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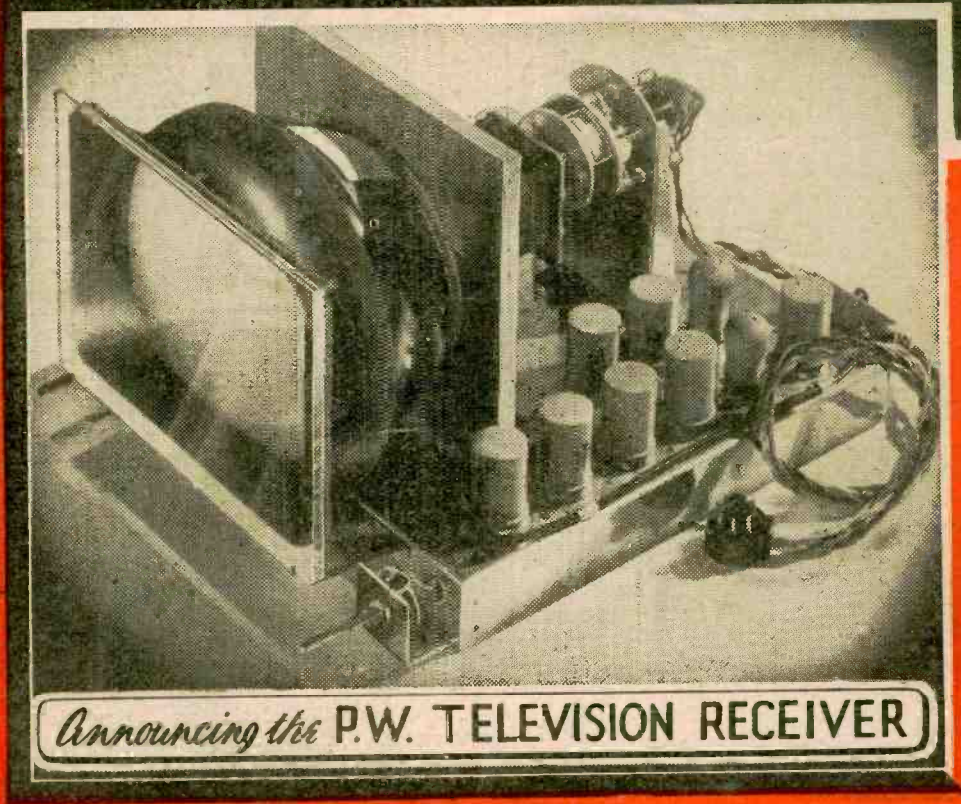
EDITOR:
F.J.CAMM

PRACTICAL WIRELESS

AND PRACTICAL TELEVISION



Announcing the P.W. TELEVISION RECEIVER

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Practical Wireless and PRACTICAL TELEVISION

17th YEAR OF ISSUE

EVERY MONTH
VOL. XXV. No. 521 DECEMBER, 1949

Editor F. J. CAMM

COMMENTS OF THE MONTH — BY THE EDITOR

Radiolympia Afterthoughts

THIS year's exhibition was a great success and a vast improvement on its predecessor. The arrangement of the stands and the gangways enabled the exhibits to be viewed in comfort and without jostling. According to the exhibition organisers the attendance was well up to standard and nearly 400,000 people visited the exhibition during its 10 days' run.

There was a tendency for prices to be reduced until devaluation was announced, which means that copper, tin and other metals and materials used in the construction of wireless and television receivers will go up in price considerably. Thus, the deflationary tendency is nullified but the full effects may not be felt for some time. Most manufacturers reported better business than at the previous exhibition. It is generally known that there has been a slump in the radio trade, but trade has improved during the last three months. Devaluation may mean that manufacturers will be able to export more, except in the matter of radiograms, which at present are not designed for the long playing records which have taken America by storm and rendered almost overnight the 78 r.p.m. record practically obsolete.

Radiograms, in our view, are still too highly priced. It is difficult to obtain one within the price range of the modern purse. We think a move should be made to cheapen these instruments, and it could be done by discharging many of the stylists who have seized hold of the manufacturers and are forcing them into expensive constructional methods of doubtful æsthetic appeal, and which do not add a scintilla to the technical efficiency of the instrument. The high cost of the present-day motor-car is largely due to the elaborate shapes and the ornamental ironmongery plastered on to its front. The public to-day are prepared to sacrifice pretty shapes providing the instrument is efficient.

There is a distinct increase in interest in the constructor markets, and great interest was aroused by our surprise exhibit of the television receiver which has been developed during the past year in our laboratory. It is introduced on another page and later issues will describe its construction stage by stage. Television has arrived at the position where it is within the means and the ability of the amateur to make at home. One manufacturer indeed exhibited a kit of parts and instructions for a very workmanlike instrument and did good business with it.

We were informed by a number of old-established firms that they intend to re-enter the components industry, so the position as far as component supply is concerned should improve within the next year. At the present time constructors are making use of ex-Government equipment, but this will not last for ever.

We were pleased to welcome on our stand many hundreds of readers and to listen to their suggestions for future articles. These are all being carefully considered.

Evidence of the popularity of this journal may be seen from the fact that during the whole run of the show we had not a copy for sale. Every copy printed is disposed of in spite of the large increase in the print which took place on July 1st, 1949. At that time, it will be remembered, we announced the good news that every would-be reader would be able to obtain a copy each month. The demand, however, proved to be far greater than we had anticipated, and within a few weeks we were compelled to place this journal back on the rationed list. We tender our apologies with this explanation to those hundreds of readers who called at our stand to purchase copies which we could not supply. Our hope is that the conditions will change by the time the next exhibition opens.

Naturally, there was greater interest in television this year. The opening of the Sutton Coldfield Station, which was announced during the show as to take place on December 17th next, acted as a fillip to television sales, and many orders were placed from those living in the Birmingham district. The demand for components for television receivers indicates that large numbers of people prefer to build rather than to buy. The situation has changed rapidly during the past 12 months. It is by no means so difficult now as it was then to build a television receiver with limited home workshop facilities.—F.J.C.

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ROUND the WORLD of WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate numbers issued during the year ended, August 31st, 1949.

Region	Number
London Postal	2,259,000
Home Counties	1,614,000
Midland	1,676,000
North Eastern	1,860,000
North Western	1,559,000
South Western	1,032,000
Welsh and Border Counties	709,000
	10,709,000
Total England and Wales	1,115,000
Scotland	194,000
Northern Ireland	12,018,000

The above total includes 162,150 television licences.

During August the total increased by 59,250, and the number of television licences by 7,000.

The Post Office has reason to believe that some sets are still being operated without licences. Each family using wireless receiving apparatus in a house, part of a house, or flat should have a licence. A separate licence is necessary for a set fitted in a motor vehicle.

Scophony-Baird Limited

THE directors of Scophony-Baird Limited state that the draft accounts of the company, now subject to audit, for the year to March 31st, 1949, show a loss on trading of rather more than £8,000. After providing for interest charges and directors' remuneration, and writing off £16,119 for research and development and £2,688 for the costs of the capital reduction and new issue which took place during the year, the total loss amounts to rather more than £30,000, as compared with £33,216 in the previous year.

The annual general meeting is convened for November 9th, 1949.

Members of Parliament Meet P.M.G.

THE Postmaster General met a deputaton of Members of Parliament, at the General Post Office, recently. The question of the development of the B.B.C.'s television service and its coverage was considered. A useful discussion took place and the Postmaster General undertook to make inquiries on a number of points raised and to see the deputation again.

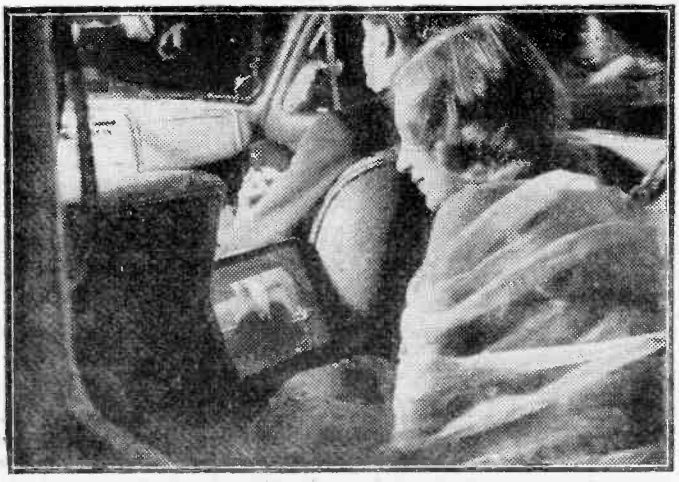
The following Members of Parliament comprised the deputation: Mr. V. J. Collins, M.P. for Taunton; Mr. S. O. Davies, M.P. for Merthyr Tydfil; Mr. F. J. Erroll, M.P. for Altrincham and Sale; Major N. Macpherson, M.P. for Dumfries; Mrs. Jean Mann, M.P. for Coatbridge; Mr. Ernest Marples, M.P. for Wallasey; Lt.-Col. Sir Walter Smiles, M.P. for Down.

Two-way Radio and Grid Maintenance

TWO-WAY V.H.F. radio equipment belonging to the British Electricity Authority is now being used by British Insulated Callender's Cables, Ltd., who are replacing conductors on the tops of two towers on either side of the Thames.

Each 487ft. high, these are the tallest transmission crossing towers in the world. They take the Grid system over the Thames from the Essex side of the river near Dagenham, to Kent, and the distance from tower to tower is 3,060ft.

The use of Pye two-way V.H.F. radio equipment on each side of the river obviates any time-lag, as the linesmen can thus communicate with each other immediately, both from bank to bank and from ground to tower-top and vice versa. The equipment does away with communication by ferry across the river or by road through the Blackwall Tunnel.



Television installed in a car. An E.M.I. experimental scheme shown at the Motor and Radio shows.

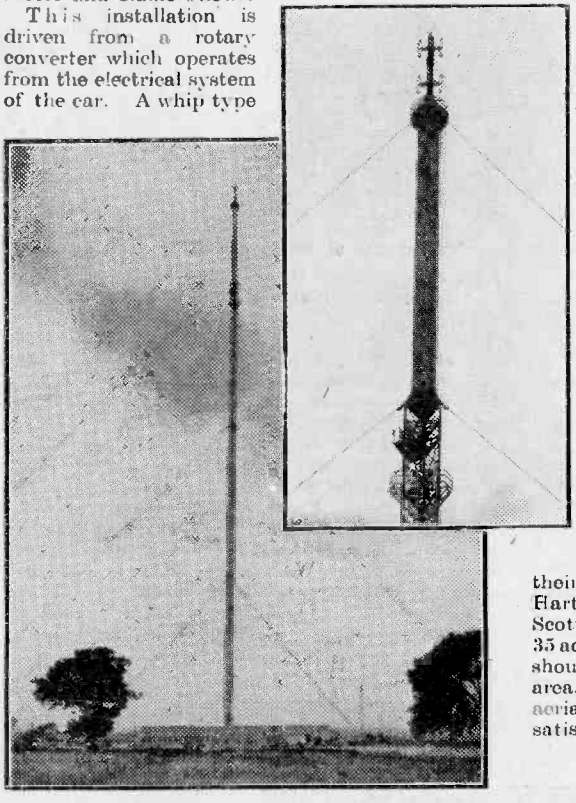
Assistant Postmaster General

THE Assistant Postmaster General, Mr. C. R. Hobson, M.P., has appointed Mr. C. F. Elms to be his private secretary.

Television for the Car Owner

H.M.V., in conjunction with one of Britain's leading motor manufacturers (The Standard Motor Company, Ltd.,), fitted an "H.M.V." television receiving set into a 1950 Standard Vanguard saloon, for demonstration at the recent Motor and Radio Shows.

This installation is driven from a rotary converter which operates from the electrical system of the car. A whip type



The transmitter building at Sutton Coldfield and its 750ft. mast. The wide-band aerial at the top of the mast is shown inset.

aerial provides the necessary signal strength for the receiver, which is fitted between the front seats. The television screen is, of course, visible only to the rear seat passengers and is tilted to the correct angle for easy viewing.

Short-wave Broadcasts from Tel-Aviv

LISTENERS in Britain should be able to receive Radio Israel without difficulty, for the Jewish Government began short-wave transmissions recently on 33.3 metres, 9,000 kilocycles.

The foreign programmes are being broadcast daily from 17.30 to 18.00 G.M.T. There are news-bulletins every day in English and Yiddish, and news in French and Spanish twice weekly, on Sundays and Wednesdays.

Director of Israel's broadcasting service is the Hon. Edwin Samuel, son of the first High Commissioner for Palestine. He served in a similar capacity in the British administration after World War II.

Amendment to Amateur Wireless Licences

THE Postmaster General announces that, as from October 18th, 1949, holders of Amateur Wireless Station Licences, who are authorised to use power of 150 watts on certain frequencies, may use this power additionally on the frequencies 144 to 146 Mc/s; 1,215 to 1,300 Mc/s; 2,300 to 2,450 Mc/s; 5,650 to 5850 Mc/s and 10,000 to 10,500 Mc/s. Licences are formally amended by a notice published in the *London Gazette* on the above date.

B.S.R.A. Meeting

THE October meeting of the British Sound Recording Association, held in London, was on "Photomicrography as Applied to Disc Recording and Reproduction," and was given by Mr. C. E. Watts.

Photographic evidence of the superiority of modern recording technique over that of reproduction, and the effect which this has on future design of pick-ups and other items was given. The equipment used, and the technique involved in the production of this evidence was described and illustrated by a series of slides and photomicrographs unique in this or any other country.

Scottish Station Site

IT is reported that the B.B.C. have, at the time this is written, almost completed their negotiations for the purchase of a site near Harthill, Lanarkshire, upon which to erect the Scottish television station. The site, extending over 35 acres, and situated nearly 1,000ft. above sea-level should provide good reception over a very wide area, and preliminary tests, both from a balloon aerial and a temporary mast have proved most satisfactory.

Improving the Miller Timebase

Modifying the Popular Circuit for Oscilloscope or Television Working

By E. N. BRADLEY

WHILST the Miller timebase in its simplest version can be classed as almost ideal for the home constructor of oscilloscopes and electrostatic televisors, it does have certain defects which at times detract seriously from its overall satisfactory operation. The three main drawbacks to the Miller timebase are the "pip" at the commencement of the scanning stroke, as shown in Fig. 1(a), loss of linearity at the lowest frequencies, and considerable differences in sweep amplitude in any normal arrangement of the timebase for oscilloscope work, where various capacitors are switched between the grid and anode of the timebase valve by the coarse frequency control switch. The timebase also suffers from a rather long flyback time at the highest frequencies.

The "pip" at the positive commencement of

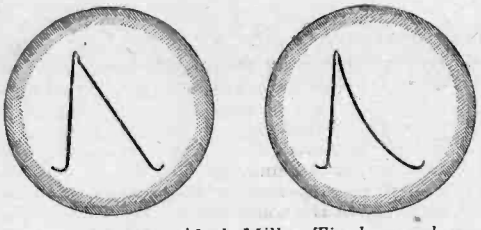


Fig. 1—(a). The ideal Miller Timebase voltage sweep and (b) (left) non-linearity at low frequencies.

the scanning stroke would appear to be eliminated, at least in part, by careful design and choice of capacitance values, and the flyback time can be reduced to a minimum in the same manner; these two points have been dealt with in the design shown in Fig. 2, and neither the "pip" nor the flyback time are obtrusive. The two major defects, loss of linearity and variation of amplitude, remain, however, in the single valve timebase circuit built up round V1, and it is highly desirable that no matter for what type of operation the timebase is to be employed these two faults should be eliminated.

In an oscilloscope the most important point is the variation of amplitude between the ranges as the main control switch S1 is rotated through its positions. Neglecting V2 of Fig. 2 for the time being, and assuming the sweep output to come direct from the anode of V1, it would be found that were the sweep voltage fed to the X plates of a tube the scan would be short with S1 in position 1 for the low frequencies, long with S1 in positions 2 and 3, and again short with S1 in position 4. This is annoying even for the most unexacting oscilloscope work, but where careful measurements or close observations are important these differences in scan length make the work difficult and tiring and can lead to the recording of inaccurate results.

For television work, on the other hand, amplitude variation is of no account since the timebase is operated at a fixed frequency. For line scanning a single-valve Miller timebase can give really excellent results, but in the majority of cases the loss of linearity makes itself felt when this circuit is used for the frame timebase, the top eight or ten lines of the picture opening out seriously. In the circuit of Fig. 2 both amplitude variation and loss of linearity are dealt with, and it is felt that the final timebase gives most satisfactory operation in an oscilloscope. The writer has as yet had no opportunity to test the circuit for television purposes, but there can be little doubt that it will provide a very marked improvement over the ordinary single-valve Miller frame timebase used by many constructors; a plain raster drawn on a VCR 97 screen had a very pleasing appearance.

Amplitude Equalisation

In Fig. 2, the EF37, V1, works as a conventional Miller timebase with switched capacitances in both the anode-grid and screen-suppressor circuits. The timebase will operate with a single unswitched capacitor of 0.01 μF value between the suppressor and screening grids, but some adjustment of capacitance over the ranges is desirable to reduce the flyback time and the "pip." The range of the timebase extends approximately from 15 to 20,000 sweeps per second, in four overlapping bands.

It is usual practice to make the anode load resistor of the Miller timebase circuit a potentiometer, taking the output from the sliding arm of this component so that sweep amplitude control is thus obtained. An extension of this idea provides for the amplitude equalisation of the present circuit, for the output resistance of V1 is made up of four potentiometers in parallel, the full saw-tooth voltage output therefore being set up across each potentiometer simultaneously. The sliding arms of these potentiometers are switched in such a manner that the range 1 output (low frequency) is drawn from R7, the range 2 output is drawn from R6, the range 3 output is drawn from R5 and the range 4 output is drawn from R4. These outputs can therefore be adjusted to be equal simply by setting the appropriate potentiometer to the correct position, and the four equal outputs are fed selectively (after linearisation has been applied to range 1) through C10 and the sweep amplitude potentiometer R13. R4, R5, R6 and R7, whence once set, do not require to be touched again, and so may be preset potentiometers mounted on the timebase chassis or on a small sub-panel tucked out of the way.

Since each of the four possible inputs, when presented to R13, are equal in amplitude, this control acts as a general sweep amplitude control

and does not require re-setting when the timebase is switched from one range to another, unless it is desired to expand or contract the trace.

The signal from R13 is applied to the second section of an ECC32 double triode, V2, for amplification before being passed to the tube deflection plates. Some amplification is desirable, since the low-frequency range, already low in amplitude when compared with the other three ranges, is further decreased by the linearisation process. As a triode is in any case necessary for the lineariser, a double triode can be employed to combine the functions of these two circuits at very little extra expense.

Low-frequency Linearisation

It will be noted that whilst the outputs of ranges 2, 3 and 4 are presented to R13 direct through S1c, the output from range 1 (the low-frequency range) is passed through R10, the anode resistor of the first section of V1. The anode current to this triode is also drawn through R10 and must be supplied from R7, the low-frequency output potentiometer. The anode of this triode is, therefore, swinging in potential at the saw-tooth frequency to which the timebase is set.

The type of non-linearity which affects the saw-tooth curve at low frequencies is shown in Fig. 1b, where the "pip" or top of the saw-tooth is positive, and if this curve is compared with the ideal saw-tooth of the Miller timebase in Fig. 1a, it can be described by saying that the curve is becoming negative too rapidly. If this potential curve is applied to the anode of a triode the anode will fall in potential too rapidly to pass a "linear saw-tooth current" through the triode, assuming the grid to be held steadily at a suitable bias voltage, and with R9 of Fig. 2 set to its minimum position—i.e., with the slider to the chassis end of the potentiometer—the output on range 1 from the whole circuit will exhibit this non-linearity.

Under these conditions, where the grid of the triode is returned directly to earth, the anode current through the valve is extremely small, since the cathode bias resistance is unusually high and the valve is biased back to the cut-off point; the saw-tooth voltage is therefore taken off after R10 with practically no attenuation due to this resistor. The amplitude of the range 1 output to C10 and R13 is, of course, controlled by the setting of R7 just as the other range amplitudes are controlled by their respective potentiometers.

With R7 set to a suitable position, consider now the effect of advancing R9, which may be termed the linearising control. Since R9 is connected via C9 to the anode of the timebase valve V1, the full saw-tooth voltage is set up across this potentiometer, and as the slider of R9 is advanced from the earthed end of the control, a fraction of this saw-tooth voltage is applied to the grid of the first section of V2. Moreover, this saw-tooth voltage is in-phase with that already applied to the anode of the triode via R7, and the triode grid thus becomes most positive as the anode also becomes most positive.

As R9 is advanced the grid of the triode will become sufficiently positive at the top of the scan stroke to overcome the high bias set up across R11, and when this condition is reached the valve will pass current at the positive peak of each saw-tooth. This current must flow through R10 across which, accordingly, is set up a voltage drop tending to drive the triode anode less positive, and this occurs at the instant when the anode is driven most positive by the saw-tooth voltage. The net result, therefore, is that the final saw-tooth voltage on the triode anode is compressed at the positive point, the non-linear top of the tooth being "bent down," and

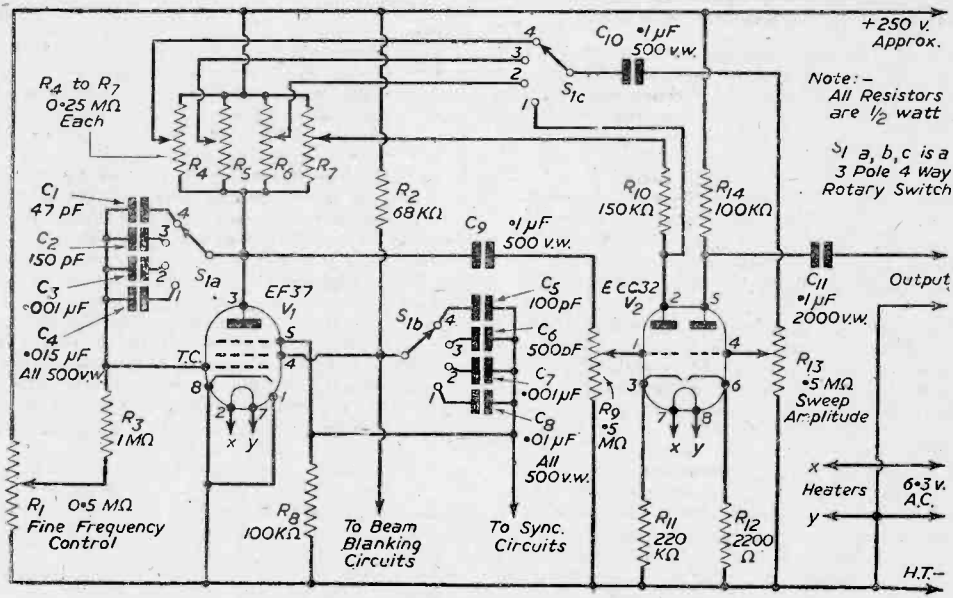


Fig. 2.—Circuit of the Improved Miller Timebase.

by careful setting of R7 and R9 the degree of "bending" can be adjusted to nullify the reverse curve of the saw-tooth, the final output being slightly less in amplitude and very substantially linear.

Construction and Adjustment

The circuit of Fig. 2 is offered to the experimenter for his own tests and adaptations; the oscilloscope constructor may require extra frequency ranges, and the television receiver constructor can eliminate the switching and build the timebase up in a simpler form. For this reason no components list is included and all component values are shown in the diagram.

No effort should be made to provide linearisation on frequency ranges other than the lowest sweep speeds, for the Miller timebase gives excellent linearity on medium and high speeds where a linearising stage will succeed only in introducing distortion.

No provision for switching the lineariser out of action on ranges 2, 3 and 4 is shown, since on trial this appeared unnecessary.

Valves other than the EF37 and ECC32 can probably be employed with equivalent results, although some changes in resistance values and particularly that of R11 may be required.

The circuit is non-critical and may be built up in any form so long as the timebase capacitor switching is arranged to have neat and short wiring, especially so far as range 4 is concerned.

Beam blanking and automatic synchronisation can be applied to the timebase, the two connecting points being indicated in Fig. 2, and the synchronising stage and beam blanking arrangement shown in the writer's D.C. oscilloscope circuit (October issue) are recommended. the timebase having been tested with these circuits with excellent results.

It should be noted that although there are seven potentiometers in the timebase circuit of Fig. 2, only R1, the fine frequency control, and R13, the sweep amplitude control, are panel controls. R4, R5, R6, R7 and R9 are all pre-set components which, once adjusted, require no alteration. They can therefore be built into the chassis of the timebase.

To adjust the circuit a separate oscilloscope is really desirable, although the linearisation and amplitude controls can be set by drawing a sine wave on the timebase scan. When a separate oscilloscope can be employed, feed the output from the timebase direct to the Y plate and set the 'scope to draw out two or three complete saw-teeth with S1 switched to range 1 and R1 at about the centre of its travel.

If the timebase is being supplied from the oscilloscope power pack remember to decouple the H.T. line through about 20,000 ohms and an 8 mfds. capacitor.

Rotate R7 to the H.T. end of the component and set R9 so that the slider is earthed, then turn back R7 so that the saw-tooth wave is drawn on the screen. R13 should be set centrally or in a position to give satisfactory amplitude, depending on the size of the oscilloscope screen.

As R7 is adjusted and the wave appears, the lack of linearity will be clearly visible. Now slowly advance R9; as the correct setting is approached, the saw-teeth will be seen to decrease in amplitude and the curve of the scanning stroke will flatten out. If R9 is rotated too far the curve will reverse, distort and then the saw-teeth will reverse in phase by "juggling" with the settings of R7 and R9 a number of interesting—though not very useful—waveforms can be obtained.

If the saw-tooth, when linearised, is not of sufficient amplitude, make a further advance of R7 and then re-linearise with R9. Observe the amplitude control obtained through R13 and especially the fact that a change of amplitude has no effect on the timebase speed, a further improvement over many timebase circuits.

With the low-frequency range satisfactorily linearised, set R13 to a suitable position and leave it, then switch S1 to range 2, after marking the height of the saw-teeth provided by range 1. This height can be observed on the graticule, should this be fitted over the screen, or by marking the tube screen direct with a crayon pencil.

Set the oscilloscope timebase to give two or three saw-teeth on the screen, and adjust the height of these saw-teeth to correspond with the amplitude of the trace obtained from range 1, adjusting R6 till the same amplitude is obtained. Repeat the process on ranges 3 and 4, employing R5 and R4 respectively.

The timebase is then correctly adjusted.

If no separate oscilloscope is available and the timebase is being built into an oscilloscope, feed suitable 50 cycles sine wave to the tube Y plates, either direct or through an amplifier. Switch the timebase to range 1, set R13 to a suitable position depending on screen size, and with R9 set to the earthed end of its travel draw out a trace by advancing R7 from the H.T. end of the potentiometer. Correct the timebase speed by adjusting R1 so that 5 or 6 complete cycles of the sine wave are drawn steadily on the screen. Observe the trace; it will be found that at one end the waveform is compressed and at the other that it is expanded. Now slowly rotate R9. The expanded end of the waveform will slowly compress—it may be necessary to make a slight alteration to the frequency control as the adjustment is made—and R9 should be rotated until the end of the trace suddenly compresses further and commences to turn in on itself, or fold back. Turn R9 back a little to counter this effect, and the scanning stroke will then be linearised correctly.

Make further adjustments to R7 and R9, should these be required to extend the scanning amplitude, and then mark the ends of the timebase sweep. Switch to range 2 and adjust R6 to give the same sweep amplitude, and similarly adjust ranges 3 and 4 for amplitude using R5 and R4. The timebase is then set up for correct operation, further amplitude adjustments being made through R13.

If it is desired to employ this type of timebase in the D.C. oscilloscope, V2 must be chosen to have an 0.2 Amp. heater to suit the heater chain. In place of the double triode it would therefore be necessary to use a pair of valves such as EF37's triode-connected.

AVO PRICE CORRECTION

WE are asked by the Automatic Coil Winder & Electrical Equipment Co., Ltd., to state that the price of the D.C. AvoMinor was incorrectly shown in their advertisement on page 378 of our October issue. The current price of this combination instrument is £5 5s.

ANNOUNCING—

The P.W. Constructor's Television Receiver

Preliminary Details of a New Receiver Shortly to be Described

CONSIDERABLE interest was shown at Radiolympia in our new television receiver, the main chassis of which is shown on our cover this month. With the accent now on television, many constructors are turning to this branch of the radio hobby, but feel that they need considerable experience before undertaking the building of a receiver of this nature. There is, however, nothing very difficult in the wiring of a television receiver, and the main thing is to forget that it is a piece of apparatus of this type and regard it merely as another short-wave receiver. This does not, of course, mean that the work can be skimped or liberties taken, although it is possible to carry out the work in a poor manner and still get results. The reliability will, however, be poor, and at any time a poorly constructed receiver may break down, so that it is worth while doing the job properly.

Cost

The main query on our stand was "How much does it cost?" The present equipment will cost about £50 for the parts—perhaps a little over. That is with all new equipment. The experienced constructor will undoubtedly see ways and means of cutting down this cost, but whilst it is possible to use ex-Service surplus here and there, this is only worth while where equipment is available for testing such surplus, and the usual advice must be given that the use of such apparatus is risky.

The fact that a home-made set will cost more than some ready-made commercial receivers must be considered in conjunction with the fact that the home-made apparatus lends itself readily to modifications and improvements as they come along, and, of course, the results should be better than a receiver costing the same amount of money. Added to this, of course, is the fact that considerable enjoyment is obtained in the building of the apparatus, and there is a feeling of satisfaction when the equipment is put into use.

The Circuit

For those who did not see the receiver at Olympia, the following details are given concerning the receiver. It is in two parts—a mains unit containing the sound-output stage and loudspeaker, together with the standard mains transformer and the E.H.T. unit. The other part contains, on one chassis measuring 14in. square and 2½in. deep, the vision and sound receivers, the sync. separator and the time bases, with the tube and its associated equipment. Focusing is by permanent magnet, and the deflection coils are choke-coupled to a hard-valve time base, the reliable and efficient Haynes components being used for this section. The sync. separator is the three-valve arrangement described in our April issue, and the interlace and locking are so good that it is possible to see the half line at top and bottom of the raster.

The vision receiver is of the straight type, with four R.F. stages, incorporating heavily damped 1/1 transformers. A double diode provides rectification and noise limiting. The sound receiver has two R.F. stages, which are not common to the vision section, and again, a double diode is used for rectification and interference limiting. Each section of the two receivers is built up individually, separating screens and tag-boards being used in a form of unit construction. These units are dropped into place and wired to the valveholders to complete the circuits. To avoid the use of chokes, etc., the heater and H.T. circuits are split, and the wiring run in different directions.

Single Sideband

As designed the receiver is for the London area, and utilises the upper sideband for vision reception. The Birmingham station is for lower sideband, and therefore the circuits of the receiver will have to be modified. Rejector circuits will be required in the cathode circuits of the R.F. stages, and details of the required modifications will be given as soon as it has been possible to test the receiver under actual conditions. At the moment data has been prepared, but only from generator and 'scope working.

Finally, it should be noted that the receiver may be mounted in either a table or console cabinet. The two chassis, side by side, will call for a cabinet about 26in. long and with an overall depth of 16in. to 18in. Alternatively, a console may be used with the speaker mounted in the lower section and the vision section about it. The field from the special loudspeaker is small enough to enable the two units to work side by side and touching. Further details will appear in a forthcoming issue.

Books Received

Outline of Radio. By eight specialist authors. 686 pp. Published by Geo. Newnes, Ltd. Price 21s.

Principles and Practice of Radar. By H. E. Penrose. 692 pp. Published by Geo. Newnes, Ltd. Price 42s.

Radio, Television and Electrical Repairs. By Roy C. Norris. 447 pp. Published by Odhams Press, Ltd. Price 10s. 6d.

Electronics Manual for Radio Engineers. By Vin Zeluff and John Markus. 879 pp. Published in England by McGraw-Hill Publishing Co., Ltd. Price 57s.

The Electronic Musical Instrument Manual. By Alan Douglas. 143 pp. Published by Pitman. Price 18s.

Pulse Generators

Modern Electronic Arrangements Explained

By R. J. YATES

THE arrangements used for the generation of pulses may be divided into two classes: (1) Circuits which generate pulses directly; and (2) circuits delivering an output which may be converted into pulses by the use of suitable circuits.

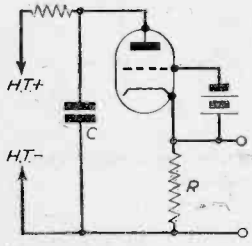


Fig. 1.—Simple thyratron circuit.

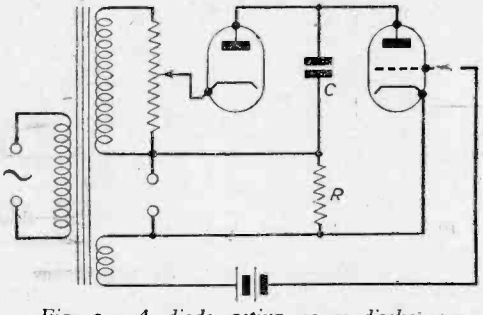


Fig. 2.—A diode acting as a discharge source.

Thyratron Circuits

When a condenser is charged through a resistance the P.D. across it rises exponentially. A thyratron connected across the condenser, with a suitable bias applied, conducts when the P.D. has reached a predetermined value. The condenser then discharges through the valve. A voltage pulse may be obtained across a resistance in series with the valve. (See Fig. 1.)

The duration of the pulse is determined by the time constant C.R., but R must not be so small as to cause heavy current through the valve, thereby damaging the cathode. If the condenser is charged from an A.C. source, the P.R.F. is equal to the frequency of the supply, and the pulse height is controlled by adjustment of the grid bias. Fig. 2 shows a circuit in which the condenser C charges through a diode connected to the secondary of a transformer. A separate winding is used for synchronising.

Blocking Oscillator

Fig. 3 shows a simple reaction oscillator, with automatic grid leak bias. Such an oscillator would normally produce C.W. oscillations, and would work in Class A, B or C, depending upon the Time Constant C.R. Under conditions of large feedback and long time constant (C.R.) it is possible for sufficient electrons to be collected, by the plate of C connected to the grid, during the first half-cycle to bias the valve to dynamic cut-off. When the bias reaches dynamic cut-off the succeeding oscillations cannot reach static-cut-off and cause anode current to flow, so there can be no energy fed back into the grid circuit, and therefore subsequent oscillations will die away. Meanwhile, electrons leak from C via R to the cathode and the bias is lifted exponentially back to zero bias. When the bias reaches static cut-off, oscillations can occur and the whole process is repeated. Therefore a positive pulse of anode current is produced on every first half cycle. (See Fig. 3b.)

It is evident that to produce the blocking action, C.R. must be long, otherwise the bias may decrease sufficiently rapidly to allow the second oscillation to cause anode current to flow. Oscillations must build up rapidly, otherwise second oscillation may be greater in amplitude than the first and two or more bursts of anode current will be produced at one time.

The following conditions must be satisfied to obtain correct operation:

1. The feedback of energy to the grid circuit must be large, this being obtained by using an iron-cored transformer which has a large mutual inductance.
2. The mutual conductance of the valve used must be high.

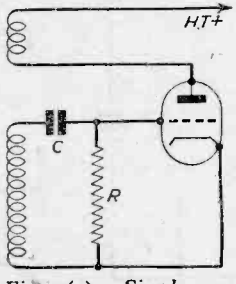


Fig. 3(a).—Simple reaction circuit.

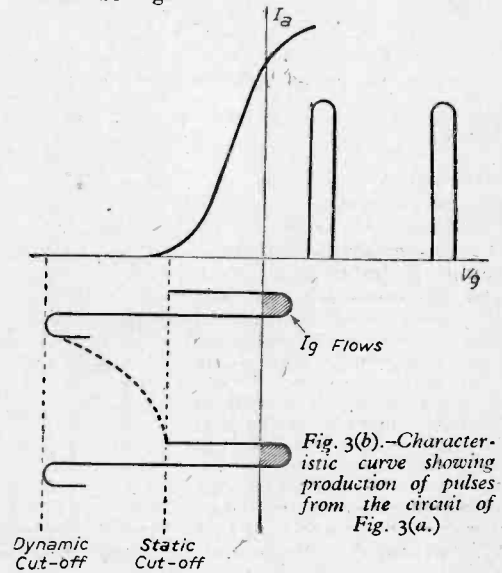


Fig. 3(b).—Characteristic curve showing production of pulses from the circuit of Fig. 3(a.)

3. The Q of the tuned grid circuit must be large. Since $Q = 1/R\sqrt{L.C.}$ (where R = resistance of tuned circuit), the L/C ratio must be high. This is achieved by using only the stray capacities across the transformer as the tuning capacity.

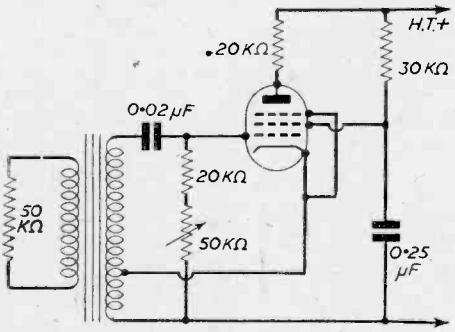


Fig. 4.—Simple Hartley oscillator circuit.

The width of anode current pulse is determined by the period of oscillation, i.e., $\sqrt{L.C.}$ and as C is fixed, the width of the pulse is varied by adjustment of L. The P.R.F. is determined by the time taken for grid capacity to discharge through grid leak. Fig. 4 shows a practical circuit, it being of the Hartley oscillator type with a large degree of feedback.

Multivibrator

A multivibrator consists of a two-stage R.C. amplifier, the output of the second stage being the input to the first stage. Each valve will introduce a 180 deg. phase shift, hence oscillation will occur. Initially both valves are conducting equally, this being an unstable condition, for immediately the anode current in one valve changes, oscillations will occur. The frequency of oscillation is controlled by the time constants of the grid circuit components and may be determined from the formula $f = 1/(Rg_1 Cg_1 + Rg_2 Cg_2)$ c/s. The multivibrator may be synchronised to run at the same frequency, or sub-harmonics, as that of some external waveform.

The circuit of a multivibrator, together with representative wave-forms, is shown in Figs. 5a and 5b.

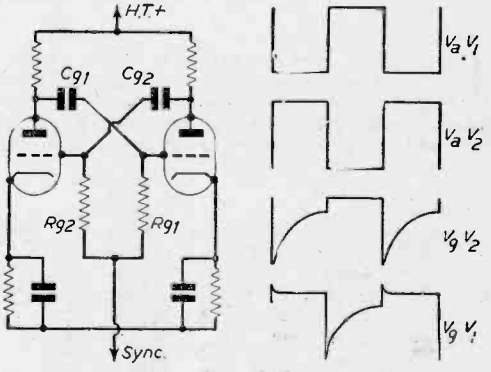


Fig. 5(a) and (b).—Multivibrator circuit and representative waveforms.

Triggered Transitrons

A transitron circuit depends upon the reciprocity of anode and screen currents in a pentode valve with fixed bias. The characteristics of such a circuit are shown in Figs. 6a and 6b.

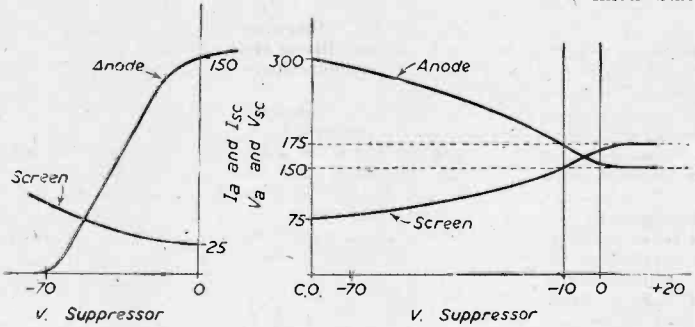


Fig. 6(a) and (b).—Characteristics of the transitron circuit.

There are two types of triggered transitron circuits :—

1. Grid triggered, giving a delayed, square d.c. pulse at the anode.
2. Suppressor triggered, giving a lengthened, square d.c. pulse.

The circuits, together with waveforms, are shown in Figs. 7a, 7b, 7c and 7d.

The diode is included to prevent the suppressor potential going positive, and hence prevents current being drawn which would upset the wave-form. The trigger pulse is a narrow, negative D.C. pulse, which must be greater than 10 v. in amplitude, or no change in anode or screen currents occur.

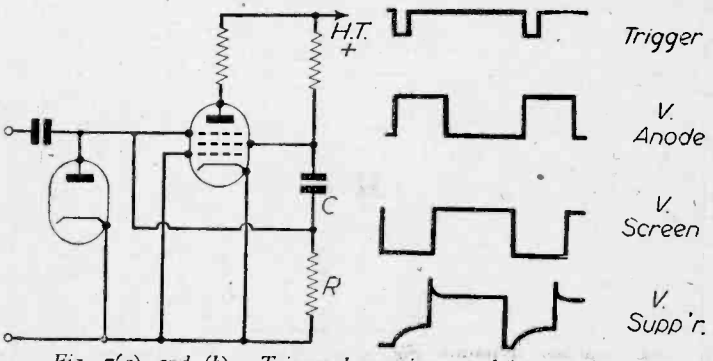


Fig. 7(a) and (b).—Triggered transitron and its waveforms.

A negative going D.C. pulse is produced at the anode, which is delayed on the start of the positive going, square wave, trigger voltage, by a time dependent upon the time constant C.R.

Squaring Circuits

A voltage of approximately rectangular waveform may be produced by a sine-wave generator followed by a number of suitably biased amplifiers. If a sinusoidal waveform voltage of large amplitude is applied between grid and cathode of a valve the effect is shown in Fig. 8.

The valve is driven beyond cut-off during the negative half-cycles, and this portion of the wave is therefore made rectangular. At the positive peak, however, grid current flows, setting up a negative bias which moves the operating point further to the left on the Vg axis. It is therefore impossible to drive the valve to saturation at positive peaks and the wave will retain a rounded shape. If the output voltage from the valve is applied to a further amplifier stage, the rounded end of the waveform will be made rectangular on account of grid cut-off, and the upper half cycles undergo linear amplification, retaining their shape. Therefore the final output will be almost rectangular. Fig. 9 shows a suitable circuit for producing rectangular pulses.

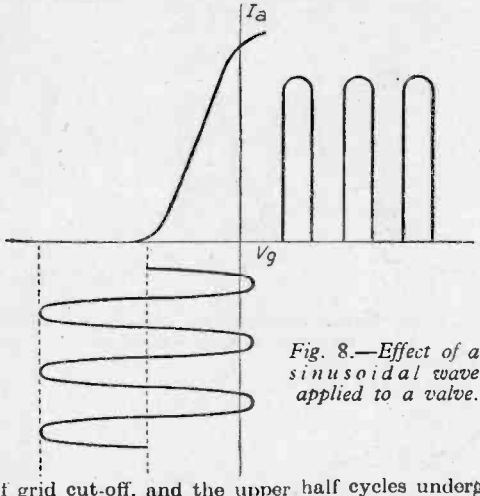


Fig. 8.—Effect of a sinusoidal wave applied to a valve.

The alternating voltage is applied to V_1 via a transformer. A potential divider is formed by R_1 and the grid to cathode capacity of the valve, which on account of grid current flow is fairly low. Bias for V_2 is provided by a variable resistance R_2.

Rectifier Circuits

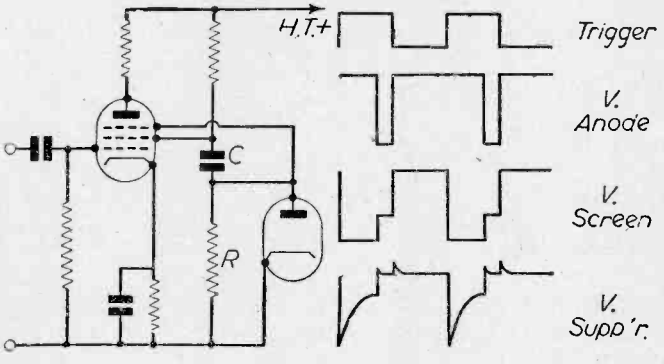
This is a modification of the method explained above. The A.C. input is fed to a half-wave rectifier followed by an amplifier. The operation of this arrangement will be understood by reference to Fig. 10.

Pulse Sharpening Circuits

C.R. Circuit

If a square wave is applied to a circuit consisting of a condenser and resistance in series the nature of the P.D. developed across the components depends upon the time constant C.R., in relation to the period (T) occupied by one cycle of the input voltage. The diagrams in Fig. 11 show the effect of C.R. upon the resultant voltages. It can be seen from these diagrams that if C.R.> T the output across R consists of alternatively positive and negative pulses which are narrow at the peak, broadening at the base. The pulses may be sharpened by an amplifier stage biased so that only the positive peaks are amplified. (See Fig. 12).

An example of this type of circuit is shown in Fig. 13, where the output from a blocking oscillator has been shaped by using a C.R. circuit.



Figs. 7(c) and (d).—An alternative circuit of a triggered transitron and its waveforms.

L.C.R. Circuit

If the potential difference across a circuit containing L, R and C in series is changed suddenly, the current produced will be an oscillatory component whose frequency is given by

$$f = \tfrac{1}{2}\pi\sqrt{1/L.C. - R^2/4L^2}.$$

If $R^2/4L^2 < L.C.$, the resultant waveform is as shown in Fig. 14b.

If R is increased, the oscillations are more heavily damped, and it is possible to obtain a current of the form shown in Fig. 14c in which the amplitude

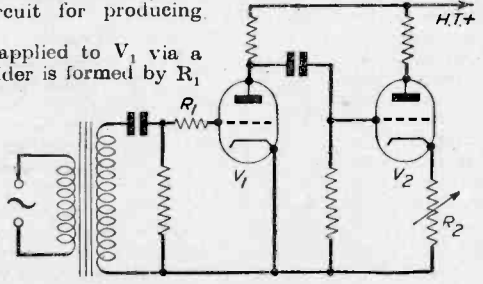


Fig. 9.—Circuit for producing rectangular pulses.

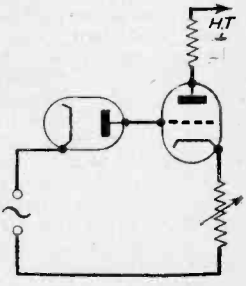


Fig. 10.—Modification of Fig. 9 using a half-wave rectifier.

decreases almost to zero after the first half cycle. A voltage of the same wave-form may be taken off across the coil. The effect of applying a rectangular pulse to this circuit, having a critical valve of R,

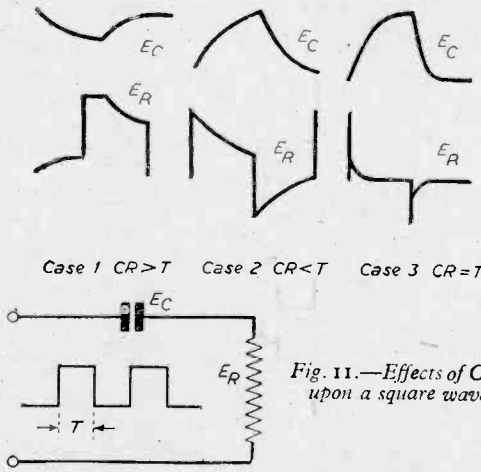


Fig. 11.—Effects of C.R. upon a square wave.

is shown in Fig. 15. One positive and one negative pulse are produced from each cycle of the input waveform. The duration of each pulse is approximately one-half of the period corresponding

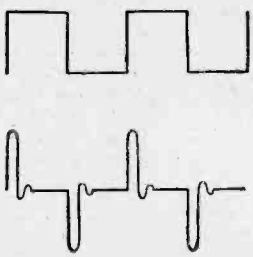
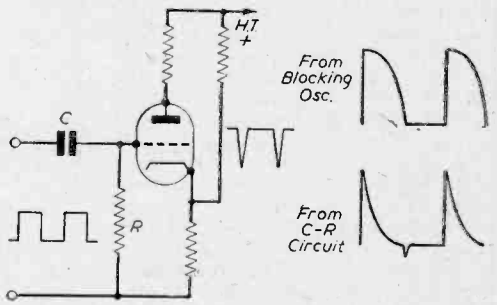


Fig. 15.—A rectangular pulse and its form after application to a circuit of this type shown in Fig. 14(a).

to the frequency given in equation (1). This can be made much less than the period of the input voltage, and the circuit thus acts as a pulse-shortening device. This arrangement is known as a "ringing circuit," and may be used to shorten pulses of any shape, provided that the wave-form



Figs. 12 and 13.—Effects of biasing, and a shaping circuit.

is steep at one point in each cycle. The pulses shown in Fig. 15 may be further sharpened by the use of an amplifier biased so as to amplify only the tips of the positive peaks.

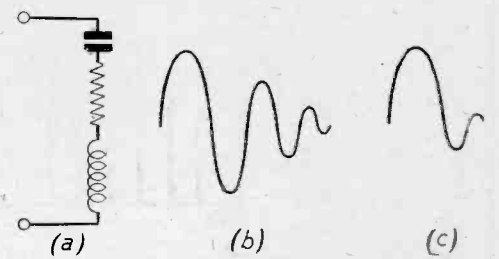


Fig. 14.—Circuit consisting of L, C and R, and the resultant damped output.

Valve News

V.H.F. Double Tetrode

DESIGNERS of mobile V.H.F. equipment will be particularly interested in a new directly-heated double tetrode (QQZ04-15) recently introduced by Mullard Electronic Products, Ltd. This valve, which is claimed to be the first of its type in the world, operates efficiently at frequencies up to 186 Mc/s. The maximum output power into the load is 19 watts at the lower frequencies, falling to 16 watts at 186 Mc/s. The QQZO4-15 may be used in all stages of mobile transmitters, and provides the distinct advantage over previous types in that the filament may be switched off during stand-by periods. This results in a considerable saving in battery consumption, and the equipment gives full output within three seconds of switching to "transmit."

The low screen inductance is another interesting feature of this valve. This results from the common screen to both halves of the valve, and obviates the necessity for neutralisation.

The list price is £3 10s.

Low-hum Pentode

IN the design of audio amplifiers there has for many years been a demand for an input valve combining the features of high gain, low microphony and low hum. This need is now fully met in the new Mullard, EF37A pentode.

The magnetic hum level of the EF37A is less than one-fifth of that of the EF37, the actual value, referred to the control grid, being less than five microvolts. Moreover, this has been achieved without in any way affecting the high gain and low microphony characteristics which are particularly desirable features in the EF37.

The operating conditions of the new valve are identical with those for the EF37.

Remote Control at U.H.F.

A Low Power High Stability Oscillator Unit

By D. E. S. ISLE

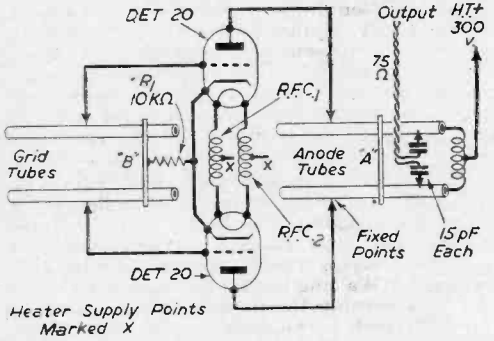
NOW that we have the 460 Mc/s band and others for use in the U.H.F. region, remote control using low power equipment is again possible.

The unit described consists of two DET20 U.H.F. triodes (also purchasable as ex W.D. CV6) working in a resonant line oscillation circuit.

The power consumed at 300 v is about 30 mA.; but this increases with frequency, until no dip in mA (anode) is indicated on tuning.

At this point the valves are shunting all of any R.F. produced and the maximum usable frequency has therefore been reached and passed.

The receiver for remote control purposes is best constructed from a crystal rectifier and 500 $\mu\mu$A. meter movement (described below).



Theoretical circuit of the control unit.

Construction

The CV6 type valve dissipates 1w. at 300 Mc/s and a decreasingly smaller output at frequencies above this figure. The anode and grid are both brought out to top caps, thus reducing the working electrode capacities of the valve to a minimum.

The length of the tubes for anode and grid circuits are equal and for frequencies in the 460 Mc/s band should be about 7in. long and 1in. diameter.

The anode is tuned together with its fellow in the second valve by sliding the shorting link "A" up and down the anode tubes until the requisite drop in combined anode currents is obtained. When this has been done the output may be taken off the anode tubes by 75Ω twisted flex and two 15pF condensers as coupling.

Reception

As the centre of a half-wave dipole is roughly a 60-80Ω impedance point (where no directive elements are used), the flex can be connected to each quarter wave section direct, with about $\frac{1}{2}$in. gap between the "current" ends.

This applies similarly to the receiving dipole. The receiver crystal detector obtainable as a "crystal-valve" used for mobile, etc., is matched to the 75Ω line by a step-down transformer.

This transformer should consist of a loop of one turn coupling the feeder, over a coil of 10 turns open-wound 18 gauge copper to which are connected the meter and crystal rectifier in parallel.

When a reading is obtained on the meter the tapping points of the aerial coupling on the transmitter unit should be adjusted for maximum output.

The meter movement necessary depends of course on the output obtained and the distance between the control and controlled points.

It will be found that a $\frac{1}{2}$ mA. movement will be sufficient for the most discerning experimenter.

Two pairs of copper tubes are used, for tuning the grid and anode circuits respectively. The grids of the two valves are tapped at equidistant points along the grid tubes, from the earthing clamp "B."

The distance from earth to grid along these tubes is the frequency adjustment of the unit and is very critical, i.e., a small change in length may alter the resonance of the grid circuit by as much as 20 Mc/s.

The resistance R_1 is a 10kΩ. 1w., and is present as a limiter for the grid drive developed in the tubes. The substitution of a 20kΩ. potentiometer makes a useful variable output control.

The cathode and one side of the 6.3v .3A heater of each valve should be strapped; and the whole decoupled by the R.F. chokes—R.F.C. 1 and 2, consisting of eight turns of 18 s.w.g. tinned copper on $\frac{1}{4}$in. diameter polythene or Perspex formers.

General

The meter movement adaptation for remote control is best left to the ingenuity of the user, but the author recommends that the principle used relies on the movement from zero, not to a certain figure, as this gives a better sensitivity, especially with a sluggish meter.

80Ω coaxial cable may be used effectively in place of twisted flex and may prove capable of giving better results.

A higher output may be obtained by using the double-triode RK34 or 4074A (Standard) operating at 500v on the H.T. line.

R1 (xmtr.) should then be increased to 50kΩ.

On your Wavelength

by THERMION

The Fidels

YOUR Uncle Thermion, as has been his wont in years gone by, regularly attended the radio show, incognito and unmolested by the jazz fiends who are anxious for his blood. From time to time I relieved the technical staff, and, of course, enjoyed a quiet joke now and again, especially with one reader who asked how old Thermion was and to whom I truthfully replied "About my age"! I am always amazed at the interest and loyalty shown by the readers of this journal. They flock to our stand and keep up a lively technical conversation with whomsoever is on duty at the time. Many readers expressed nostalgic wishes for the days of plenitude of long ago, of larger issues and ampler pages, of blueprints and tool-kits, of plentiful supplies of components. In spite of all the shortages, however, their interest in construction remains.

Of course, the readers fall readily enough into classes of interest. There are the short-wave fans, the television enthusiasts, the amateur transmitters, the high-brows and the low-brows. It is in this connection that I wish faithfully to report on a discussion I had with three readers on the stand, two of whom were interested in quality reproduction. I pointed out that quality was a nebulous thing and that no one knows what it is. Of course, it is possible to say that one receiver sounds better than another, but this does not mean that the better of these two is a quality receiver. Quite frankly, I have little sympathy with this craze for quality receivers—this search to gild the lily or improve upon something which is already nigh perfect.

How can anyone claiming to have a quality receiver (and by quality I mean a faithful reproduction of the noises radiated from the studio) know that his receiver is reproducing faithfully the noises transmitted? It is impossible for one person to be in two places at the same time, and therefore I say that it is sheer nonsense for anyone to say that he possesses a quality receiver.

There are also those who do not care very much about such things as cut off, extraneous or parasitic noises. And there are those who use a wireless set merely to listen to or waggle their limbs to the aboriginal noises of Sol Pieface and his orchestra. There you have three distinct classes—the high-fidels, the lowfidels, and the infidels! I was able to convince this triumvirate that there was no such thing as quality in the sense in which they used the term. It is a subtle form of vanity, a superiority complex, when the bespectacled quality fans expatiate and deliver their learned disquisitions on quality.

One reader, who prefers to be known as "Old Boy," and who hies from the salubrious district of Portsmouth, had an attack of nostalgia after visiting the show and thought I might like to reflect on some of the words of wisdom which poured from my inexhaustible fount in past issues! He sent me a couple of show issues of years ago. Age, however, proves nothing but antiquity. It is much more important to have become first than to have been first.

Comparing what I then wrote with the present time, I do not think that the atmosphere of Radiolympia has changed a great deal. The young men of those earlier years are now fathers of sons who are our readers. It is true that not so many firms to-day cater for the home constructor, but there are still plenty of components about, especially ex-Government equipment, some of which is superior to components one buys in the ordinary way. I observed that one or two of the manufacturers are getting back into the component market, one firm at least selling a kit of parts for building a television receiver. The demonstration I saw of this at Radiolympia showed the set to be a workmanlike job and gave quite a good picture.

There was a general complaint, of course, at the prices, and mingling with the crowds round the various stands one heard the reasons why the public is not buying wireless receivers as it did a few years ago. "Waiting for the purchase tax to come off," "Not earning the money I did," "Taxation is so high that I can barely make ends meet," "Living in a room because I cannot get a house and the landlord objects to radio," "Had my present set for over 12 years and see nothing wrong with it," and so on. It seemed to me that the stylists have got hold of the radio trade as they have got hold of the car trade and that the receivers could be greatly cheapened by cutting out the ornate trimmings designed to catch the eye and divert attention from the technical specifications.

Fancy shapes are costly to produce and in a world of austerity and utility it might be wise to drop the curves and the finishes more appropriate to a period of prosperity. The show this year was better staged than the last and the public greatly appreciated the many sideshows staged by the B.B.C. and various Government Departments. If there was any complaint on this score it came from the manufacturers, who thought that these sideshows tended to suck away the interest from their stands, and from their prospective clients.

To my many friends who inquired after my health, the temperature of my fountain-pen point, the makers of the vitriol which they think I use as a writing fluid, what I look like, and to the antis who think that jazz (pah!) and crooning (bah!) are the apogee of musical accomplishment, which is like comparing a sausage to caviare, and to those who think my hobby is biting crooner's throats I tender my thanks and appreciations.

A Battery Midget Two

A Diode-pentode and Tetrode in a Simple Circuit Arrangement

By F. G. RAYER

BY taking advantage of the miniature moving-coil speakers now available, and the 1.4 volt glass button-base valves designed for "personal" receivers, it is possible to construct an extremely compact set. In the receiver described here, two high-efficiency valves are used—a diode-pentode in the detector position and a beam tetrode in the output position. The total filament consumption is .15 amp. so that a small dry cell will have a useful period of life. The H.T. current demands can also be economically met, and sensitivity and volume are maintained to a rather surprising degree. (That this is so is largely due to the design of the valves, which operate efficiently with low anode voltages. The output tetrode has a power output of slightly over ¼ watt, with an anode voltage of 90, which compares very favourably with any ordinary battery-operated receiver.)

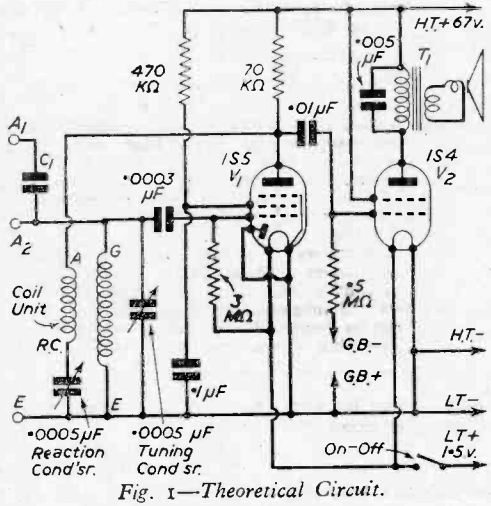


Fig. 1—Theoretical Circuit.

The size of the receiver will be seen from the diagrams, and it comes into the personal midget class. It is intended for use with a short external aerial since a frame-aerial of this size would give poor signal pick-up. A few yards of thin flex can almost always be used without inconvenience and maximum volume is assured by taking this directly to the tuning coil grid winding. (For longer aerials, an alternative terminal is provided.)

It is recommended that separate batteries be used for low and high tension. With the batteries supplying both H.T. and L.T. wastage may be caused by one section running down when the other could still provide many hours of useful service.

Theoretical Circuit

This is shown in Fig. 1. The diode in the detector valve is not required and is returned to filament negative. For tuning, a small iron-cored medium-wave coil is used; this provides good results and is easily obtainable.

Unnecessary modification of the component values is not recommended. This is particularly so with the screen and anode resistors used with the detector. The currents passing are very small and operation may be seriously upset if the value of these resistors is changed.

The speaker—a 2½in. unit—is coupled by a 90 : 1 midget output transformer. It is wise to buy transformer and speaker together, to be certain that the secondary of the transformer is suitable for the speech-coil impedance of the speaker.

A H.T. voltage of about 67 is shown. (A well-known midget H.T. battery is rated at 67½ volts.) This may be increased up to a maximum of 90 volts, but even with half this voltage excellent results can be obtained. So this point is a matter for personal choice.

Chassis Construction

A top view of the chassis is shown in Fig. 2. Holes ⅝in. in diameter will be required for the valve-holders. A small cut-out is also necessary, as indicated, so that the speaker may project slightly below the level of the chassis.

A metal panel is used, with 3-ply for chassis and rear runner. If the panel should be made of wood also, a further lead must be connected from the moving plates tag of the tuning condenser to the negative filament tag of one of the valveholders.

The panel is shown in Fig. 3 with dimensions. It is fixed to the chassis by soldering on small brackets. (Bolting will be necessary with aluminium, unless the constructor has the means of dealing with this metal.)

Some types of 2½in. speaker have no fixing holes round the rim, and these can be secured by bolting on three small pieces of metal, to hold the rim against the panel in the correct position. Soldering is also in order, provided the job is properly done.

The output transformer goes immediately beside the speaker (to the extreme left in Fig. 2.). This leaves a space about 1in. by 4in. on the chassis.

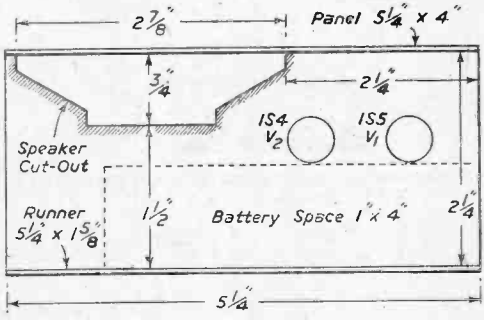


Fig. 2.—Chassis cutting and drilling details.

If this is insufficient for the batteries it is intended to use, these can stand behind the chassis.

The valveholders are fixed by means of small screws driven up from the bottom. Only one lead passed through the chassis—that from tuning condenser (fixed plates) to the .0003 μF fixed condenser.

Wiring Details

A complete wiring plan is shown in Fig. 4. This may seem rather cramped, but the chassis is quite deep and actually the wiring is not so congested as the diagram appears to suggest. All leads should be well insulated with sleeving.

As the valves are of a type where the pins are mounted directly in a glass base, the valveholder sockets are "floating." Therefore very stiff, rigid leads should not be made to the socket tags, or these leads may hold the sockets so that correct alignment with the valve pins is difficult. As a further aid to assuring the valve bases are never fractured, most valveholders of this type appear to require a little treatment to open up the valve sockets before inserting the valves. Pressing a large needle into each socket will accomplish this. On no account should a valve be *forced* into the holder because the glass button bases are not sufficiently robust to bear such treatment.

In Fig. 4, switch and transformer are not in position. The latter is positioned as mentioned. The switch is fitted immediately below the speaker.

The capacity of C1 (aerial condenser) depends to some extent upon the aerial used. As described, it is not in circuit with a very short aerial, which is taken to terminal A2. For an average, fairly short aerial, C1 should be about .0001 μF. For a long aerial, a reduction to about .00005 μF is recommended if selectivity is important. A pre-set condenser could be used, so that the capacity could be adjusted.

Final Notes

As the baffle area provided by the panel is so small, it will be found a noticeable improvement in reproduction arises when the receiver is placed in a cabinet. Such a cabinet can be constructed so that the whole receiver pushes in from the back.

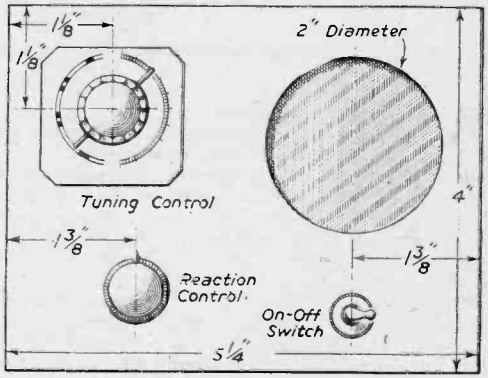


Fig. 3.—Panel lay-out.

If an earth is used, this can be taken to the metal chassis, or to H.T. negative. The output valve will require between 4.5 and 7.5 volts grid bias, depending upon H.T. voltage. For 67 volts H.T. 6 volts is suitable.

LIST OF COMPONENTS

2½in. speaker.
Pentode output transformer (midget type) for same.
1S5 diode-pentode glass button base valve.
1S4 glass button base output beam tetrode.
Two valveholders for above.
Two .0005 μF solid-dielectric variable condensers
Two knobs for ¼in. spindles.
On-off switch.
Small medium-wave iron-cored coil with reaction.
Fixed condensers: C1 (see text); .0003 μF mica; .01 μF mica; .005 μF paper; .1 μF paper.
Resistors: 3 megohm and .5 megohm grid leaks (½ watt or less); 70,000 ohm anode resistor; 470,000 ohm screen resistor (½ watt).

A small tuning dial will require to be drawn up in coloured ink, and stations may be marked upon this. No difficulty whatever should be experienced in obtaining sufficient volume for any average room, with a short indoor aerial.

The valve positions are shown in Fig. 2. No leads should be in contact with the unused valveholder tags because in some cases (notably in the 1S4) the valve pins pass through the base and help to support electrodes.

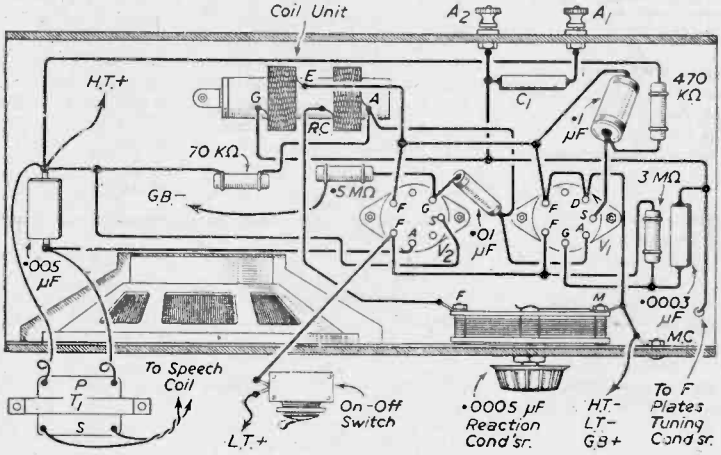


Fig. 4.—Complete wiring diagram.

Radiolympia–1949

THE MARQUIS OF DONEGALL Reviews This Year's Radio Exhibition

ONE can hardly blame the lay Press for what I can only describe as a bit-and-piece description of Radiolympia, 1949. We appreciate their difficulties and the fact that almost everything, owing to the strike, had to be written for the great national dailies from the excellent hand-outs which we had all been receiving for many weeks.

Well, that is not really good enough for the technical Press. Frankly, we are like the man from Missouri and we want to be shown.

It was in this spirit that I went to Radiolympia on the Monday, before the official opening, at which there was alleged to be a pre-Press view. At six o'clock on the Monday, Radiolympia looked far more like an exhibition that was being dismantled than an exhibition that was in the process of being put up.

On the Tuesday it was obvious that no change would take place until late in the day and looking from the gallery in the evening a certain improvement had occurred. But there was still precious little to report on.

By Wednesday morning a near-miracle had occurred over-night and one may speculate on whether it was great loyalty to Mr. Herbert Morrison, who was scheduled to open the exhibition at three o'clock that afternoon, or whether, conversely, it was something to do with patriotism that converted complete chaos into an exhibition overnight.

So let us see what we can do in the limited time allotted before it becomes impossible to see anything. Here are the main headlines of our hurried tour:

(1) The only news to anybody who has ever taken a wireless set to pieces and put it together again is in the television field.

(2) As far as wireless is concerned, by and large, there is nothing that we have not known about for years.

(3) A great improvement in cabinet-making and a far greater variety of cabinets than at the "Britain Can Make It" Exhibition in 1946.

(4) Doubtless all this is Fairyland to about 40,000,000 people who have been systematically sabotaged in one way or another and have never even seen the kind of portable battery radio that I carried in my pocket as a war correspondent so many years ago.

Well, of course, news is relative, but when I see a firm displaying as a novelty one of those things that open like a cigarette box and that I discarded as being perfectly useless for a war correspondent's job in favour of another American machine of a different shape, which has never yet been produced in this country, I give up. And I would not insult my readers by trying to foist it off on them as news.

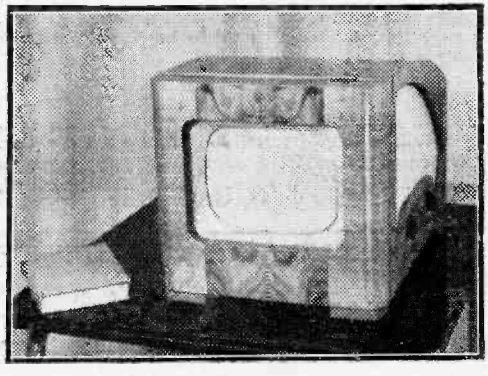
Do not think that I am going to be a sour puss on the whole of the British Wireless Industry. That is not my intention at all and I propose to return to the subject of wireless. On our tour I think that we find very favourable things upon which to comment.

In the meantime, let us apply more or less the same methods to the field of television.

(1) Television at £37, including purchase tax, is *news*. (More of that later.)

(2) The television in colour put over by Pye, Ltd., is a great improvement. But is it *news*? I quote from an article I wrote in the *Sunday Dispatch* of December 22nd, 1940:

"Mr. Baird invited me the other morning to a demonstration of improvements in television that he has been working on since the war began. 'Bring something red or blue,' he said. So I went along to his laboratory near the Crystal Palace and took with me Miss Paddy Naismith with her natural red hair and wearing a blue coat. By this



The Baird "Everyman" television receiver which costs 35 guineas.

time it had dawned on me that we were probably going to see a primitive attempt to televise colour.

"Mr. Baird first gave us a series of posters in colour, televised from the annexe of his house. The colour seemed excellent, but not having seen the original posters it was impossible to judge the quality.

"Then Paddy steps in, her red hair came out magnificently and her general colouring was good. The blue of her coat was quite faithful, but the green of her shirt came out black. No doubt this will be overcome, but the whole thing is certainly a revolutionary advance in television."

I think that that is almost enough of Donegall in his most critical mood. So let us continue our tour of Radiolympia looking for what we like, instead of as we have done up to the present in this article, looking for trouble.

Personally, I think the outstanding display of the whole of Radiolympia was that of the B.B.C. It really was first-class in interest. The advertising angle was so well disguised and so much in conformity with the trends of the best modern advertising. I can hardly imagine Mr. and Mrs.

(*Continued on page* 483.)

(*Continued from page* 480.)

Everyman and the small boy leaving the B.B.C. display without nudging each other and saying: "Yes, dear, we must get *The Radio Times* in future." But in the meantime, Mr. and Mrs. Everyman have had a great deal of free entertainment—no, fun!

Few people while I was there had the courage to comment on the horse-race of which there was a working model. The unwary are invited to pick up the microphone and comment on a ficticious race which is viewed on a kind of marionette stage but is worked on the conveyer-belt system. The hapless victim picks up the microphone to commentate the race and is not told that his voice will boom out all over the stand. This might easily lead to a breach of the peace. In my own case what happened was that my wife who was at a neighbouring stand, heard my voice getting more and more excited as the winner came in to the post, saw a large crowd around me and rushed back, pushing her way through, presuming that I had got into a fight with another Irishman.

During the few hours in which the Press were able to play with the toys, I had great amusement on the dial telephone unit "calling up" all of the 14 services of the B.B.C., successively. As I was dialling the 14 services, one after another, a chap came up to me and said: "What is it, chum?" And I said, "Turkish!" That got rid of him. I went back two hours later after the public had been admitted and the whole system had broken down. Maybe they put it right again. I don't know. But it was fun while it lasted.

Again full marks to all of the Services for their stands and the displays that they have put over. I have no space to deal with all of them, and therefore I pick the R.A.F. for their excellent demonstration of the Berlin Air Lift. Having been on the thing from Wunsdorf (Hanover) to Gatow (Berlin) myself, I was amazed at how graphically they had managed to reproduce the whole operation of the Air Lift in miniature and had made it understandable to the ordinary public.

Where do we go from here? Oh, yes, the most expensive outfit in the show. This remarkable achievement has been produced by Dynatron Radio, Ltd. The whole thing is extremely complicated, and how rightly the manufacturers have called it the "Add-on" Units. Not having my slide-rule with me, I shall have to take a rough guess and therefore I would say that the whole doings knocks you back about £500. That really is reasonable enough, because as I look at the specification of what you get it becomes increasingly obvious that it furnishes your entire sitting-room space with room only for one armchair to gaze upon what you have bought. To wit: radio unit, gramophone unit, television unit, wide-range loudspeaker, storage cabinet, flat-side panels, bookshelf ends, corner-pieces, glass-top panels and, although it doesn't say so, I should think old Uncle Tom Cobley and all thrown in.

To go from the millionaires' category down to the income level of ourselves, we had better take a quick look at the cheapest set in Radiolympia. That was the Ever-Ready Battery Portable at £6 10s. including tax. Being more interested in this than in the millionaire class, I did take the trouble to see whether it did what it was supposed to do or not. The answer is that it is a very good proposition. Incidentally, you get the essential aerial and earth wires supplied for your six quid and ten shillings.

Now let us go for something special in the under-£20 class. On our tour we have taken a very good look at the portables, and I think we have to come to the conclusion that the neatest job is Vidor. I am referring to what they call their "Attaché" Portable. Again I do not want to harp back and be captious—not in that sense at all—but this is the nearest thing that I have seen both in performance and particularly in presentation to the American luxury models of the post-war era.

Looking at the whole thing purely from a mercenary point of view, I would recommend any of you to keep in mind the Ambassador £68 Console. The Ekco motor-cycle fitted with radio transmitter and receiver is a very nice-looking job. In fact, it is a much nicer-looking job than the same thing which is in general operation with the Chicago Police.

The much-publicised pocket radio was rather a disappointment. It is really a deaf-aid which the user can switch-over to one selected radio station. This is, of course, an excellent idea and meticulously carried out in midget technique, but is of little practical value except to the deaf.

Again, I am not impressed. At the Coronation of King George VI I whiled away the five hours before their Majesties arrived in the Abbey by listening to the B.B.C. commentary on a set the size of an ordinary 7s. 6d. novel with an earphone attachment. Everybody, of course, thought that I was just one more deaf Peer.

And now in the wishful hope that at least one reader may have got this far, I will produce what I consider the only real news in the whole of Radiolympia. That was the Baird "Everyman" Table-model Television Receiver at 35 guineas including purchase tax. Rather optimistically the blurb calls it "Television for the Million"! Well, I would only halve that and call it "Television for the 500,000." Certainly, it is a most attractive little job. It has a nine-inch cathode-ray tube and is presented in grained walnut exactly the same as their somewhat more expensive model that requires no aerial and can be moved from room to room. I have been using one of these with excellent results for the last six months.

The actual dimensions of the "Everyman" are: height, 12¾in.; width, 12 11/16in.; depth, 17 3/16in. The mains voltage consumption is 150 watts, 200-240 volts A.C.

The signal from the aerial is fed through a three-position attenuator, an aerial transformer, to a six F12 RF pentode, which amplifies both the sound and the vision signals. I don't think I need to go on, because that should give you enough to supply a mental picture of rectification and vertical scanning power. Incidentally, the high tension supplied to the receiver is by means of a metal rectifier.

I have only one other thing to say about Radiolympia, 1949, and that is that strike or no strike, miracle or impossibility, it had the effect of producing a spirit of good comradeship and co-operation among exhibitors and public that we have not been privileged to see in this country since the bad old days of Hitler's blitz on London.

Wiring Problems

Some Practical Hints and Pitfalls to Avoid in Wiring Modern Apparatus

By W. J. DELANEY (G2FMY)

THE newcomer or the one-time amateur who is taking up radio again after a lapse of years might be forgiven for thinking that modern radio is beyond him if he examines the interior of a few modern commercial pieces of apparatus. Apart from the fact that in many pieces of equipment the odd components (resistors and capacitors) have tolerance marking and apparently are critical so far as concerns their values, there are also the many points arising from the actual wiring. In some equipment there is, perhaps, a single component or tag-board carrying a large

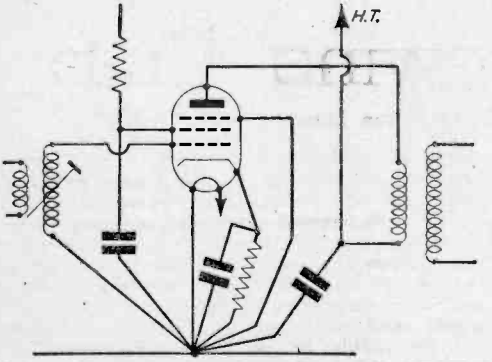


Fig. 1.—Circuit diagram indicating a common earthing point in an H.F. stage.

number of resistors and capacitors, with all the inter-circuit wiring running to this. In another piece of equipment there may be several such boards. Yet another maker will adopt what might be called the "old-fashioned" arrangement of making the components themselves the source of the inter-circuit wiring. How is one to know which is the best scheme to adopt when confronted by these different arrangements?

The first thing for the amateur to bear in mind is that the manufacturer is in a position to make up one arrangement after another and subject each build-up to elaborate laboratory tests, and therefore it is of no use regarding any one arrangement as ideal. It will suit that particular receiver, and although it may apparently contravene some popular statement regarding either layout or stability, it is possible that the manufacturer has allowed for such in his complete design, and therefore that arrangement must not be taken as standard—even for that type of receiver.

Short and Medium Waves

Everyone is well aware that quite a different technique is called for on the short and ultra-short wavelengths compared with the medium or broadcast bands. Although it is not possible to generalise when discussing layouts, there are two or three points which can be laid down, and it is with these that we will deal here. First, as regards the short or ultra-short waves. Wiring here can affect the tuning as well as the stability, and a modern television receiver is a good example of the most efficient way of wiring a receiver. Take the case of a simple H.F. stage. In the anode circuit will be a decoupling arrangement, the purpose of which is to prevent H.F. from passing into the remaining parts of the circuit. Obviously, then, if a simple tag-board is used, as shown in Fig. 1, there will be a long lead from the anode to the tag-board, and this lead will be carrying H.F. Now the object of the decoupling components is to restrict the H.F. so that it does not get into subsequent stages and thereby introduce instability and other troubles. H.F. is present at the anode, and therefore the main aim should be to restrict it to an area as small as possible. Where the circuit calls for it the ideal arrangement would be to solder the H.F. by-pass condenser direct to the anode pin and to earth, with the resistor or H.F. choke also taken direct to the anode pin. Fig. 2 shows the ideal, but, of course, there may have to be a resistor, coil primary winding or other component between anode and decoupler. In that case the same idea should be carried out, namely, to connect the essential H.F.-carrying components or leads as near to the anode pin as possible so that the H.F. currents are kept in bounds.

Chassis Currents

A point which is very important in U.H.F. equipment is the use of a common earthing point. One is often recommended to take all H.F. by-pass condensers to a common point in an H.F. stage as indicated in Fig. 3. But this is not always a good plan, as it will mean that some of the condensers will have to have long leads. It may prove

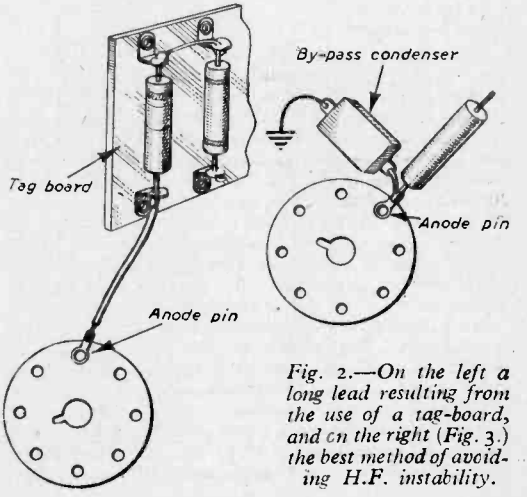


Fig. 2.—On the left a long lead resulting from the use of a tag-board, and on the right (Fig. 3.) the best method of avoiding H.F. instability.

desirable in such cases to keep to the rule of short leads, taking the condenser to the nearest part of the chassis (the wire ends of the condenser should, of course, be cut down to the shortest possible length).

If this scheme is adopted it will mean that H.F. will be present in the chassis, and care should be taken to avoid an arrangement whereby a circuit is completed through two points soldered to a chassis some distance apart. It is difficult to convey in a drawing the exact arrangement which should be adopted, not only because it is not possible to show components which may have to be mounted one over the other but because each circuit must be regarded more or less on its merits.

Screening

The use of screened sleeving or screened flex may also lead to trouble. It is undoubtedly desirable that long leads carrying L.F. currents (such as from a mike or pick-up) should be screened to avoid picking up or introducing hum. But there are many cases where the performance of a receiver may be affected seriously due to the use of such types of lead. For instance, a long lead may run from an anode top-cap to a coil, due to bad design. If such a lead is screened and the screening earthed the effect will be introduced of connecting a capacity from anode to earth, and it is quite possible that most of the signal will be by-passed by this capacity and very little will get to the coil. Grid leads can, and in many cases must, be screened, but remember that if H.F. is being carried the screened lead should be as short as possible, and if unavoidably long a very thin wire in a large-diameter screening sleeve should be used to keep the capacity to earth low.

Extension Viewing Units

More About the New Cossor Television Extension Units

LAST month we gave preliminary details of the new Cossor units and the difficulties which had to be solved in producing a practical unit suitable for any type of television receiver.

In effect the units are just tube assemblies plus normal time bases and mains supplies. The video signals are taken off from the input to the tube in the standard or master receiver. By the introduction of suitable circuitry it is possible greatly to reduce the amount of visible interference noticeable on the supplementary screen with those receivers that use cathode modulation, whilst in those that use grid modulation it reduces the interference on both parent and auxiliary screens. The only connections to the parent receiver are those for the loudspeaker extension and one from the modulating electrode of the parent cathode-ray tube to a cathode coupling unit. Isolation from the parent receiver is achieved by means of condensers.

Wider Bandwidth

The output from the cathode coupling unit is fed via a special co-axial cable together with the power supply leads in a combined harness to the extension receiver. Standard supplementary receivers are provided with a 30ft. run of cable which is considered adequate for the majority of cases, but means are provided for extending this to 70-80ft. A plug terminates the cable in a socket on the back of the remote receiver, and then feeds the signal to a circuit that ensures that the phase of the signal is correct for the particular method of modulation employed. A simple change-over switch is provided for this function, and once the correct position is determined no further adjustment is required. The video amplifier is designed to provide a wider band width than the conventional video stage, so that no depreciation of the signal shall arise in the extension unit. Therefore the picture quality on the supplementary screen should always be as good as that of the basic picture in terms of definition, but the linearity of the auxiliary may be a considerable improvement over the parent set. Any form of line or frame distortion in the parent set is not transferred, hence the inherent quality of the extension scanning generator circuits determines the distortion in this field. Separate video contrast control is provided in the auxiliary receiver, so that with some receivers it will be possible to turn down the brightness control of the parent until no picture is visible, but the picture will be visible on the extension screen. This feature is determined by the design of the parent receiver.

Installation

The installation of this new receiver presents no difficulty. Any service engineer with no further gear than his basic tools will be able to add an extension unit in a few minutes. Adjustment of the two trimmers to compensate for frequency distortion of the parent set completes the installation, and the normal television receiver controls are all found in the new model.

One of the outstanding features of this system of extension viewing is the facility of having a different size screen at the auxiliary position. For example, a 9in. parent receiver of any make can operate a Cossor Extension Unit which may incorporate up to a 15in. cathode ray tube, or larger. Also, exactly the same receiver is suitable for either the London or Birmingham transmissions, and as the more delicate circuits have been removed from the normal television set in order to create the extension viewer, servicing problems are reduced to a minimum. One or two of these new viewers can be added to any parent receiver, but for those cases where more screens are desired a video and power amplifier unit becomes essential.

It is felt that these viewers will command a ready sale for use not only in the home but also in hotels, flats, hospitals and entertainment centres where television reception is needed in several locations at the same time.

AS all the parts are adjustable it will be seen that it is only a matter of timing and positioning to cause the pick-up to lift from the record, swing clear along the track, swing back to a certain point and be lowered on to the record again for each revolution of the driving spindle.

The Clutch and Trip Mechanism

Rather than give a step-by-step description of the making of the clutch and trip mechanism an explanation of the working of this unit will be given, so that the constructor will be aware of what he is aiming at.

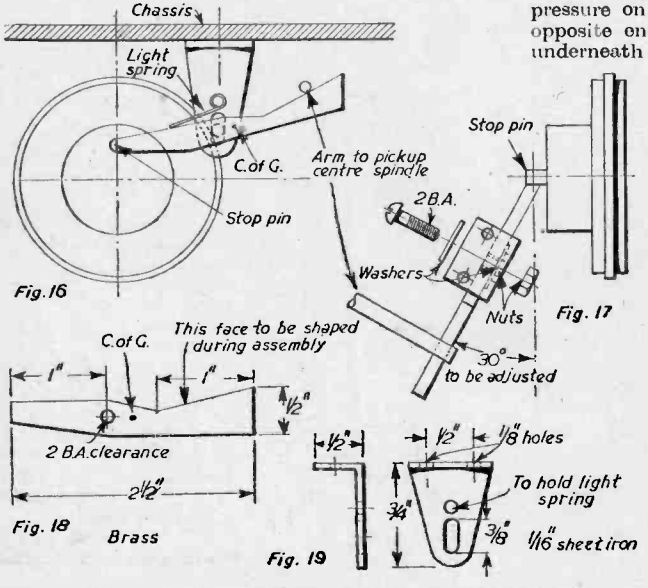
The main driving spindle is driven through a second motion shaft from the gram. motor by a round wire belt of the type used on cine projectors, the pulleys having vee grooves to suit. One pulley is on the motor spindle and revolves at 78 r.p.m. The other is on the second motion shaft and gives a reduction of 2 : 1. The second motion shaft has a rubber bush tightly fixed to it which is set to contact the rubber disc previously mentioned, so that the gram. motor when mounted will drive the main spindle. The reduction at the friction drive is 3 : 1, so that the spindle will make one revolution in five seconds approximately. Now if a small portion of the circumference of the large rubber disc is cut away, as shown by the dotted line in Fig. 12, the rubber bush will idle in the slot thus made. A slight movement to the disc will cause it to touch the revolving rubber bush, when it will immediately engage and rotate the disc and, therefore, the main driving spindle. When the disc has completed one revolution the slot is again opposite the bush and, provided the flywheel effect of the spindle is eliminated, it will stop. To do this is the purpose of the pin in the side of the boss.

Making a Rec

Further Details of This

By H

A bracket called the trip lever bracket is bolted (Fig. 19) to the underside of the chassis and supports the lever on a pivot. As the pivot hole in the lever is not central the lever will hang vertically, so as to bring it to an approximately horizontal plane; a piece of steel wire is bent to form a spring and attached to the bracket, the other end of the spring resting on the top of the lever. The object is to set the end face of the lever in line with the stop pin on the friction drive boss. If the position of the slot in the rubber disc is at the point where the rubber bush idles at the same time as the stop pin strikes the end face of the trip lever, the main driving spindle cannot revolve again until the lever is pivoted slightly to allow the stop pin to pass under it, and at the same time a slight rotary motion given to the driving spindle to engage the drive. To provide the rotary motion a cam is machined on the friction drive boss, and a spring-loaded roller rides on the cam. Provided the roller is on the sloping portion of the cam, as the slot comes opposite the rubber bush the pressure of the roller will cause the friction clutch to rotate slightly when the stop lever is lifted clear of the stop pin. This movement is sufficient to cause the clutch to engage and rotate the whole assembly one revolution. In the stop position the rubber bush idles in the slot in the rubber disc, the stop pin is against the end face of the trip lever, and the roller is on the sloping portion of the cam. By very light pressure on the sloping end of the trip lever the opposite end will lift and allow the pin to pass underneath due to the pressure of the roller, and by rotating the second motion shaft by hand the main spindle will revolve until the stop pin once again strikes the end face of the trip lever. In practice the lever is caused to lift over the stop pin by the action of the long arm mounted on the pick-up centre spindle striking the sloping end of the trip lever. As the pick-up is attached to the centre spindle it will be seen that, as the pick-up follows the record groove to the eccentric at the centre, so the arm will be carried on to the slope with correct adjustment. Actual contact is made before the record finishes playing, but the lever will not move sufficiently to free the pin until the record has been played. The pressure required to cause the mechanism to trip should be so slight that it can only just be felt at the pick-up head when the pick-up is moved over the turntable by hand. Causes of stiffness here are too strong a spring on the trip lever and/or cam pulley, or faces of lever and stop pin not set



Figs. 16 to 19.—Details of the trip lever and bracket.

rd Changer–2

ıl Radiogram Accessory

RLICK

square. One other item remains to finish off the changing mechanism and this is the record-supporting pillar and release gear.

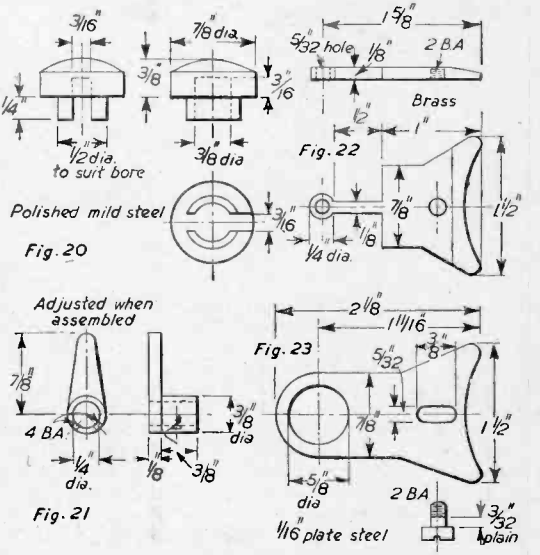
The Supporting Pillar

This is machined from ⅜in. diameter polished mild steel 4½in. long and is attached to the chassis by a nut on the underside (Fig. 25). The upper end has a table upon which slides a brass plate, held to the table by a set screw, but allowing a backward and forward sliding movement. The back of the plate is attached to a push rod (Fig. 26) extending down the inside of the pillar and operated by the record release cam mounted on the main driving spindle. Make the pillar first and then make the table to be a nice fit over the spiggot at the top end. The spiggot will project through the table about 1/32in. to allow for riveting. An old lathe centre was used for riveting this, the point being placed in the bore and the back end hammered so that the spiggot spread slightly, thus firmly holding the table. Now drill a ⅛in. hole half way down the pillar and at right angles to the centre line of the table. This hole takes a pin for pivoting the push rod. Make the push rod to the dimensions given, thread through the bore of the pillar so that the ⅛in. hole locates with the hole in the pillar and fits the pin. The object of the table is to support the edge of the unplayed records, a specially shaped spindle, to be described later, supporting the centre. A sliding plate must now be made (Fig. 22) which will move in sympathy with the push rod and, when fitted, it will be seen that the sliding member leaves the edge of the table showing, with the push rod as far back as possible, but that with the rod forward the slide is over the edge. The edges of the table and the slide will need trimming to the correct size with a record as a gauge when the whole unit is finally assembled, but the dimensions given leave ample room for this. Finally, adjust the release cam on the driving spindle so that it pushes against the push rod. The cam will need to be shortened probably, so that the push rod does not bind against the inner edges of the pillar. A spring is attached to the push rod where it projects through the chassis to hold the rod towards the cam and therefore keep the sliding plate away from the table edge. The only time the slide goes over the edge is when the cam pushes the rod. This occurs once every revolution, of course, but the action takes place on only a part of a revolution, the spring immediately returning the slide. It will be obvious that by setting the cam on the shaft in such a position that it only engages the push rod when the pick-up swings outside the record edge the slide will deliver the next record without fouling the pick-up. A cap to be a good fit in the top of the pillar can be machined and given a high polish, and a slot cut in the side to allow the sliding plate to move freely (Fig.20).

The Turntable

The turntable rotates round a stationary centre spindle and is mounted in ball-bearings. The drive is through gears from the motor spindle, one gear wheel being attached to the motor spindle and another to the turntable boss, an idler gear being mounted between them so that the turntable revolves in the same direction as the motor spindle. For the turntable in the original model an aluminium casting was obtained and machined to 9in. diameter, the boss being bored out to take two ball-races. Where the acquisition of a casting and/or machining such a large diameter would be difficult the alternative would be to modify the normal pressed steel turntable to suit. If the centre of the turntable is cut out at about 2in. diameter a boss can be machined to fit the hole and fixed by four 2BA counter-sunk screws. The disadvantage of using a normal turntable, which is usually 12in. diameter, is that when eight records are on the turntable it is difficult to grip the bottom record to lift them all off at once. By using a 9in. turntable the edges of the records overhang. The centre piece cut from the turntable and having the taper hole to fit the motor spindle must be retained, as it will be used later to carry the gear wheel which takes the drive to the turntable. The gear wheels used in the original changer are of plastic material and were already on hand. The idler is aluminium and this combination has proved successful as regards silent running and freedom from wear.

Any combination of gears will be suitable, of course, provided the driver and the driven are of the same size and large enough for one of them to be bored out to fit the turntable boss. Don't have them too big, however, 3in. to 4in. in diameter being suitable. Obtain two ball-races to fit a $\frac{5}{16}$in. spindle, and having an outside diameter of



Figs. 20 to 23.—The record release components.

$\frac{3}{8}$in. These fit tightly into the turntable boss. One of the gear wheels is mounted on the boss by boring the gear wheel to fit the boss and then fixing with 2BA screws. A base plate having a spiggot (Fig. 28A) to suit the 1in. diameter hole in the centre of the chassis can be made and fixed by counter-sunk screws and nuts. The centre spindle is fitted to this plate and must be a tight fit in the $\frac{1}{4}$in. hole, being held by a nut on the underside. When assembling the turntable and spindle tap the upper ball-race into the boss first, thread what will be the top end of the spindle through the bore and the race as far as it will go, i.e., to the shoulder, then thread the lower race on to the spindle and

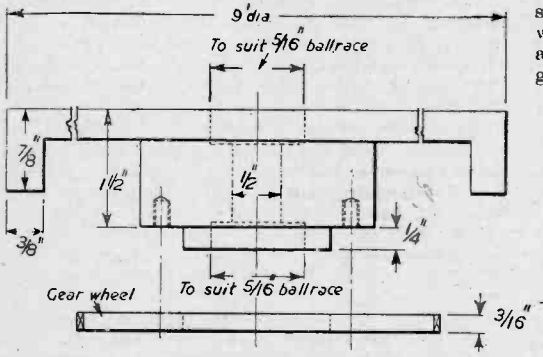


Fig. 24.—Turntable details (aluminium).

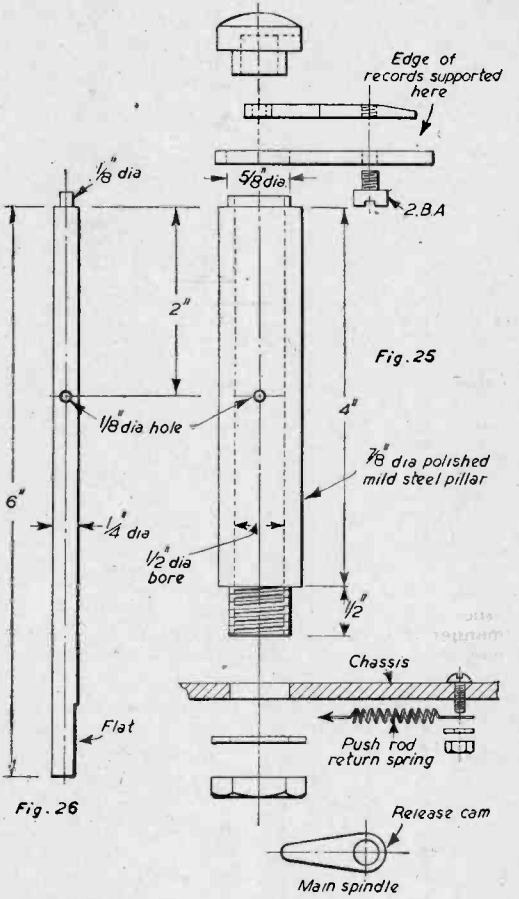
into the boss. A distance piece between the bottom race and the base plate holds the centre of the race when the spindle is in position and also allows for adjustment of the height of the turntable above the chassis should this be found necessary. The race must be a tight fit in the boss and on the spindle. With the turntable mounted on the spindle and the nut tightened the turntable should revolve freely and be perfectly true.

As will be seen, the spindle is bored out at the upper end and has a $\frac{1}{16}$in. pin across the bottom of the bore.

Mounting the Motor

Most gramophone motors have plenty of power in hand, so the changing mechanism can conveniently be driven from the motor spindle. The motor used had three mounting brackets and was so mounted on the chassis that these brackets were clear of the driving belt coupling the mechanism to the motor. At the same time the gear wheel which is attached to the motor spindle must not foul the gear wheel mounted on the turntable boss but should just nicely clear it. The gear wheel is fitted to the motor spindle by attaching it to run perfectly true on the turntable centre-piece previously cut from the pressed steel turntable. Tap it on to the taper on the motor spindle, taking care not to tap too hard as the bottom of the spindle is mounted in a bearing which may easily be bent or broken. In any case, the gear wheel will have to be removed when the motor is being mounted, but make sure it runs true and does not slip on the taper. The motor must be mounted so that the taper shank of the motor spindle is through the chassis, but with enough of the spindle below the chassis to take a grooved pulley. To do this it will be necessary to put distance pieces between the mounting brackets and the chassis, as normally it is intended for the motor spindle to project a good way through the motor board.

Make a grooved pulley as shown in Fig. 15, and fix it to the motor spindle just clear of the motor frame (Fig. 30). Now find a suitable position to mount the motor so that the pulley is in line with the pulley on the second motion shaft and the gear wheel just clear of the gear wheel on the turntable, at the same time making sure that the belt drive does not foul the motor brackets or anything else. Aim also at getting the belt as short as possible. The hole in the chassis through which the motor spindle passes can be quite large so that the gear wheel centre piece can pass through (Fig. 30) and allow the gear wheel to lie close to the chassis. The gear wheel must be exactly in line with the gear



Figs. 25 and 26.—Record supporting pillar assembly.

wheel on the turntable, and is set by the distance pieces on the motor mounting. Finally, the idler pinion must be fitted in such a position that it meshes with both gear wheels.

(To be continued)

Stabilised Power Packs

Of Especial Interest to Battery and Mains Users of Class B

By C. SUMMERFORD

BUILDING a power pack to drive one single piece of apparatus is a comparatively simple job, and usually takes the form of that shown theoretically in Fig. 1. It is generally understood however, that the voltage at the output terminals will only remain constant if the current taken from the power pack is also constant, and is, moreover, approximately that which the power pack is rated to give.

When, therefore, it is required to drive some

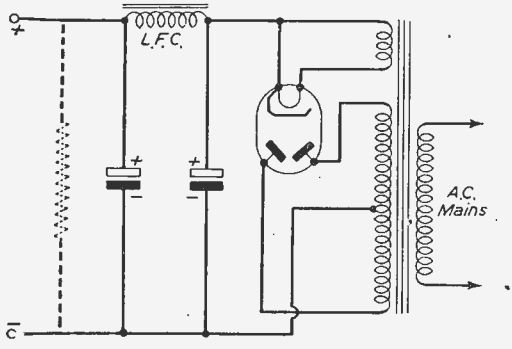


Fig. 1.—Standard power pack circuit.

other piece of apparatus, which may, for example, be a Class B amplifier, the circuit of Fig. 1 will be found to be totally inadequate. The reason for this is that a Class B output stage has a current swing which, varying between rather wide extremes, causes the power pack voltages to vary between similar wide extremes. As current peaks will coincide with voltage reductions, it will be appreciated that this will cause considerable distortion, due not only to the throttling effect on the Class B valve, but also to the fact that all other valves in the apparatus will suffer in like manner from inadequate voltage. The distortion may even take the form of the so-called motor-boating, which is, of course, A.F. instability caused by oscillation at very low frequency.

To overcome this difficulty a bleeder resistor is sometimes included across the power pack output, as shown by the dotted lines in Fig. 1. Provided this resistor has a low enough value a measure of voltage stabilisation will be achieved, although, as a low value shunt resistor will take appreciable current, the power pack current capabilities will have to be greater to meet this extra demand. As this will entail the use of a bigger mains transformer, plus a smoothing choke of heavier current-carrying capacity, it is obvious that the power pack will be more costly.

Luckily, there is a device available which enables us to overcome the problem quite simply. This is the gas-discharge tube or, as it is perhaps more generally known, the neon stabiliser. One such stabiliser is the Cossor S130 (Services No. VS110), which has the ability to keep the voltage across its electrodes almost constant at 125 volts while passing current which may vary from 7 to 75 milliamps. This current will not commence to flow until the *applied* voltage is about 135 volts, and will then continue to flow in increasingly greater quantity until the maximum operating voltage of 180 volts is reached.

The remarkable regulating properties of the stabiliser may be seen graphically in Figs. 3a and 3b. Fig. 3a shows the amount of voltage variation at the stabiliser electrodes, plotted against the current, in milliamps taken from a given power pack by its associate apparatus, while Fig. 3b shows voltage variation plotted against current through the stabiliser. In their different ways these two curves clearly show that maximum voltage deviation is only about 3 or 4 volts, which is tantamount to a regulation to within 2½ to 3 per cent. Such a regulation compares very favourably with that obtainable from even a large-capacity H.T. battery.

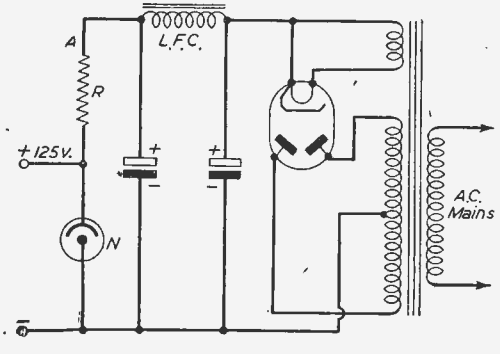


Fig. 2.—A stabilised tapping point.

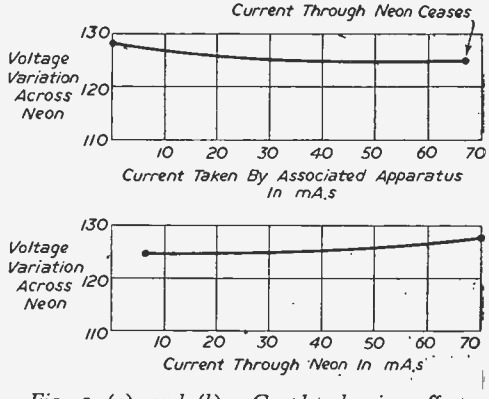


Fig. 3 (a) and (b).—Graphs showing effect of stabilisation.

For Battery Class B Users

A suitable power-pack for battery receivers and amplifiers in general, and those with Class B output in particular, incorporating the S130, is shown at Fig. 2. As will be seen, this differs from that shown in Fig. 1 only by the addition of the stabiliser and dropping resistor. But let us analyse the circuit completely.

The first thing one has to do when designing this

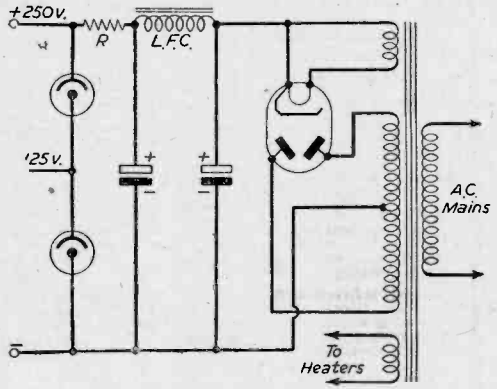


Fig 4.—Two stabilised outputs are given by this arrangement.

type of power pack is to ascertain the approximate maximum current likely to be required by the receiver or amplifier. Even during momentary peaks, such as are encountered in Class B, this maximum is unlikely to exceed 45 milliamps. Add to this the minimum current required by the stabiliser which, as stated above, is somewhere around 7 milliamps, and we have a total of 52 milliamps. In view of this, a mains transformer rated at 250-0-250 volts at 60 milliamps will be entirely suitable, and accordingly one of this rating has been chosen. Rectification is by the normal full-wave method, and filtering is accomplished by the usual smoothing choke and twin 8 μF electrolytic condensers.

There now remains only the value of dropping resistor R to be decided. To arrive at this we must

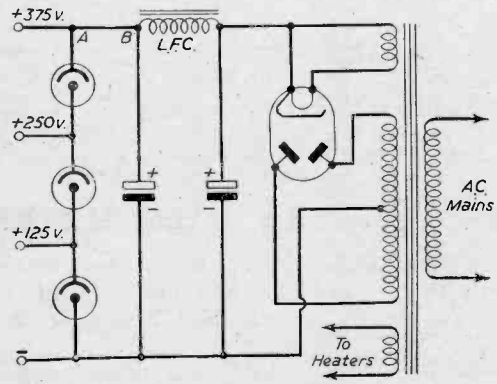


Fig. 5.—How three stabilised outputs may be obtained.

first know what the rectified voltage will be at full current consumption; in this particular case it will be 250 volts approx. Next we must ascertain the *D.C.* resistance of L.F.C. and, by a simple application of Ohms Law, find out the voltage drop across it. Supposing, for instance, that L.F.C. has a D.C. resistance of 500 ohms, then 60 milliamps passing through this will cause a voltage drop of 30 volts. Subtracting this from 250 gives a voltage at the point A in Fig. 2 of 220 volts.

We have already seen that the stabiliser requires a minimum "striking" voltage of approximately 135 volts. Therefore the voltage to be dropped across R will be 220 minus 135, i.e., 85 volts. Again applying Ohm's Law, V÷I=R, where in this case V is 85 volts, and I is 60 milliamps, we find that R is 1,416.6 ohms. In practice it is not necessary to be so precise, and a resistor of 1,400 ohms will be quite satisfactory.

Summing up, then, there are only two important points to remember: (1) that the stabiliser must not be asked to carry more than 75 milliamps; (2) that when calculating the value of R the D.C. resistance of the smoothing choke must also be taken into account.

It may be thought that a further smoothing condenser should be included across the stabiliser, but although one may be added if desired it is not always essential, as the stabiliser itself has a condenser-like effect and is equivalent in this

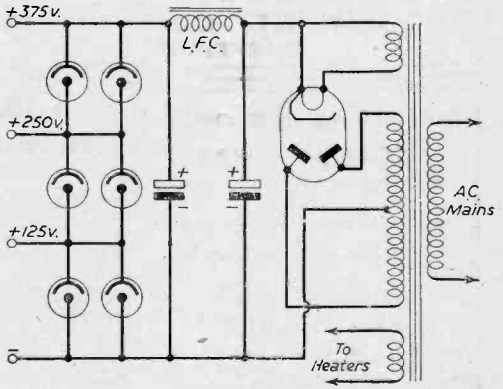


Fig. 6.—For class band similar arrangements, maximum stabilisation is required on these lines.

respect to a 6 μF condenser at 100 cycles, which is the ripple to be smoothed on 50 cycle mains with full-wave rectification.

One further point that should be made about resistor R is that in this particular power pack its wattage rating should be at least 6 watts.

For Mains Users

Much of what has already been said of the Fig. 2 circuit also applies to that of Fig. 4. It will be observed that in this circuit, however, two S130s are series-connected across the output, thus stabilising the voltage at 250 volts, although there is still a 125-volt stabilisation point at the connection between the two tubes.

Most mains receivers or amplifiers use rather

(*Continued on page* 502)

Using Copper Wire Tables

Hints for the Constructor of Transformers, Chokes, etc. By ERIC LOWDON

ON the face of it, this article seems to be rather superfluous. Copper wire tables! What comments can possibly be necessary on so straightforward a subject?

First, let me relate the experience of a young friend who decided to construct a mains transformer for a radio set. Having designed it down to the last detail on paper, he commenced to wind the primary.

It wasn't long before he encountered a snag; the number of turns allotted to each layer just wouldn't fit into the available space. 28 s.w.g. enamelled wire was being used, the length of winding space was 1½ins., the wire table gave the turns per inch as 62.5, that is 94 turns for the complete layer, but it would only take 89 turns close wound, five turns short of the calculated value. He decided, however, to carry on and complete the primary, an extra layer being necessary to take all the turns. This added about .015in. to the depth of the winding.

The secondary winding proved to be the same, here the calculated turns per layer for 36 s.w.g. enamelled was 180 but only 170 could be accommodated, no matter how carefully wound. Two extra layers were again necessary, which meant another .016in. to the depth of winding. The valve heater windings proved to be most inconvenient, instead of two layers, as calculated, it was necessary to start a third layer on each winding to take two extra turns, thus, as it was thick wire—16 s.w.g.—.065in. was added to the depth of each. The winding depth for the completed transformer was, therefore, greater than calculated by, .065+.065+.015+.016=.161in.

The crowning tragedy was yet to come, due to the increased depth of winding the laminations would not fit over the coil and it had to be stripped down again.

This little story, which is by no means unique for I have seen the same thing happen many times with beginners, should serve to stress the importance of the following points, not only with reference to turns per inch but also to other properties listed in wire tables.

There was obviously something here which required explanation. Were the wire gauges wrongly marked on the reels or were the figures in the wire tables wrong? Neither of these reasons were likely, nor did they fit the bill in this case. The real reason was that the wire tables were imperfectly understood

Turns per Inch

The turns per inch figure given in wire tables is the number of turns which can be wound into an inch length, providing the turns are wound absolutely close one against the other. In practice this is not possible except by very slow and painstaking winding, and it is necessary to multiply the table figure by a "space factor" to arrive at the turns per inch obtainable in practice.

In machine-wound coils the space factor is usually in the region of .95; this figure can also be used for carefully hand-wound coils, otherwise the factor should be somewhat lower. For example 28 s.w.g. is given in the table as 62.5 turns per inch, the figure obtainable in practice will therefore be $62.5 \times .95 = 59.4$ turns per inch.

Current Rating

There is an idea abroad among beginners that the current ratings given in tables are absolute, consequently they usually use conductors that are much larger than they need be, or occasionally conductors which are too small for the job.

The figures given are usually based, unless otherwise stated, on 1,000 amps per sq. in. cross sectional area of conductor. In practice the rating of a conductor is governed entirely by the temperature to which the wire will rise, and this in turn will be governed by the conditions under which the wire is used as well as on its cross sectional area.

For example, 20 s.w.g. is rated in the tables at 1.0 amp.; if, however, a small coil of 20 s.w.g. is immersed in cold, running water it will safely carry many times this figure. On the other hand, if the same coil is embedded in, say, the heart of a ball of cotton wool which will prevent the heat generated in the coil from escaping, the wire will become exceedingly hot with only a very small current flowing. Again, the ultimate temperature will depend to a great extent on the period of time for which the current flows. 20 s.w.g. could safely carry 100 amps. for a very short period.

Between these extremes lies an infinite variety of conditions which will modify the choice of wire for a particular application, and obviously no hard and fast rules can be laid down to cover all conditions.

In general, however, conductors used in small transformers, chokes, and other multi-layer components may be rated up to 2,000 amps per sq. in., that is, double the currents given in the tables. On this basis 20 s.w.g. would be used to carry 2 amps instead of 1.0 amp. In open components with only one or two layers and reasonably good air circulation, this figure can be increased still further, while open lengths of wire in airy locations will carry still greater currents without undue heating.

Ohms per Yard

It is often necessary to calculate the resistance of a proposed coil, as in transformer design, in order to assess the volts drop in the winding so that the number of turns may be adjusted to compensate for it.

Wire tables give a figure for the ohms per yard of the various gauges, on which such calculations are based, but as often as not they neglect to say that this figure is true only at a temperature of 60 deg. F.; as the temperature increases so also does the resistance.

Unless designed on very generous lines, a transformer will heat up appreciably and volts drop calculations based on the resistance figures given in the tables will err by as much as 20 or 30 per cent. It is, in fact, normal practice in transformer design, to assume a figure 20 per cent. greater than that given in the table for ohms per yard. This ensures that calculated figures will be very close

to those which exist in the transformer under working conditions.

As in the case of current ratings it is difficult to formulate hard and fast rules to cover all conditions, but where resistance is important this point should be borne in mind.

Depth of Winding

When designing multi-layer coils it is necessary to calculate the depth of winding to ensure that it will fit into the bobbin or, as in the case of transformers and chokes, that the laminations will fit over the windings.

Extreme care must be exercised here, otherwise a lot of work may be expended in winding a coil only to find when the job is nearly finished that the wire will not fit into the available space.

From the tables we can easily calculate the number of layers required and hence the depth of winding. This will be on the assumption that each layer will lie absolutely flat one on top of the other, and not forgetting to take into account the thickness of any paper or fabric insulation that may be used between layers. In practice, however, the layers will not lie perfectly close to each other and, as in the case of turns per inch calculations, it will be necessary to take into account a "space factor" to arrive at the real depth of winding.

This factor will vary to some extent with the type of coil, but will usually lie between 1.1 and 1.15. If, for instance, a round bobbin is being used on which is to be wound a single multi-layer winding such as a choke, then quite a low space factor can be assumed. If the calculated depth is, for example, 0.25in. then this figure would be multiplied by a space factor of, say. 1.1. The actual depth of winding will therefore be $0.25 \times 1.1 = 0.275$in. If a rectangular bobbin is used then the factor will be increased, for here the windings tend to be tight on the sharp corners and bulge on the flat sides, this effect is particularly noticeable with machine-wound coils, the space factor should therefore be in the region of 1.12 in such cases.

In transformers where two or more windings are used, the factor should usually be not less than 1.15 or if a round bobbin is being used, slightly less.

Thus, if the winding depth of a transformer as calculated from the tables is 0.32in., then the actual depth occupied by the winding will be $0.32 \times 1.15 = 0.368$in.

Mobile V.H.F. and the Press

ALTHOUGH the uses of V.H.F. radio in industry and commerce are slowly becoming known, there are many applications which, although advantageous, have not yet been attempted on a large scale. One is in the newspaper field, and a Wolverhampton newspaper has adapted a caravan as a triple-purpose unit with radio as the focus of its utility.

The caravan, in effect a branch office on wheels, contains a "Bush" machine for stencilling sports results into the stop press column of pre-printed papers, a fully equipped photographic dark room and a 20-watt V.H.F. radio transmitter and receiver made by The General Electric Co., Ltd.

The most modern form of frequency modulation is used for this V.H.F. radio, and it is found that interference caused by electrical machinery, etc., is almost non-existent. No special technical knowledge is needed to use the equipment and there are no tuning knobs to turn. The handset is picked up and used as an ordinary telephone, and the control box contains a small loudspeaker so that the station can be called when the handset is hanging up.

By having the vehicle equipped with radio it is not only possible to transmit news direct to head office at Wolverhampton, but sports results for the "Bush" machine can be transmitted from head office to the van.

It is also possible to advise the News Editor as to pictures available or on their way to him, and for the staff of the van to maintain general contact with headquarters when the vehicle is at functions such as agricultural shows, sports meetings, etc. On such occasions it is often a general inquiry office for any matter which might be referred to the paper by the public, and has proved to have substantial prestige value by allowing an answer to be given very quickly to any type of question.

An interesting feature of the G.E.C. radio equipment is that the same apparatus can be switched to become a public address amplifier, and thus announcements can be made from the loudspeakers on the roof without the need to have a special amplifier for this purpose.

The radio equipment has a nominal coverage of 15 miles radius from Wolverhampton, but in many cases this is greatly exceeded, especially when the trailer is standing on high ground. Power is drawn from batteries carried in the caravan, and these can be charged off the dynamo of the towing vehicle.

For Railways

ANOTHER novel V.H.F. Unit has been designed by the same firm for use in railway systems, mines, quarries, large agricultural schemes and similar applications where rough usage might be expected.

The equipment consists of a 15-20 watt frequency-modulated transmitter and receiver mounted in a cast light-alloy, dust and weatherproof case. The equipment can be installed in any position for remote control from the footplate of a railway engine.

Resilient mountings are provided for the equipment within the case, whilst for servicing and maintenance the whole chassis can be withdrawn on runners.

A particularly interesting feature of the apparatus is the (optional) built-in selective calling device. The system depends on the headquarters (fixed) transmitter being modulated at audio-frequency so that uniselectors in the sub-station (mobile) receivers step round in sympathy with the audio impulses transmitted. Constant monitoring at the sub-stations is therefore not necessary. At the wanted sub-station the operator's attention is drawn by means of a bell or light.

The selective calling system is applicable to simplex, two-frequency simplex or duplex working, and is generally arranged so that all the unwanted stations are locked out during use of the main transmitter. It is always possible, however, to call groups or all the sub-stations by using special dial numbers.

Programme Pointers

Our Music Critic, MAURICE REEVE, This Month Reviews Some Recent Programmes

THE third Edinburgh Festival has been so successful that this annual gathering of the arts in the Scottish capital is certain to be perpetuated and to proceed from triumph to triumph. The usual murmur of adverse criticism apart, chiefly on the hackneyed nature of some of the orchestral programmes, it does provide a wonderful feast of music, drama, opera and other arts and crafts, such as we have never hitherto enjoyed without a continental journey.

Those items of its syllabus which have been broadcast, and which I have listened to, have been uniformly excellent. The opening concert by the Royal Philharmonic Orchestra under Sir Thomas Beecham electrified the audience and aroused everyone to the highest pitch of enthusiasm. I cannot share the complaints as to the "second-class" character of the programme—Berlioz's "King Lear," Dvorak's "Variations on an Original Theme," Handel-Brahms's "St. Antony Variations," and Sibelius's "Tapiola"—though I might have had it been under any other baton. It excited and scintillated to the last degree, and it came over superbly.

Mozart's "Jupiter" Symphony sounded noble and not too stylised, played by Eugene Goossens and the Berlin Philharmonic. Of the two operatic broadcasts I heard, I preferred Verdi's "Masked Ball" to Mozart's "Cosi fan Tutti," but only as broadcasts, mark. Probably because the Verdi work is more a stranger to us and is slightly less affected by the amputation of the visual half. The Mozart is so perfect that if we cannot have all of it we don't much care what's left out. But with Verdi we can more easily fill in the blanks ourselves. Silveri and Margherita Grandi are splendid artists.

Equal in excellence to the Beecham concert, though very different in style and thought, was that of the Orchestre du Conservatoire de Paris, a magnificent body of musicians whose visits to London are always eagerly awaited, conducted this time by Bruno Walter. The "Funeral March" in the "Eroica" Symphony will not readily be forgotten: all the heroes of antiquity, with their panoply of fame and honour, seemed to be celebrated as the incomparable music rose to its climax and faded to its conclusion.

Gonzalo Soriano

AN interesting recital was that given on September 1st by the Spanish pianist Gonzalo Soriano, who played works by various of his countrymen. Señor Soriano didn't burn the piano up, exactly, but then most of what he played was of very poor quality. The exception was a beautiful "Allegro de Concierto" by Granados; it stood out head and shoulders above the other things, and Señor Soriano obviously enjoyed and seemed to prefer playing it.

Granados and Albeniz bear a striking resemblance inasmuch as both wrote one set of masterworks each for the piano—the former Goyescas and the latter Iberia—both of which are enormously difficult and exotically beautiful, whilst the remainder of their work, with few exceptions, such as the "Allegro de Concierto," consists of masses of trifling morceaux of little consequence. Strange that they should have concentrated all their pianistic and musical genius into one collection each.

Munich Crisis

READERS will remember the striking series of broadcasts reconstructing the Munich crisis given just a year ago. A new set of four, the first of which—"Prelude to War. September, 1938-September, 1939"—started on September 4th, continues the fateful story and promises to be equally interesting.

Although the point of view presented is naturally the Allied and presumably the correct one, I am not sure whether a few more references to the other side—Hitler's rantings apart—would not heighten the interest. There were two sides to the issue, and, on some points, Germany had a strong case. Her misfortune, and the world's, was that she was led by a maniac who, as a result, completely distorted and perverted her, and prevented justice or even logic raising their voices. In "Prelude to War," as with "Munich," the moment a German opens his mouth we know we are going to hear nothing but a music-hall teuton, complete with hair on end and bulging cheeks, shriek and stamp, rave and bellow, roar and yell; whereas, when the Allied, and chiefly the English, protagonists come forward all is going to be, and turn out to be, the sweetest reasonableness, the calmest logic, and the suavest school-tie polish. This is absurd, obviously, and though it may serve to heighten tension and emphasise points to a certain degree, as the telephone bell and the thunder do in a thriller, I do feel they have been overdone to a certain degree, to the sacrifice of reality and common sense.

But these criticisms apart, the series is most admirable, enjoyable and, in the long run, instructive. One last point: an American interjection or two might have added pungency. I expect there were plenty.

An Amusing Feature

"TALK YOURSELF OUT OF THIS" is a most amusing feature which should have a long and successful career. Someone has to watch a little story enacted, wherein they are portrayed as the leading character in an embarrassing and awkward situation. They are given thirty seconds to talk themselves out of it, whereupon they are cross-questioned and generally put through it. In conclusion the jury renders its verdict. Much ingenuity is shown by the guilty culprits in lying their way out, and great amusement is afforded to all. Harold Warrender could not be bettered as the host of the occasion.

A Thriller

"COUNCILLOR AT LAW," by Elmer Rice, made a much more exciting and fast-moving thriller than "The Third Visitor," by Gerald Anstruther. Both came out in Saturday Night Theatre. Neither is a "thriller," in the Green

Penguin meaning of the term, inasmuch as there are no dead bodies in the cupboard under the stairs, or bound and gagged heroine escaped from a fate worse than death, but which she might have preferred. The Rice play was a slick piece about a not-so-crooked up-town New York lawyer, whose rise to fame and fortune was based on the successful pleading of a false alibi. Just as this is about to come to roost, and as a worthless wife departs for a European "vacation," solutions are found which render unnecessary a contemplated leap from the office window on the 35th floor. Abraham Sofaer headed an energetic team which put over the atmosphere very creditably. Sonia Dresdel gave the other piece most of the distinction it possessed.

White v. Black

I DIDN'T think "Deep are the Roots," a sordid little piece on the white woman versus the black man down south, worth one presentation, let alone two. Apart from its salaciousness, it could have little interest for English Saturday evening fireside audiences. But Scheriff's "Badger's Green" came over with a freshness and a charm that was most captivating. The partisan fervour of the local cricket worthies would have done credit to either Headingley or Old Trafford.

Closing of the Proms.

THE Promenade Concerts have drawn to their close for, I think, the 54th time, having maintained their Albert Hall standards, but having broken very little new ground. It was a great disappointment that Szigeti had to cancel the two performances he was scheduled to make; he would have added great distinction to the season. I preferred performances, among the soloists, of the Dvorak and Elgar 'cello concertos by Pini and Fournier, of the Brahms first piano concerto by Solomon—how much sounder his reading is of the first as compared to the second—and of the second Chopin, by Elinson.

Myself When Young

A MOST delightful talk by Prof. Gilbert Murray, in the series "Myself When Young," is the type of item and the quality of performance I would like to listen to every day. When men of Prof. Murray's standing tell us how their genius developed and flowered, and from what seed it came, as well as to give us their views and impressions on the great events of their time, must surely always be a joy and delight.

Death of Richard Strauss

I CONCLUDE with a humble tribute to Richard Strauss, whose death not only brings to an end the unparalleled dynasty of great German composers, which began with the births of Bach and Handel in 1685, and contained the mightiest names in music, but which marks one of the steepest declines music has made from Beethoven's seat on Parnassus to its present miserable state.

News from the Clubs

STOURBRIDGE AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: W. A. Higgins, 28, Kingsley Road, Kingswinford, Staffs.

AT the meeting held at King Edward's School, Stourbridge, on Tuesday, October 4th, there was an excellent attendance. Mr. F. Bills, G3CLG (member), gave an introductory talk on television.

Twenty-eight members of the society made a trip to the B.B.C. Daventry recently and this was voted the best outing to date.

Meetings every first Tuesday and third Friday in month.

CRESCENT AMATEUR RADIO SOCIETY
Hon. Sec.: W. Houseman, 15, Snowdon Street, Barnton, Northwich, Cheshire.

THIS club has been formed at the Winnington Works of the Imperial Chemical Industries, Ltd.

Membership of the society is limited to employees of the company and meetings are held on alternate Tuesdays in the works conference room.

It is hoped to open a club workshop in the near future.

TORBAY AMATEUR RADIO SOCIETY
Hon. Sec.: K. J. Grimes, G3AVF, 3, Clarendon Park, Tor Vale, Torquay.

AT a recent meeting of the society, which was again well attended, Mr. Launder, B.Sc., (G3FHI), gave an interesting lecture on the Oscillatory Circuit.

Mr. W. B. Sydenham, B.Sc. (G5S7), the president of the society, also gave a demonstration of his new design of a Frequency Meter and Multivibrator.

The society now has a junior section, where those between the ages of 14-17 years are admitted as members. Particulars may be obtained from the hon. secretary.

Meetings are held every third Saturday in the month, at the Y.M.C.A., Castle Road, at 7.30 p.m.

SOLIHULL AMATEUR RADIO SOCIETY
Hon. Sec.: G. Haling, 121, Bradbury Road, Olton, Birmingham.

S.A.R.S. are now well established in their new headquarters, after completing the alterations to the premises.

A fine winter programme of lectures and discussions has been prepared, together with constructional classes, the workshop for which is available every Wednesday evening.

Membership continues to grow and all visitors and new members are welcome at S.A.R.S., c/o Tucker Switches, Ltd., King's Road, Tyseley.

SOUTH MANCHESTER RADIO CLUB
Hon. Sec.: Maurice J. Wilks, G3FSW, 57, Longley Lane, Northenden, Manchester.

THE club has now been issued with the call G3FVA and work is getting under way constructing the club station.

Programmes in future will run as follows:—
7.30—8.00 p.m.—Morse classes under G2HNR.
8.00—9.00 p.m.—Technical class in preparation for R.A.E. under G6DN and 3EON.
8.00—9.00 p.m.—Building club station by those not taking above class.
9.00—9.15 p.m.—Refreshments.
9.00—10.00 p.m. Talk, lecture or demonstration.
10.00—10.30 p.m.—General discussion.

HIGHSTONE UTILITIES

Crystal Sets, which are fitted with a permanent crystal detector. Why not have a set in your own room—9/6, post 6d. De Luxe receiver in polished oak cabinet. 18/6, post 1/-. Spare Permanent Detectors, 2/- each. When ordered separately, 2/6. With clips and screws, 2/10, post 3d.

Headphones, in good order, 4/6 and 5/6, post 6d. (better quality, 7/6). **New Headphones**, 10/- a pair. Balanced armature type (very sensitive), 12/6 a pair, all post 8d. New **Single Earpieces**, 3/6. Bal. armature type, 4/6; ex-R.A.F. earpieces, 2/-, post 4d. All headphones listed are suitable for use with our crystal sets. **Hand Microphones**, with switch in handle, and lead, 4/-. Similar instrument moving coil, 7/6, post 6d.

Sparking Plug Neon Testers, with vest pocket clip, 3/3, and with gauge, 3/6, post 3d. **Soldering Irons**. Streamlined iron, with two interchangeable bits, one each straight and curved, 200/250v 50 w., 9/-. **Standard Iron** with adjustable bit, 200/250 v., 60 w., 9/6. **Heavy Duty Iron**, 150 w., 12/6, all post 6d. **Neon Lamps**, for use on mains, showing "live" side of switches, etc., 3/6, post 4d. **Telephone Hand Generator** with handle, 7/6, post 1/6. Bell, 4/6, post 6d.

Ex-R.A.F. 2-Valve (2-volt) Amplifiers, can be used to make up a deaf aid outfit, intercommunication system, or with crystal set, complete with valves, 20/-, post 1/6. Ditto, less valves, 10/-. Wooden box to hold amplifier, 2/- extra.

Meters. 15v., 2½in., m/c, 9/6; 150v., 2in., m/c, 10/-; 300v., 2½in., m/i., 13/6; 3,500v., 3½in., m/c, 20/-; 6,000v., 3½in., m/c, 57/6; 15/600v., 2in., m/c, double reading, 8/-; 100 m/a, 2in., m/c, 7/6; 40 120 m/a, 2in., m/c, double reading, 8/-; 3.5 amp., 2in. T.C., 5/-; 4 amp., 2½in., T.C. in case with switch, 7/6; 20 amp., 2½in., m/i, 9/6. Meter Movements, 2in. size with magnet and case (500 microamp), 2/6. Units containing two movements, 5/-, or with one 100 microamp. and one 500 microamp, 5/6. All meters post extra. Money refunded if not completely satisfied.

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6V6G	7/6	EF50	7/6
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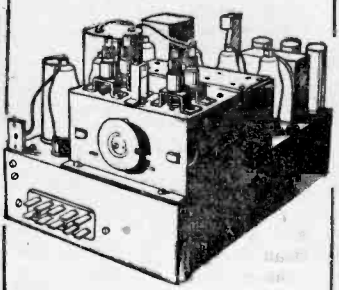

BRAND NEW EX-GOVT. Phillips 6 v. Communication Receiver R/FF/C 2.1FS. DDT Pentode Output, Spin Wheel Tuning, Built in Speaker, Power Pack for A.C. Mains, or Power Pack, 6 v., Wavebands 16-50-200-550, 800-2,500, **£17 10s.**

NEW VCR97 Tubes for Television. 35/-. Carriage, etc. 5/6.

.25 M.F. CONDENSERS, 500 V.A.C., 2,750v D.C., 6/6; 25 mF, 2,750v D.C. 100v D.C. 6/6.

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RECEIVER CHASSIS R1225, 8 valves: 5-EF50, 2-53 and 1-54. Tuning Condensers, etc., 27/6.

INDICATOR UNIT, TYPE 162, has the following components: One VCR 517, one VCR 139, one VT60A, three VR65, one 6J5, four diodes (two 6 v., two 4 v.), 24 v. blower motor, one 0.1 mA meter. Carriage paid, £4 5s.

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12 VOLT Vibrator Power Pack. Admiralty Patt. W7460. New. 21/6. 12 v. D.C. Supply 300 v. 100 mA.

WESTERN ELECTRIC BALL MIKES. Type 4021C. New. £4 19s. 6d.

WAVE FORM GENERATORS. Type 34. Contains 13 Valves, 7 SP41, 3 EF36 1 EBC33, 2 EB34, 30/-.

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OPEN TO DISCUSSION

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

Home-made Television Receivers

SIR,—May I, through the medium of your columns, make an appeal on behalf of the many potential television constructors in the Midlands who, like myself, another of the semi-initiates, propose using the now popular VCR97 tube and, as in my case, have been experimenting with this tube and associated circuits with extremely varying degrees of success.

I have followed your "Open to Discussion" page with keen interest, but note that the majority of letters from television enthusiasts using ex-Government equipment are confined mainly to the London area, rarely a voice from the Midlands.

Now there are, to my knowledge, a number of constructors in the Birmingham area who are regularly receiving the A.P. transmission with ex-Government gear, a fact which has been given publicity in the local Press at various times, and the experimental test pattern now being radiated in this locality should prove an incentive to further efforts, so if there are any successful amateurs in this area who would be willing to pass on their experiences to novices such as myself, I am sure they would not find us ungrateful.—M. BURFORD (Birmingham, 2).

SIR,—I also experienced the same trouble as Mr. Peel in having dark bands which locked across the screen when the signal was "on." I tried both of his suggested remedies without much improvement, but found I can completely cure the trouble by simply reversing the mains plug.

I thought perhaps the tip might be useful to some other readers.—R. A. J. SAY (S.W.19).

SIR,—With reference to Mr. Kenneth A. Peel's letter in the October number of PRACTICAL WIRELESS, I have found in practice that VCR97 tubes differ quite considerably in usable screen area. The tube I am at present using exhibits no cut-off or "shadow" area at all, and by expanding the raster I can completely fill the screen. However, a previous tube (now discarded) was not so accommodating—it behaved in the manner described by Mr. Peel, thus limiting the available picture width. Several friends have had similar experiences. I presume the amount of shadow depends on the exact location of the deflector plate assembly.

As a point of interest, during initial experiments with my second VCR97 I was able to secure a full-screen raster without the aid of a line-scan amplifier. Both line and frame scanning were effected by a single valve in each case—an EF50 in a transitron-Miller circuit—driving only one of each pair of deflector plates. I used this temporary arrangement until the vision receiver was completed, then finally added push-pull scanning amplifiers to cure trapezium distortion (EHT—2kV, H.T.—450 v.).

My only outstanding snag to date is slight non-linearity of frame, which, however, is not noticeable except on the test pattern. After much experimenting, I have almost come to the conclusion that a linear scan stroke cannot be obtained from a Miller circuit at frame frequency (though in theory linearity should be almost inevitable).—DAVID WAYNE (Essex).

SIR,—There must be some other explanation to the VCR97 picture cut-off mentioned by K. A. Peel than that offered by J. A. Smithers. All VCR97 tubes are used with rubber bands round the neck, and the appearance of these bands does not indicate a smaller tube neck diameter in any way. The A.M. specifications for these tubes certainly do not permit the neck tolerances J. A. Smithers seems to find. The electrode assembly will normally allow a full sweep to be obtained in both directions. I suggest that K. A. Peel has insufficient sweep voltage in one direction (presumably the line), and should try the effect of a reduced E.H.T.

The condenser from tube cathode to earth is simply smoothing out ripple on the cathode which is modulating the beam. If the heater is joined to the cathode, reversal of the heater wires will do the same thing without the use of the larger condenser.—S. A. KNIGHT (Wellingboro').

SIR,—I have pursued with some considerable interest the recent accounts in the pages of your journal by an assortment of electronic "gen-men" narrating their attempts at conversion of ex-radar equipment into television sets—most, it would appear, with frustratingly disappointing results.

As four out of five of B.B.C. television broadcasts are an insult to the intelligence of the viewing masses, the building of a set was in my case merely the acknowledgment of television as an electronic miracle. The building of the set was the end in itself. Both visually, acoustically and artistically, the results of any expedition into the (to me) unknown leave nothing to be desired, though the on/off switch will remain rather in the "off" than in the "on" position until the cricket season re-opens. Time to build? Seven evenings, including one solid week-end.

Time bases: three evenings.
Sound chassis: all Saturday.

Power chassis: half Sunday.
Vision chassis: two evenings.
Plus one half-day lining up and erecting dipole.
Previous experience of radio construction? One crystal set in 1934.
The kit? Commercial—inclusive cost seventeen guineas.
I close with expression of the hope that television programmes will in the not too distant future cease to cater down to the tastes of those who can afford sets.—D. H. MACLEOD (St. Albans).

Magnetic Recording

SIR.—I am surprised at the number of letters that are arriving daily in response to my letter on magnetic recording, published in a recent issue of PRACTICAL WIRELESS. Most of the writers appear to have experimented with wire recorders, and, strangely enough, the main trouble has been either getting reasonable volume and quality of reproduction, or inability in constructing a suitable H.F. oscillator, for biasing and wiping. No one appears to have had any difficulty with the mechanical side of the question.

Further to my last letter regarding the supply of magnetic recording tape, several firms have informed me that they market as a separate commodity, tape on reels, usually 1,200 ft. in length. The usual price is 25s. per reel.—F. C. BLAKE (Tunbridge Wells).

Meter and Rectifier Resistance

SIR.—I have followed the recent discussions on measuring meter resistance, and should like now to put my own problem.

I have a moving coil meter with an F.S.D. of 10 mA. and wish to make a multi-range voltmeter to measure A.C. volts R.M.S. only, a rectifier of appropriate size with a ballast resistance in series being used to make up the actual unit.

As there must be a voltage drop across the rectifier which will vary with applied voltage (and also with different makes), how can one assess the resistance of the rectifier and also the value of the series resistance?

It is intended that the lowest range will read 0—5 volts and the highest 0-500 volts A.C.—"PUZZLED" (Liverpool).

BC454

SIR,—I read with some interest J. R. Murch's (Horley) letter in the November issue, as I have fitted up two of these sets, one on a Vauxhall 1947 model which had positive earthed, and my own car, which had negative earthed, and in both cases the sets worked well, screwed on to the chassis direct.

I can only assume that our friend has some fault in the L.T. wiring. Originally these sets had series/parallel wiring, and it is quite easy to slip up and even leave a valve with no supply, or no earth return. Should he still find trouble perhaps he would care to communicate with me direct and he could see one of them working if he wished.—F. C. VOKES, F.B.H.I. (S.W.20).

SIR.—I would suggest your correspondent, Mr. J. R. Murch, alters the polarity of his car lighting system to overcome the difficulty of the positive earth on his BC454.

This can be done quite simply if the car generator is the three-brush type by changing over the battery leads and reversing the ammeter connections and when the car is started the dynamo will reverse its polarity, providing the battery is fully charged.

This will do no harm to the system. Many makers claim less pitting of the distributor points and sparking plug electrodes.—DONALD MOSTON (Lymm).

Instruction Books

SIR.—Have just read your article on "Instruction Books," and thoroughly agree with you.

Quite a lot of paper, and work, etc., could be saved, not to mention time in turning to files for service sheets when an old type of receiver needs attention.

Have been in the radio trade since 1931, also regular reader of your excellent book since 1933 with every copy filed, and should like to wish you success on this point, also the future of PRACTICAL WIRELESS.—E. W. G. HEVER (S.E.7).

STABILISED POWER PACKS

(*Continued from page* 490.)

more than 75 milliamps and therefore, unlike the unit already discussed, it must not be switched on unless it is connected to some piece of apparatus that will absorb all excess current above 75 milliamps. For instance, if the circuit of Fig. 4 is rated to give 100 milliamps, then the minimum amount of current to be absorbed, irrespective of that taken by the stabilisers when fully loaded, will be 25 milliamps.

The minimum voltage at which the two stabilisers will now "strike" will be precisely double that required by the single tube, i.e., 270 volts, while the maximum voltage that may be applied will now be 360 volts. Assuming a 350-0-350 volt 100 milliamp transformer, we may expect a rectified voltage at full load of 350 volts. Therefore the voltage drop required across R and L.F.C.C together will be 350 minus 270, which gives us 80 volts. Calculations as to the value of R alone may then be made in the way already outlined.

Stabilised voltages of 125, 250 and 370 volts may be obtained by series-connecting three stabilisers across the output as shown in Fig. 4. In this pack the mains transformer will require to have a H.T. secondary of 450 to 500 volts. No dropping resistor is shown in the circuit diagram, but if one is required it should, of course, be inserted between points A and B. Current handling capabilities are still of the same order (75 milliamps), and again precautions will have to be taken to ensure that this stabiliser current is not exceeded.

The circuit of Fig. 6 differs from the preceding one in that it has six stabilisers connected in series-parallel across the output. Admittedly, six stabilisers are liable to push up the cost somewhat, but as against this may be set the advantage of having stabilised voltages of 125, 250, and 375 volts at currents varying between 14 and 150 milliamps. This is adequate to cope with the current swing of even large Class B and Class AB amplifiers. The mains transformer of the power-pack shown at Fig. 6 may, of course, have a current rating 200 or 250 milliamps, provided the precautions as regards maximum stabiliser current are observed.

Impressions on the Wax

Review of the Latest Gramophone Records

THE Concerto in B Minor, Op. 104 for 'cello, is one of the most consistently successful things Dvorak ever wrote. It has now been recorded by the eminent French 'cellist Pierre Fournier, accompanied by the Philharmonia Orchestra conducted by Rafael Kubelik, on *H.M.V. DB*6887-91. It is stated to be the first concerto in which the composer solved all difficulties.

Corelli's Suite for String Orchestra, arranged by Pinelli, is another interesting release made by the Philadelphia Orchestra, conducted by Eugene Ormandy, on *Columbia LX*1214. The first two movements of this suite are in well-known dance-forms of the period; the third, a Badinerie, perhaps needs explanation. A Badinerie is a piece of a playful, trifling nature—the word is the same in meaning as "badinage." Badineries are remote ancestors of scherzos. Archangelo Corelli was one of the best of the early eighteenth century violinist-composers; dying in 1713, he was the forerunner of the talented band of violinists who established the technique of the instrument on lines leading up to modern practice.

The nature-pieces of Delius stand out from the composer's achievement as perhaps the most successful things he wrote. His composition "On Hearing the First Cuckoo in Spring" is no exception, and it has now been recorded on *H.M.V. DB*2693 by Sir Thomas Beecham, Bart., conducting the Royal Philharmonic Orchestra. Issued under the auspices of the Delius Trust, this version of the famous tone-poem is one more instance of the deep insight into everything to do with Delius possessed by Sir Thomas Beecham. It is superbly played and conducted.

The Rio Grande had its first London concert performance in the Hallé concert at the Queen's Hall in December, 1929, and met with such success that it was repeated at the subsequent Hallé concert the following month. Without being too exact as to locality, the music and poetry endeavour, and with great success, to paint a tone-picture of any gay cosmopolitan riverside town in South America, particularly where Negro dances mingle with other musical influences. It has now been recorded by the composer Constant Lambert, who conducts the Philharmonia Orchestra and Chorus, Kyla Greenbaum, pianoforte, and Gladys Ripley, contralto, on *Columbia DX*1591-2. The score roughly divides itself into three sections: a small choir, with an occasional solo for the contralto: an orchestra of strings and eight bass instruments, with a percussion department containing no less than fifteen varieties of instruments, with five players to handle them; and a piano solo.

Vocal

Bruce Boyce makes his début this month as a new lieder singer with a recording of Schubert's "Im Frühling" and "Ganymed" on *H.M.V. C*3900. During the past few months he has been making a recital tour in Scotland and he has appeared regularly in B.B.C. broadcasts which included several first performances of modern works as well as singing the "Winterreise" and "Die schöne Müllerin" of Schubert and Schumann's "Dichterliebe" and "Liederkreis" and other lieder broadcasts.

Jussi Bjorling's excellent operatic style is heard to advantage in his latest recording of Puccini's "Manon Lescaut, Act I" and Mascagni's "Cavalleria Rusticana" on *H.M.V. DA*1908. A gifted linguist, he sings the original language of these arias with conviction and understanding.

An attractive record among the latest releases is Gwen Catley singing the "Doll's Song" from Offenbach's Tales of Hoffman and the "Waltz Song" from Gounod's Romeo and Juliet. The Tales of Hoffman was first produced at the Opéra-Comique in 1881. The score is Offenbach at his best, and the "Doll's Song" is one of the most attractive numbers from this sparkling music. François Gounod's Romeo and Juliet is still very much appreciated in France, where it comes second to Faust—*H.M.V. C*3902.

Variety

A grand selection of melodic standbys of the "Good Old Days" is played by that master of the theatre organ, Reginald Dixon, on *Columbia FB*3516. His many admirers will particularly welcome the inclusion of "I do like to be Beside the Seaside"—the bright number Reginald adopted as his signature tune in 1932.

That attractive young actress-singer Ann Stephens has recorded a delightful selection of songs from "Snow White," a fitting successor to the two numbers from "Bambi" which she previously made on *H.M.V. BD*1210. On this occasion Ann is accompanied by a choir of pupils from the Cone-Ripman School and Philip Green's Orchestra. This new recording is on *H.M.V. BD*1261.

André Kostelanetz and his Orchestra have chosen "Thousand and One Nights," by Strauss, and Kalman's "Waltz from Sari" for their latest recording on *Columbia DX*1588. The "Thousand and One Nights" is in its way fully as delightful as the better-known and perhaps over-played Strauss waltzes. Kostelanetz conducts it in true Viennese style.

The music of Geraldo is considered the very best that there is in popular and concert dance music. This pre-eminence is again clearly demonstrated in the latest recordings by Geraldo and his Orchestra, which couple "Song of Capri," the new hit from the Myrna Loy-Richard Green film "That Dangerous Age," with "My Golden Baby"—*Parlophone F*2377.

Billy Thorburn's intriguing combination of piano, organ, strings, brass and rhythm are heard to good effect in a coupling of "I'll Always Love You" and "Behind the Clouds" on *Parlophone F*2378.

BRITISH SHORT WAVE LEAGUE (founded 1935)—over 20 departments (QSL Bureau; DX Certificates; Technical; Translations, etc.) and monthly "Short Wave Review." For membership details send S.A.E. H.Q., 145, Uxendon Hill, Wembley Park, Middlesex.

ILLUSTRATED CATALOGUE, price 9d. Full details of Denco and Eddystone Range. Tuning Units, Television Kits and Surplus Radio Bargains. MASON'S. Wivenhoe. nr. Colchester.

R.S.G.B. TECHNICAL PUBLICATIONS. "R.S.G.B. Bulletin" Monthly Journal; current issue 1/6, five recent back issues 2/6. "Valve Technique," 104 p.p., 3/9; "V.H.F. Technique," 96 p.p., 3/9; "Microwave Technique," 68 p.p., 2/3; "Transmitter Interference," 32 p.p., 1/6; "Service Valve Equivalents," 32 p.p., 1/3; "The Transmitting Licence," 32 p.p., 1/-. All prices include postage. RADIO SOCIETY OF GREAT BRITAIN, 28, Little Russell St., London, W.C.1.

"PERSONAL PORTABLES" is the title of E. N. Bradley's latest book. The first of its kind, it describes the building of a series of miniature personals, including the first-ever all wave personal set. Illustrated with circuits, layouts, drilling, constructional and point-point wiring plans of fully tested sets of loudspeaker type the book costs 2/6 (2/8 posted) from BRADBOOKS, Sennen, Penzance, Cornwall.

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J. T. ANGLIN, G4GZ. 106, Cleethorpe Rd., Grimsby has large selection of valves and components; send s.a.e. for Bargain List.

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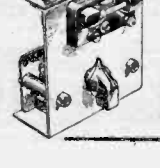

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Practical Television

Vol. 1. No. 10 NEW SERIES DECEMBER, 1949

Televiews

THE demonstration of colour television by Pye at Radiolympia, using a closed circuit system employing a special camera and transmission installation and six receiving sets, indicates the possibility of the future. For colour television is not yet ready for the market. At present it is but a qualified success, and the demonstration was intended not so much to indicate quality, for that has a long way to go, but to show the public that scientists are at work on the problem.

The demonstration itself shows that there are no insuperable problems in colour television and it also proves that colour television must be the ultimate aim of every television manufacturer, especially when one compares it with the present black and white pictures. The demonstration, it could be argued, should not have been held until the matter had progressed further, for it was reminiscent more of a lantern slide than of Technicolor. We thought the same when we first witnessed colour television at the late J. L. Baird's house during the war.

Notwithstanding American competition, it was a British firm which first produced colour television and placed it within the realms of a commercial proposition. At the same time we must point out that the public should not wait for colour television before buying a television receiver. It will be at least 10 years before it has emerged from the development stage. Only a prototype exists at the moment. There is no suggestion that the B.B.C. propose to put out a colour programme, nor at present has it the equipment to do so. It will possibly not be before several television stations are spaced about the country that colour television will be taken up seriously. The possibilities, however, are vast. It would be possible, as with the films, to show the cartoon style of film, to stage a fashion parade, the changing of the guard or a costume play in the colours in which the audience see them. Large stores could show special demonstrations on television screens in every department simultaneously as well as in its windows. Industrial control offers some further possibilities. The works manager of a plant covering a large area would be able to see at a glance through a number of screens in his office what was happening in every department.

The method demonstrated at Radiolympia employed synchronised rotating colour filters in both camera and receiver, giving 50 pictures per second in the three primary colours successively, which the viewer's eye blends into full colour. The manufacturers stress that it is only one step in the right direction but that other developments more suitable for use with domestic broadcasting are certain to come.

Michael Westmore, a 29-year-old actor, was the man responsible for the colour television programme at Radiolympia,

In producing the colour television show Mr. Westmore, a graduate of Cambridge University, had to overcome difficulties not normally experienced by B.B.C. television producers. His artists had to operate from a minute stage, and all arrangements were carried out in almost military secrecy, as the makers intended springing television on the country as a surprise. Even the characters did not know they were being televised in colour.

Our Television Receiver

ELSEWHERE in this issue appear advance details of the television receiver prepared in the PRACTICAL WIRELESS laboratory and which was shown on our stand at Radiolympia. It is now within the means and the skill of the average amateur to build his own television receiver. Indeed, one manufacturer at the show exhibited a kit of parts with stage-by-stage blueprints, and we learned that others are likely to follow suit.

Our television receiver has been designed with the limited facilities of the home constructor well in mind. Only components which are readily available are used, and full-size blueprints will be available. This receiver has been under test for some months and has reached the stage where it can be placed before our readers with every confidence.

Telenews

American Tube Size

AN 8½in. tube is now being mass-produced by the Raytheon Mfg. Company. Hitherto 7in. tubes have been regarded as more or less standard, and these new tubes are intended as direct replacements to give a full scan with the circuits designed for the 7in. tube.

Television by Slot Machine

A FIRM in New York recently tried out a slot-machine television receiver. This is fitted with a "Visimeter" which gives the user one hour of a television programme for each coin inserted in the slot. The money is collected at intervals and placed toward the purchase of the receiver.

Italian Television

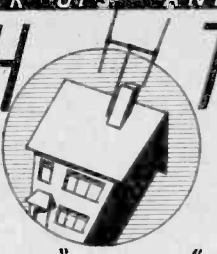
AT the end of the recent convention in Milan the Italian Government stated that no final decision had been arrived at, and that contracts for the Rome and Milan transmitters will be put out to International tender.

Collision-warning Radar

A NEW unit utilising radar principles was introduced at Radiolympia by Ekco. This unit has been subjected to an exhaustive test on a B.O.A.C. flying-boat during a flight to the Far East and has proved its efficacy.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By "Scanner"

REVUES are the fashion again. Suburban and provincial music halls have followed up in their own particular way the successes recently registered in the London West End by the sophisticated "Twopence Coloured," "Sauce Tartare" and other revues. Television viewers had an opportunity of seeing extracts from both of these shows and found them good. Sophisticated revue, with its satirical sketches, musical numbers and ballet, seems to be particularly suited to television. The television close-up gives a very direct contact with the artiste and enables one to enjoy little subtleties of performance which are seen only from the first few rows of the stalls at the theatre. Such a close look exposes faults, too, but in the case of Renee Houston in "Sauce Tartare" there weren't any! This talented artiste's fine sense of burlesque and comedy timing came over perfectly in two solo numbers, "Deanna of the Dairies" and "My Man at M.I.5." Claude Hulbert, who is well known to viewers, was also seen at his best in the same show, and Jessie Matthews put over some delightful song-and-dance numbers with great charm.

TV and the Live Show

"SAUCE Tartare" was televised from the Alexandra Palace, and I was extremely interested to see the same show a couple of weeks later performed "live" at the Cambridge Theatre. Before a packed audience, the comedy numbers took on an aspect considerably different from the television studio performance, and Renee Houston played her burlesques in a much broader manner, with timing adjusted to the laughter and applause of the delighted audience. Enquiry of the management of the theatre elicited the fact that there had been no falling off in the size of the audiences since the television transmission—in fact, they had increased. Managements will sooner or later realise the publicity value of the televising of extracts from their shows. Cecil Landeau, producer of "Sauce Tartare," hasn't regretted his decision, anyway, as viewers have turned up in strength at the theatre, and they have also told their friends about this bright and witty revue.

Theatre TV O.B's

STAGE musical comedy is not usually a type of entertainment notable for its wit, but provided the artistes are first-class and, if the show is performed in the television studio, they modify their performances to suit the special requirements of the television camera, then all is well. Good examples have been seen recently in "Bob's Your Uncle," "Her Excellency" and also in the stage farce, "The Chiltern Hundreds," in which the veteran actor, A. E. Matthews, gave such a magnificent performance. Less successful have been the relays from theatres, and particularly disappointing was the O. B. from the Regent Theatre, Hayes, where the players seemed to shout their dialogue at one another in A. G. Macdonnell's comedy, "The Fur Coat." The B.B.C. had announced that the new type O. B. equipment, which had been so successful on the Boat Race broadcast, was to be used, complete with cameras with turrets of lenses of different focal lengths, including so-called tele-photo lenses. The producer certainly availed himself of the facility of a multiplicity of camera angles without being able to apply the same flexibility to the microphone pick-up. Sound quality was poor and seemed to bear no relation in sound perspective to its associated picture. Theatre acoustics may have had something to do with this, but the quality at times reminded me of that obtained with certain highly directional microphones used for special purposes during the war. The fact is that television studio technique has made such progress that the restrictions and lack of flexibility inevitable when theatre relays are carried out have become more and more obvious. The long-range close-ups seem to emphasise these faults. And yet, one can recall several relays of musical plays from theatres which have been highly successful.

Twelve Years Ago

I RECENTLY unearthed some radio periodicals of October, 1937, which carried reports of the Radiolympia of that year, with details of television sets then on sale. It is amusing to note the wide variation in picture size, and particularly the large number of makers who specialised in small screen receivers. Tiny pictures of 6in. x 4½in. seemed quite popular, and there were special "add on" units which were intended to be used connected up to ordinary broadcast receivers. Reduction of picture size to widths of six or seven inches enabled manufacturers to produce receivers at prices ranging from £35 to £45, compared with about £60 for a ten-inch-wide screen. Two projection-type receivers were exhibited, which gave picture sizes of approximately 20in. x 16in. and cost about £120. Cossor's produced a remarkable auto-radiogram with a television screen of 10in. x 8in. for £90, and this was one of the finest examples of electrostatic focusing and deflection ever produced. Owners of these sets are now having difficulty in getting replacements of these early type tubes. Considering the small numbers of sets being produced at the time, the prices were low, and I don't think there was very much profit in it. But the manufacturers were buying experience, getting ready to turn out sets in batches of hundreds instead of in dozens.

Kinescope Repeats

THE television craze has certainly hit the U.S.A. in a big way. It will not be long before

there are no less than 100 stations sending out regular transmissions, and the process of "kinescope recording" is in regular operation at the main centres. This is the term used to describe the recording on cine film of programmes carried out with a special motion-picture camera which photographs the picture on a 15in. cathode-ray tube. The B.B.C. has been experimenting with this type of equipment for some time, and it was used to record the Boat Race, for retransmission the same evening. A greatly improved kinescope recording equipment will shortly be put into regular use, but is likely to be used for daytime sporting events only. Owing to the failure to reach agreement with the Actors' Equity, Musicians' Union and the Variety Artists' Federation, it cannot yet be used for the recording of variety shows, revues and plays. "Kinescope Repeats" have brought with them quite a large number of non-technical problems, such as fees payable to actors and musicians for each repeat performance, royalties to authors and composers, and the fact that a kinescope recording on 35 m.m. film, capable of being projected at a cinema, constitutes a possible infringement of films rights of books, plays or of films themselves.

The National Anthem

IT is gratifying to note that shortly after the absence of the National Anthem from the television programmes had been commented upon in this column, the playing of "God Save the King" was resumed, a very good recording being put on at the end of the television news.

Odd Numbers

SOME SCANNING DATA

By DAVID WAYNE

BRITISH television picture definition is 405 lines, U.S.A. 525, Russia 441, France 819, and Holland 567. When you think about it, this is a rather curious state of affairs—not the diversity of standards (though this is a regrettable enough fact) but the actual figures themselves.

Why not have 400 lines instead of 405, or 820 instead of 819? In fact, why not have any nice round numbers in place of the apparently arbitrary values chosen?

Looking at the figures again—405, 525, 441, 819, and 567—one would expect to find some characteristic in common, since they all relate to television scanning speeds. The first thing that strikes the eye is that they are all *odd numbers*. This is a significant point. And secondly, a little simple arithmetic reveals that they are all multiples of simple factors. For instance:

$405 = 5 \times 9 \times 9$; $819 = 7 \times 9 \times 13$;

$441 = 7 \times 7 \times 9$, and so on.

This is also a significant point.

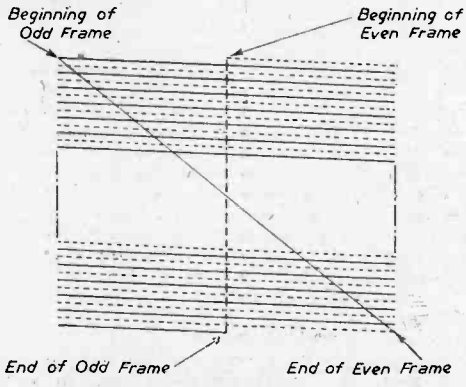
It would appear then that the product of any number of integers (in practice restricted to 3 or 4) would be suitable for television lineage, provided that the product is an odd number. Obviously all of the integral factors must be odd numbers too, since the inclusion of only one even number produces an even total. Thus we could use $9 \times 7 \times 11$ to give a 693 line picture, and this would be perfectly satisfactory.

The Reason

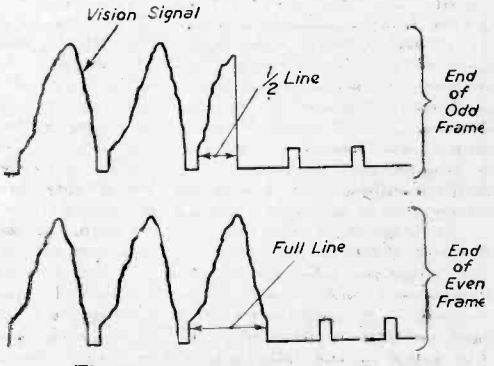
Now why this appearance of mystical method in relation to the choice of numbers for television picture lineage? Is it just a video superstition, or is there a basis of hard scientific fact behind it all?

A brief glance behind the scenes at Alexandra Palace provides the answer to the problem—in the pulse-generating equipment which supplies the square-wave synchronising pulses that trigger the line- and frame-scanning circuits, and modulate the vision signal.

A master pulse frequency of 20,250 cycles per second is generated. This is double the line frequency of 10,125 c.p.s., but is necessary for frame interlacing, as we shall see. This master frequency is applied to a series of multivibrator stages which act as frequency dividers. The first divides the master frequency by 2, thus producing the line frequency. The remainder



How a normal raster is built up by the interlacing method.



The characteristic of the signal and synchronising pulses.—Not to scale.

divide the master frequency by 9, 9, and 5 in sequence, the final quotient being 50 c.p.s.—the frame frequency.

The frequencies of the multivibrator stages are locked in these integral steps, and in addition the 50 c.p.s. stage is locked to the frequency of the mains supply; perfect synchronism being achieved by means of a synchronous motor which actuates the vanes of a variable condenser governing the master frequency.

So the simple factors are essential in order to obtain multivibrator frequency division from the master frequency, so that the frame frequency is always an exact submultiple of this (and is, incidentally, always tied to the frequency of the A.C. mains). Since interlacing is required, the frame frequency must be double the picture repetition frequency, and cannot be derived from the line frequency by simple integral division. Consequently the master frequency equal to double the line frequency turns out to be a necessity.

Interlacing

Now for the other problem—why odd numbers? Once again it has to do with interlacing. Two consecutive frames (of 202½ lines each) must, in order to interlace, be mutually displaced by a distance equal to half of the vertical interval between two scanning lines. This amounts to an actual displacement of half a line, and in fact each frame is arranged to contain an odd half-line—at the end of the first frame, and at the beginning of the second (interlacing) frame. Therefore, in order to accommodate the extra line for "splitting," a television picture must contain an odd number of scanning lines.

In this way the interlace is automatically produced. Triggering for the half-line termination and commencement, is derived from the master frequency, which generates two pulses to each scanning line. Each frame is triggered on the 405th pulse; i.e., after every 202½ lines (the succeeding 14 lines being blacked out for frame sync. purposes).

Thus odd numbers form the arithmetical basis of modern television lineage. So, if anyone points out that the original Baird transmissions comprised 30 and 240 lines respectively (both even numbers), remember that they didn't use interlacing in those days. The frame interlace was first used in the present E.M.I. 405-line system introduced in 1936.

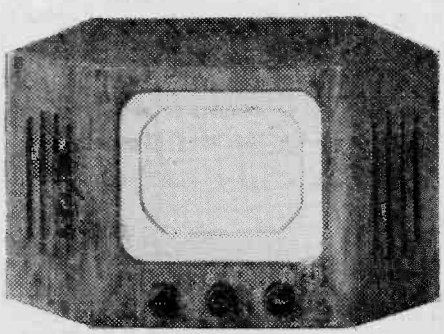
And if anyone talks idly of the 1,000-line pictures to come, you may politely indicate that the nearest possible lineage using interlacing and integral factors is $13 \times 7 \times 11 = 1{,}001$ lines!

Television on Tap

E.M.I. RELAYS (HAYES), LTD., have now perfected a system capable of supplying houses direct by wire with high-quality vision and sound programmes. For a very reasonable weekly charge people will soon be able to enjoy the unique advantages offered by a relay system.

Equipment

A special receiver is supplied of the size and appearance of a normal table television set, designed to rest conveniently on a table or stand of usual height. All that is necessary is to plug it into the mains and connect to the special lead-in provided.



The relay terminal unit, which is fitted with a 10in. tube.

No aerial is needed, and with the E.M.I. television relay unit is incorporated a switch giving, in addition to the television picture and sound, a choice of five radio relay programmes all at the highest quality. Another unique feature of the television relay service proposed by E. M. I. Relays (Hayes), Ltd.—who are a subsidiary company of Electric and Musical Industries, Ltd.—is, of course, the provision of a 10in. aluminised Emiscope cathode-ray tube in the vision unit providing clear pictures, and bright enough to be satisfactorily viewed in daylight or normal room lighting.

As far as the user of E. M. I. television relay is concerned, all he needs do is to turn a switch to enjoy the continuous trouble-free reception of television programmes.

Advantages

Among the important advantages of television by relay are ease of installation (no aerial is required); complete absence of all forms of interference (due to the special location of the master receiver and re-transmitting equipment and the special distribution methods used); free servicing—including valve and tube replacements; simple control (brightness and volume only); no setting-up adjustments, and continuous stability of pictures.

The equipment which has made this possible was seen for the first time at Radiolympia.

Television at Sea

An Ipswich radio dealer recently installed a standard commercial television receiver on H.M.S. *Woolwich*. This ship is permanently moored a mile off shore near Harwich, and the aerial installation was attended to by the naval authorities—the standard "H"-type dipole being fixed on top of the 125ft. main-mast. In spite of the mass of machinery on board and the distance from the London station, excellent pictures are being received, and the set is now to be fitted with a magnifier. The only interference experienced is that from motor-craft which approach the vessel, and steps are being taken to supply interference-suppressing devices to these.

Practical Wireless
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PRACTICAL WIRELESS DEC. 1949

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