New "Acos" Microphones

TWO new mikes are announced by Cosmocord, models, 33-1 and 35-1. Model 33-1. shown on the right of the accompanying illustration has the following specification :

Output level : —55 db ref. 1 volt/dyne/cm².
Output impedance : equivalent to approximately .002 M.F.D. (.8 megohm at 100 cycles).
Omni-directional Frequency response : substantially flat from 30 to 7,000 c.p.s.
Recommended load resistance : not less than 1 megohm dependent on low frequency response.

Model 35-1 has the following specification :

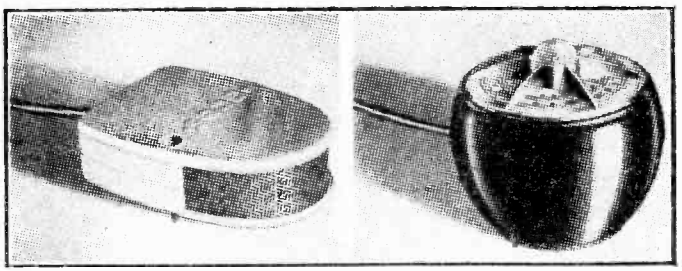
Frequency response : Substantially flat from 50/5,000 c.p.s.
Output level : —55 db ref. 1 volt/dyne/cm².
Load resistance : 2 megohms included.

The MIC 35-1 microphone is provided with a built-in shunt resistance of 2 megohms and when connected straight into the grid of the input valve will give a response substantially flat from 50/5,000 c.p.s. The resistance if any of the input circuit will reduce the low frequency response of the microphone. A grid leak of ½ megohm will reduce the output at 500 c.p.s. by 3 dbs. and pro rata at lower frequencies.

If additional length of cable is used, this should be of low capacity. The approximate capacitance of the microphone is 750pF and cable capacitance will reduce the output in proportion.—Cosmocord Ltd., Enfield, Middlesex.

Coronet Kits

J. T. FILMER has produced a list of the parts used in the Coronet, with suitable alternatives where possible. The list is available on request.—J. T. Filmer, 21, Old Bexley Lane, Maypole Estate, Bexley, Kent.



The new Acos microphones reviewed above.

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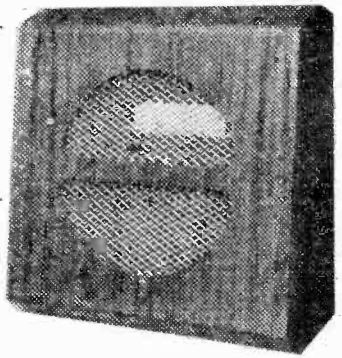

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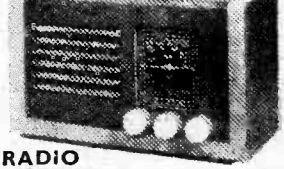

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