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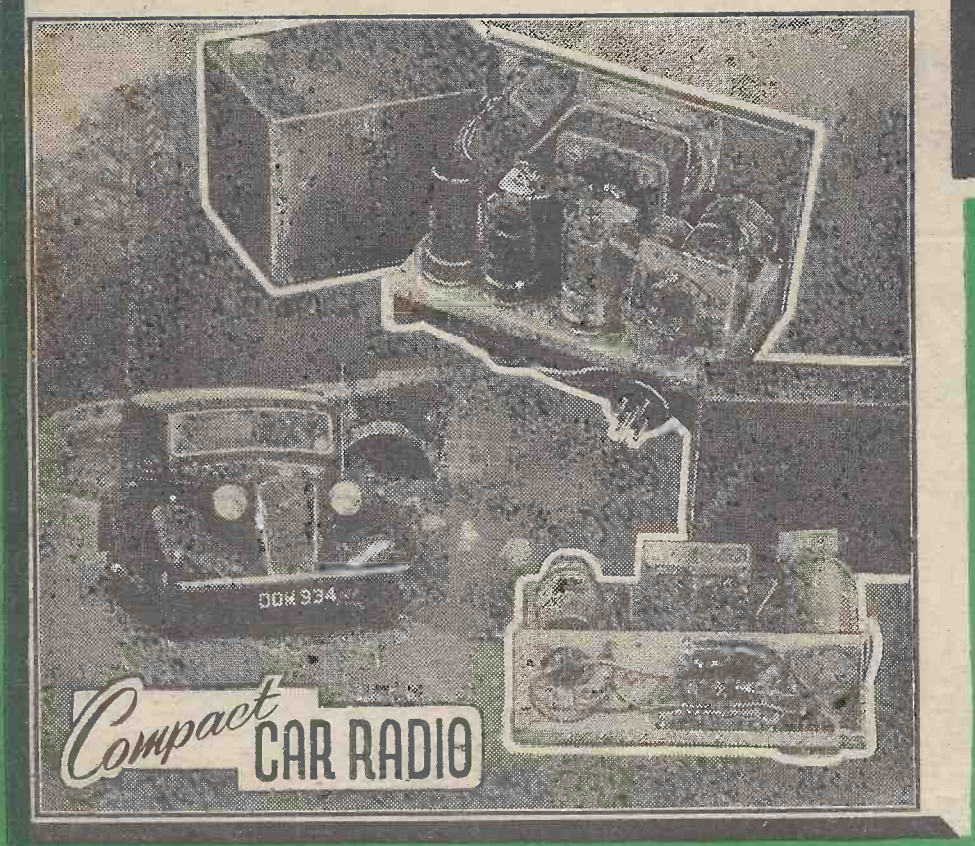
EDITOR:
F. J. CAMM

PRACTICAL WIRELESS



CHIEF CONTENTS

AN APOLOGY

The inconvenience and annoyance caused to the public and to our friends in the trade by the delay in delivery of *acos* microcell pick-ups is a matter that causes us the gravest concern. It is in the main due to the unprecedented demand for these pick-ups which has outrun the supply of certain raw materials and also made our factory space inadequate. Commitments to manufacturers made prior to the general announcement of the pick-ups have still further aggravated the position.

Happily, the raw material problem should shortly be solved and plans for greater production facilities are being urged forward. In the meantime, we are doing all we can to meet existing orders, but regret that delivery on new orders will be subject to about three months' delay.

We can only express our regrets for the circumstances that have made this announcement necessary, and trust that our trade friends and the general public will bear with us in view of our assurance that all possible steps are being taken to meet the situation and to reduce delay to a minimum.

COSMOCORD LTD. ENFIELD MIDDX.

Practical Wireless
19th YEAR OF ISSUE
EVERY MONTH.
VOL. XXVII. No. 531 JANUARY, 1951
Editor F.J.CAMM

COMMENTS OF THE MONTH — BY THE EDITOR

Sir Wm. Haley on Broadcasting

IN an article contributed to an American journal, Sir Wm. Haley, Director-General of the B.B.C. comments: "That while a broadcast may have far wider coverage than any book, newspaper, or magazine, it suffers a most grievous restriction where influence is concerned. It can travel widely in space. It is held to one point in time. There is the paradox that while broadcasting is one of the most powerful and persuasive of mediums it is also one of the most restricted."

A speaker can tell millions in one broadcast about some single aspect of a subject. It is only rarely that serious interest can be so engaged and sustained over an appreciable number of separate broadcasts as to ensure that the same listeners are given anything amounting in total to the contents of an ordinary size book.

The spoken word is an ephemeral thing, and what is spoken, whether over the air or in ordinary conversation, to be of value depends upon the retentivity of mind of the listener. If this were not so, broadcasting would be all-sufficient and we should have no need for textbooks, newspapers or periodicals. Indeed, when broadcasting started publishers generally were apprehensive that with its wide coverage it would destroy the demand for the printed word.

Events have shown that the reverse has been the case. Newspapers, periodicals and books are selling in larger numbers than ever before, which indicates that the spoken word creates a demand for something more enduring than sound. Nothing can replace the printed word. If you do not understand a particular sentence you can re-read it. With the spoken word the thought is expressed and is gone. It is in this respect that broadcasting as a means of education is a failure. Its metier is one largely of entertainment, like a theatre or a cinema, and it would be to the benefit of listeners if programme time was largely occupied by items which are intended to amuse and not to educate.

Fewer people listen to broadcasts of an educational nature than to those of entertainment. It is significant that the B.B.C. depends upon the printed word to advertise its programmes, and it depends to some extent on press notices in the daily papers to draw attention to forthcoming programmes. An announcement over the air at a particular moment does not have the desired effect. A statement in printed form is permanently recorded and the listener during the day has ample time to consult the night's programmes.

If this were not so there would be no need for the B.B.C. to publish *Radio Times*, the large circulation of which indicates the proof of Sir Wm. Haley's arguments and our comments on it.

Our readers will have heard on the radio or read in the Press of the Printing dispute which has prevented normal publication of this journal since the issue dated September-October. We are happy to record that a settlement has been reached and we shall now be able to publish normally.

We greatly regret the inconvenience which our readers have suffered but feel sure it will be appreciated that this break in publication has been due to circumstances beyond our control.

Valve Prices

The British Radio Valve Manufacturers' Association has been able to avoid price increases in the past few years on the majority of British valves. In a recent statement it says that this is the result of a policy of continued extensive research and development allied with new techniques and increased production.

The development of modern valves has, however, necessarily rendered obsolete or obsolescent many types for which there is nevertheless a continuing demand for the maintenance of existing equipment.

The manufacture of progressively decreasing quantities of those types and the effect of advanced costs of raw materials, wages and overhead expenses over the past few years has made price adjustments essential to economic production.

In a complete review of the British valve range the opportunity has been taken to re-align prices more closely to current production costs. Accordingly, certain valves have risen in price during recent months. In some cases, however, price reductions have proved possible. The newer all-glass types have similarly been increased, whilst some have been reduced. It is important to note that these price changes will not affect stocks already in the hands of traders, which must continue to be sold at the prices marked on the carton, in conformity with an assurance given to The Central Price Regulation Committee on this point.

Valves released by the manufacturers after September 1st last bear the new prices and are officially labelled.—F.J.C.

ROUND the WORLD of WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate numbers of licences issued during the year ended September 30th, 1950.

Region	*Number*
London Postal	2,336,000
Home Counties	1,639,000
Midland	1,726,000
North Eastern	1,888,000
North Western	1,600,000
South Western	1,058,000
Welsh and Border Counties ..	728,000
Total England and Wales ..	10,975,000
Scotland	1,125,000
Northern Ireland	205,000
Grand Total	12,305,000

The above total includes 470,800 television licences.

New Mullard Appointment

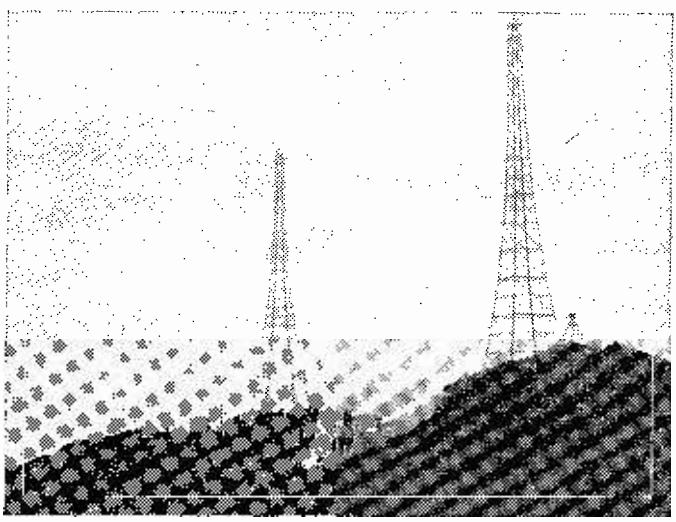
MR. C. L. G. FAIRFIELD, M.A., A.M.I.E.E., A.M.I.Mech.E., has been made a director of Mullard Equipment, Ltd.

The appointment took effect from August 1, 1950.

A Studio Without Engineers

IN the past the B.B.C. frequently has wished to include in its programmes a topical interview with some celebrity just disembarked from one of the transatlantic liners. This has meant the transport of an engineer and a duplicate set of outside broadcasting equipment from Bristol or some nearer point where the outside broadcasting staff were working at the moment. The dislocation in the planning and staffing of outside broadcasts has been unavoidable, and the cost in transport and engineer hours has been considerable.

To meet the difficulty, the B.B.C. Engineering Division is experimentally installing an unattended set of studio equipment in the Guildhall at Southampton. The equipment will normally be locked up, but is installed in such a way that it can be switched on and send its programmes via the G.P.O. lines to Bristol, without anyone being present other than the celebrity and the programme representative responsible for the interview.



The aerial array at the broadcast station at Wellington, New Zealand, situated on the summit of Mount Victoria.

Scophony Baird, Ltd.

MR. JOHN DIAMOND has resigned from the Board. The Board has been reconstructed: Lieut.-General Sir Charles J. S. King, K.B.E., C.B., M.I.C.E., and Mr. J. F. C. Dugdale have joined the Board, and Mr. E. S. Watkins and Mr. V. B. J. Seely have resigned. Sir Charles King has been elected chairman.

B.I.R.E.

THE following meetings of the institution will be held in December, 1950:

LONDON SECTION.—Friday, December 15th: Commencing at 6.30 p.m. London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1. A discussion meeting on "Progress in Loudspeaker Design," to be opened by R. L. West, B.Sc., A.M.Brit.I.R.E.

NORTH EASTERN SECTION.—Wednesday, December 13th: Commencing at 6 p.m.—Neville Hall, Westgate Road, Newcastle. "A Survey of Television Development and its Problems," by H. J. Barton Chapple, B.Sc., M.Brit.I.R.E.

SCOTTISH SECTION.—Thursday, December 7th: Commencing at 6.45 p.m.—Heriot Watt College, Edinburgh. "Vacuum Engineering Applied to Electronics," by D. Latham, B.Sc.

NORTH WESTERN SECTION.—Thursday, December 7th: Commencing at 6.45 p.m.—College of Technology, Manchester. "High Fidelity Reproduction," by H. J. Leak, M.Brit.I.R.E.

Details of the remaining section meetings are not yet available. The meetings for January, 1951, will be announced in our next issue.

B.B.C. Recording Unit at B.I.C.C. Research Laboratories

AN interesting event at the Wood Lane Research Laboratories of British Insulated Callender's Cables, Ltd., recently, was the visit of a B.B.C. mobile recording unit to record details and impressions of B.I.C.C.'s new surge generator for "Radio Newsreel." The interviews were conducted by Mr. Valentine Selsey, the well-known B.B.C. reporter, whilst Mr. Shelton-Williams supervised the actual recording.

Mr. P. R. Hartshorn, who is in charge of high-voltage testing in the laboratory where the surge generator tests are carried out, was interviewed first and briefly stated the purpose of surge-testing cables and accessories. He was followed by Mr. W. G. Hawley, the High-voltage Research Manager, who described for listeners some interesting features of the new generator.

Also included in the recording was a demonstration flashover, for which use was made of a string of fourteen glass suspension insulators, the flashover occurring at 1,250,000 volts.

Broadcasting Committee

THE Broadcasting Committee which, under the Chairmanship of the Rt. Hon the Lord Beveridge, K.C.B., F.B.A., is inquiring into the future of the broadcasting services of the United Kingdom, announces that it has now completed the hearing of evidence.

B.B.C. Engineering Division

THE B.B.C. announce the following new appointments in the Engineering Division.

Mr. R. T. B. Wynn, C.B.E., M.A., M.I.E.E., becomes Deputy Chief Engineer, with responsibility under the Chief Engineer (Mr. H. Bishop, C.B.E., B.Sc.(Eng.), M.I.E.E., M.I.Mech.E.) for the general control and direction of all Engineering Departments. Mr. H. L. Kirke, C.B.E., M.I.E.E., becomes Assistant Chief Engineer, with responsibility for the co-ordination and direction of the technical work of the Research, Planning and Installation, Designs, and Equipment Departments.

Mr. W. Proctor Wilson, C.B.E., B.Sc., M.I.E.E., succeeds Mr. Kirke as Head of the Research Department, and Mr. E. C. Drewe, M.I.E.E., becomes Assistant Head of the Department.

Water "Flying Squad" Vans

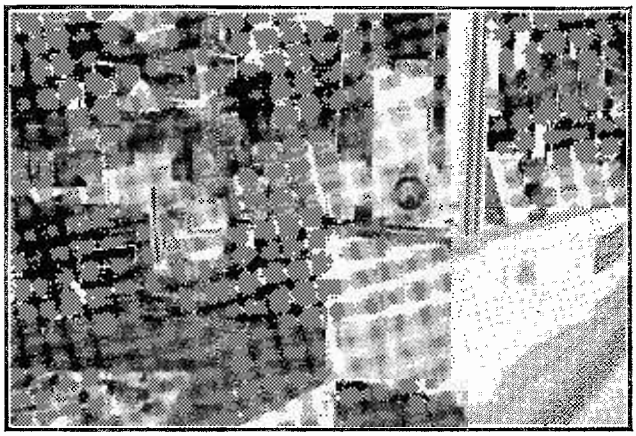
VANS fitted with V.H.F. radio communication having a range of 25 miles are to be used by Southend Waterworks Company to speed up repair work.

The installation is from the range of mobile communication equipment introduced by E. K. Cole, Ltd., and comprises a V.H.F. fixed station giving two-way communication with mobile V.H.F. equipment installed in the Water Company's vans. Communication is in the 80-90 Mc/s band and frequency modulation is used to give reasonably interference-free communication over ranges of up to 25 miles

The fixed station transmitter has an aerial power of 25 watts and the mobile units a power of 5 watts. The installation includes a system of selective calling to enable the fixed station to call any one of the mobiles individually without disturbing the others. The method of calling the operator at both fixed station and mobile units is by bell. Facilities are also provided for inter-mobile communication via the fixed station.

National Radio Show

THE 18th (British) National Radio Show is to be held at Earls Court, London, from August 28th to September 8th, 1951, the first day being reserved for distinguished visitors, overseas buyers and Press.



The Hastings Television Club had a stand at a recent Model Engineering Exhibition, and demonstrated the effects of interference on radio and television reception.

The show will include British radio, television and electronic equipment of all kinds, as well as valves and components. The B.B.C. will co-operate in demonstrations and performances of television from a large and fully-equipped studio in the exhibition hall.

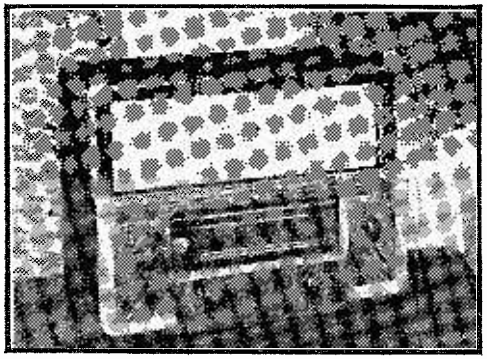
A Problem Solved

THE approach of Christmas brings once again the problem of choosing gifts for ones friends, both at home and overseas.

The solution need not be difficult. Send them subscriptions to PRACTICAL WIRELESS and you ensure a gift that is not only original and immediately acceptable but also has a cumulative value in that every issue throughout the year serves as a reminder of your good wishes.

We shall be pleased to arrange as many gift subscriptions as you may wish to send at the normal rate of 10s. 6d. (Canada 10s.). In addition, an attractive special Greetings Card will be sent in your name with the first copy of each subscription.

Just write to the Subscription Manager, PRACTICAL WIRELESS, Dept. G.5, Tower House, Southampton Street, Strand, London, W.C.2, enclosing the addresses of your friends with remittance to cover, and we will do the rest.



The " Blue Peter " receiver from the Pilot range.

1950 Radio

We Regret that the Protracted Dispute in the Printing Industry Prevents the usual Detailed Report of the Radio Exhibition. Here are the Highlights

OWING to the printing dispute we regret that we were unable to publish our usual stand-by-stand report of the exhibits at the annual Radio Exhibition. We are therefore giving below a brief review of the main features of the radio section of this exhibition. The television exhibits were fully covered in the September/October issue of our companion paper, *Practical Television*.

An examination of the radio exhibits revealed the fact that there was very little which could be called new. In previous years each exhibition has produced something new, and in many cases startling, either in circuit design or in some other part of the equipment; but the rapid growth of television has led manufacturers to concentrate on this side of the industry, and as a result very little has been done to produce novelties in sound radio. One would therefore be quite in order in stating that there was nothing new to be seen.

Midget Components

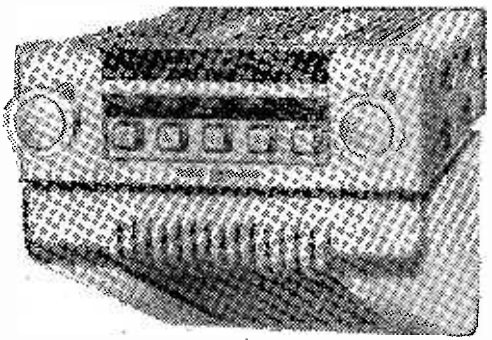
When, however, one looked into the back of the receivers it became apparent that many manufacturers had increased the use of the various types of midget components and valves which are now available, with the result that chassis were much more compact than some of the earlier models. In a large number of cases the tuning dial was as large as in last year's models and was as long or longer than the actual chassis, but the cabinets had not been reduced in size. Some of the space which had been made available was taken up by larger loudspeakers.

Radiograms

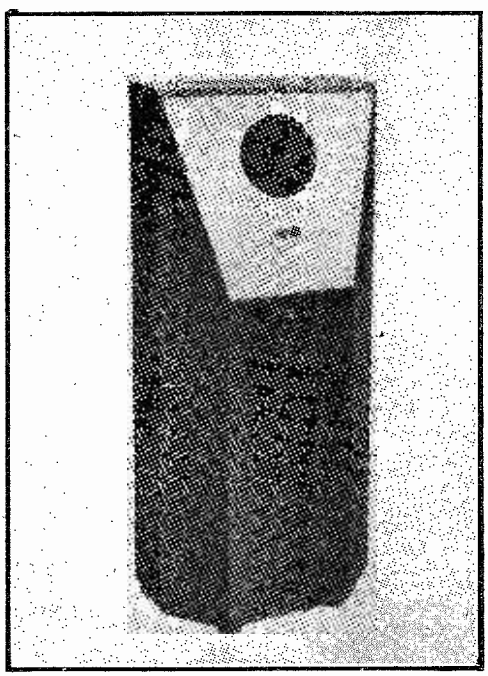
Some of the larger types of apparatus were quite imposing, but in the very expensive class it was noted that the combined radio and gramophone had been coupled with television, and as a result prices were very high. Specialists in these larger pieces of apparatus, such as R.G.D., for instance, had some interesting exhibits in bird's-eye maple, Sheraton, Empire, etc., one of which was a 10-valve auto-radiogram covering from 13 metres upwards, and with an 8-watt push-pull output stage driving a 12in. duplex cone speaker. These instruments cost over £200.

Dynatron were also showing auto-radiograms in various cabinet styles, again in the high-price class, one version of their " Ether Conqueror " being priced at £401 7s. 10d. Both of these models incorporate the new speed turntable, about which more will be said later.

The small-type personal receivers were prominent on Vidor and Marconiphone stands, and a feature of the Vidor was that a warning device has been incorporated to prevent the lid being closed without first switching off. Even if there is no programme being received, when the lid is lowered with the switch on, a loud howl is generated and thus warns the user to switch off.



The New Radiomobile Car Radio receiver.



A corner speaker produced by Decca.

Show Report

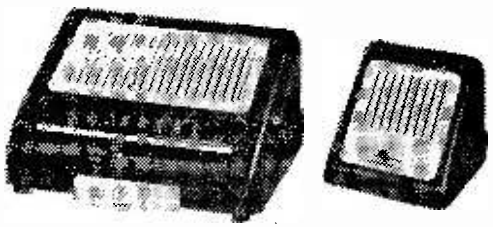
Printing Trade Prevented us Publishing our The Following Brief Summary Explains Some of the Show

These small portables, which are in the form of attaché cases, are of the combined battery-mains type, and the batteries to be used are of the all-dry type with very low current consumption.

Amplion were showing a small unit known as the "Convette," which is a small mains unit which can be fitted in these small all-dry battery receivers so that they may be operated from the mains. The standard battery type four-pin socket is fitted so that the replacement of an all-dry battery by the mains unit is exceedingly simple.

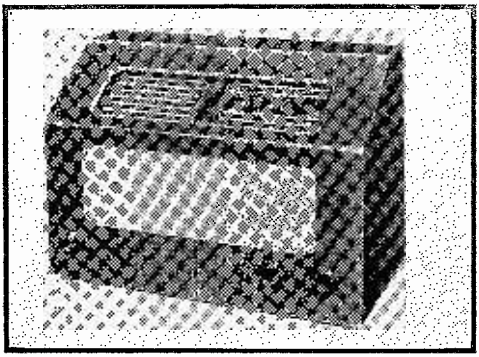
In the Marconiphone receiver the mains unit is built in, and a five-position master switch provides selection of mains or battery operation, wave-band and on/off control.

An important feature of many of these small personal type receivers is the very good quality of reproduction which is given, in spite of the use of small loudspeakers.



A loudspeakerphone equipment from Ediswan.

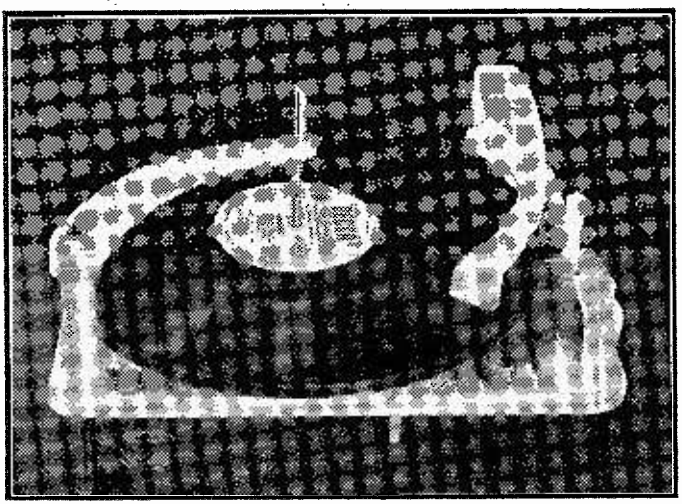
The servicing of receivers has now reached a very high standard, and more test equipment is available at a price within the reach of the small dealer or service depot. Apparatus which previously had been considered only suitable for laboratory and research work is now available in compact form and at such a price that receiver fault-finding is reduced to a very simple job, which does not call for a highly-skilled technician. For instance, the new Mullard valve tester reviewed on another page enables a customer to bring into the shop all of the valves from his receiver, and the indication is such that he may see for himself just what condition the valves are in, and the testing only takes a matter of a few minutes.



Pye Model P47B.

Amplifiers are available now for home use in a variety of types, and the use of special test equipment enables a reliable response curve to be supplied, and it is noted that the lower frequency range provided on many of these calls for the use of a special loudspeaker or a well-designed acoustic cabinet if full use is to be made of the frequency response. The use of negative feedback over all stages has resulted in improved linearity of the response curves and the removal of all traces of hum, with the result that the connoisseur can now have a very high standard of reproduction of both records and radio.

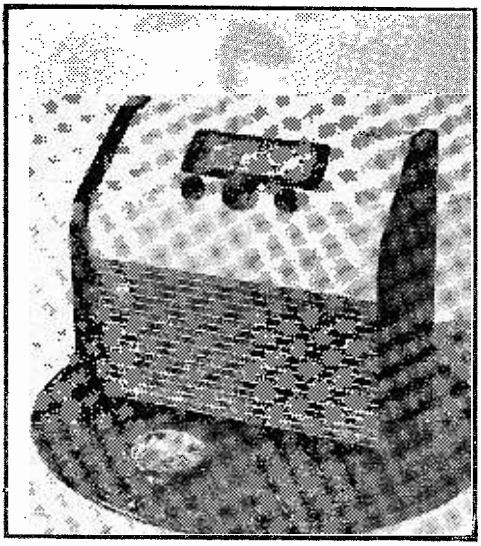
Manufacturers are now able to supply wooden cabinets designed on acoustic labyrinth and similar principles, into which the constructor may fit the loudspeaker of his choice, and small radio-units for either local station or wide-range reception may also be obtained for use in conjunction with the amplifiers. In this way a constructor may build up at reasonable cost a very impressive installation.



Decca's autochanger with dual-speed motor for standard or long-playing records.

Intercom. Equipment

A valuable industrial accessory is gaining popularity in this country, although in general use in U.S.A. This is the intercommunication equipment which, although not strictly radio, embraces similar electronic principles in the amplifiers and loudspeaking equipment. In brief, it consists of a microphone, selector switch, and a series of amplifiers for each distant point with loudspeaker. The master, or control, unit may use



A new table Battery Model from the Vidor range.

a speaker in the dual function of microphone and reproducer, or be fitted with a separate microphone, and interesting combinations are available in the master unit.

In some it is possible to talk to single stations individually without overhearing; others enable individual stations to call the master and break in on a conversation, and so on.

An L.F. Oscillator for test purposes. This is an Ediswan product.

L.P. Records

As a further development in high-quality reproduction there is the new micro-groove or long-playing record, which is intended for a much slower playing speed than standard records. Furthermore, the grooves call for a specially-designed fine point and a minimum of weight, with the result that manufacturers have had to develop special slow-running motors and turntables and special pick-ups. Obviously it would be expensive and impracticable to have two or more turntables and associated pick-ups in a radiogram, and there has therefore been developed motor and turntable equipment capable of being run at two or three different speeds, and pick-ups in which heads may be plugged in to suit the record in use.

Decca have produced the first of the long-playing records in this country and a fairly wide range is now on sale. They have also produced a suitable pick-up and a playing desk for their records which, incidentally, are intended for a speed of 33⅓ r.p.m. Their all-wave radiogram previously mentioned is provided with an automatic changer mechanism which may be run at either 33⅓ or 78 r.p.m., and the pick-up is a special lightweight *ffrr* (full-frequency range recording) with interchangeable heads using sapphire points. The head for normal records is much heavier, to provide the necessary additional weight, and the changing of the pick-up heads automatically makes the required circuit compensation.

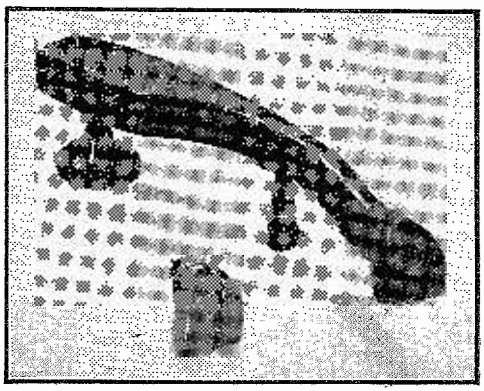
To enable the maximum performance to be obtained from these discs and associated equipment Decca have produced a corner type of loudspeaker in which the unit has a high flux density (14,000 lines) and will handle up to 10 watts. The internal part of the cabinet takes the form of a folded tapered air column, and when fitted in the corner the walls of the room act as extensions of the baffle. These speakers are available in three impedance ranges and cost £21 10s.

In connection with these long-playing records, it is interesting to note that a statement has recently been issued from the E.M.I. headquarters concerning that Group's attitude towards this new development. It is apparently not their intention, at the moment, to produce discs of this type and they are watching the situation as it exists in the U.S.A. where three different systems are competing with each other. We hope to publish the E.M.I. statement in our next issue.

Cabinet Work

Apart from the increased use of plastics, a notable feature of the cabinets was the high standard which has been adopted in not only the choice of timbers but in the finish. Cabinets are much more robust and the thin plywood box has been dispensed with, and as a result reproduction should be improved by the lack of "boxiness" or boom. The speaker opening has also been more artistically covered or designed in some models, and the Decca receivers are a good example of the arrangement adopted.

Obviously, at such a late stage and in such a limited space, it has not been possible to deal with all the exhibits or exhibitors and we must apologise for any omissions which have unfortunately been made.



The Decca dual-purpose pick-up with plug-in heads.

CRYSTAL FILTERS—2

The Use of the Piezo Crystal in Improving Selectivity

By H. SASSON

FIG. 6 in the last issue is the circuit of a practical telegraphy filter. As the input transformer secondary has to have a high inductance to ensure efficient operation two conventional I.F. transformer secondaries are connected in series on either side of the primary winding. Both stator and rotor of the phasing condenser have to be insulated from ground. The whole filter unit can either be placed in one or two transformer cans or else the various components can be grouped around the socket of the valve following the filter and supported in the wiring. Stray coupling between the input and output circuits must be avoided, as such a coupling would by-pass the crystal and destroy its objective. To cut out the filter and revert to normal receiver operation it is only necessary to bend over the tip of one of the rotor vanes of the phasing condenser Cp, so that in the position of minimum capacity the condenser is short-circuited and the receiver restored almost to its normal condition, especially so with a high-inductance secondary to the input transformer, as has been described. The presence of the crystal in the other arm can be ignored as it will have no effect on the circuit.

Filters for Telephony

As a more uniform response over the whole of the pass-band is necessary for the reception of telephony than is adequate for C.W., a flatter top to the response curve is required. This levelling can be effected simply by substituting a tuned circuit for the output resistance.

A band-pass of 2—4 kc/s is the narrowest one can use in practice without severely cutting the sidebands, which would give rise to distortion. The receiver is so tuned that the carrier lies symmetrically in the middle of the dip between the peaks. With such an arrangement the higher modulating frequencies will be strengthened, as they would lie on the peaks on other side, and the signal would thus become crisper and more readable through atmospherics, etc. Another alternative is to tune the receiver so that the carrier falls near one edge of the band-pass, in which case the range of reproduction will be approximately doubled.

Installing the Filter

It is essential for the receiver to have a sufficient reserve of amplification to overcome the slight drop in signal strength caused by the filter.

The high-frequency oscillator must have a high order of stability if the filter, whether band-pass or crystal gate—but especially the latter—is to be used successfully.

The best place for the filter in the receiver I.F. amplifier can only be decided upon after taking into consideration several factors.

As the filter functions best on strong signals, this being due to the slight friction between crystal and holder which the signal has to overcome, it must be inserted as late as possible in the I.F. amplifier. It need not be between two I.F. amplifier valves, for one particularly efficient position is between the last I.F. valve and the second detector. This detector, for best results, must have a relatively high impedance to go with the high dynamic resistance of the input and output circuits, in which case no tapping of the output coil is necessary.

The "Infinite Impedance" Detector

As the diode detector is a low-impedance device it is often put aside and replaced by one of higher impedance. The best detector in this respect is the "infinite impedance" detector (Fig. 8) which combines the high signal-handling capabilities of the diode detector with good linearity (low distortion). Like the anode-bend detector it does not load the circuit it is connected to, but whereas the load resistance of the anode-bend detector is in

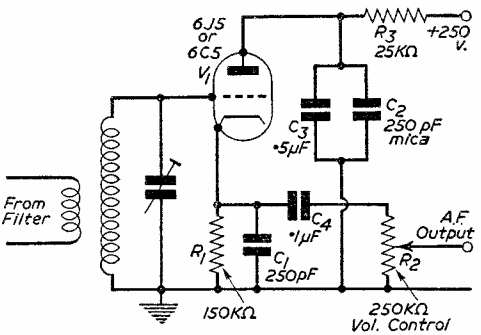


Fig. 8.—The infinite impedance detector.

the anode lead, in the case of the infinite impedance detector it is connected between cathode and ground, giving negative feedback for audio frequencies. The cathode is by-passed to ground for radio frequencies only, but the anode is earthed via condensers for both radio and audio frequencies. The infinite impedance detector can be made to regenerate by making C_1 variable, hence the loss in amplification due to the filter can be overcome. If the receiver has only one I.F. stage, regeneration (reaction) becomes a necessity and is often the best solution.

Converting an Existing Crystal Gate to a Band-pass Filter

A second crystal, identical with the existing one, must be obtained differing in frequency from it by 200—500 cycles if the filter is to be used for C.W., and by about 2—4 kc/s if a telephony filter is envisaged. This second crystal is then connected across the existing phasing condenser, which is now found to have lost its characteristic features. To restore a state of balance, capacity is added across the original crystal till the bridge balances at the same setting of the phasing condenser as before.

Audio-frequency Signal Generator

A 5-valve Unit for the Experimenter

Described by D. ALLENDEN, Grad.I.E.E.

IN the field of audio-frequency signal generators the once supreme beat-frequency oscillator has in recent years largely been superseded by the various types of resistance-capacitance oscillator. The latter are capable of producing excellent waveform, have good amplitude and frequency stability, and their design is considerably simpler. The only advantage possessed by the B.F.O. which is not inherent in the resistance-capacitance oscillator is the ability of the former to give a wide coverage in a single range. However, the frequency in a R-C oscillator is usually proportional to 1/RC, whereas in a conventional tuned LC oscillator it is proportional to 1/LC. Thus the R-C oscillator can cover a given range in a smaller number of steps than an LC oscillator. In practice the audio-frequency band can be covered in three or four ranges.

The signal generator to be described uses the Wien bridge circuit. Of all the R-C circuits this one is perhaps the best where a wide range of frequencies is to be covered, as the other types do not lend themselves to variable frequency operation. The instrument has a coverage of 20 to 20,000 cycles/sec., high and low impedance outputs, and can deliver either sine or square waves, thus permitting either steady state or transient response to be tested. Many constructors will, it is felt, wish to modify the design to suit personal preferences or available components, so it is proposed to describe the design requirements in sufficient detail to enable the amateur to produce a satisfactory design.

All R-C oscillators are basically amplifiers in which sufficient positive feedback is applied to produce continuous oscillation. For oscillation to occur at any one frequency the feedback system must be frequency-conscious. The resonant circuit that is employed at higher frequencies is, however, not ideal at audio frequencies, largely owing to the bulk of the necessary inductor and the possibility of distortion in the iron. Also it is difficult to vary the frequency of a low-frequency resonant circuit in a continuous manner.

Two-stage Amplifier

There are, however, various types of frequency-conscious feedback systems using a combination of resistance and capacitance. Consider, for instance, a two-stage amplifier with its output fed back to its input via a network of the type shown in Fig. 2. The positive feedback will not be constant for all frequencies, but will depend on the output frequency. At zero frequency the impedance of the upper (series) branch will be infinite and there will be no feedback. At infinite frequency the impedance of the lower branch will be zero, and again there will be no feedback. At some intermediate frequency the feedback will be a maximum, and analysis shows that this frequency is given by $f_0 = 1/2\pi CR$. At this frequency the feedback path behaves as a resistive potential divider in which the upper resistor has twice the value of the lower. Hence at this frequency a $33\frac{1}{3}$ per cent. positive feedback is obtained. The actual manner in which

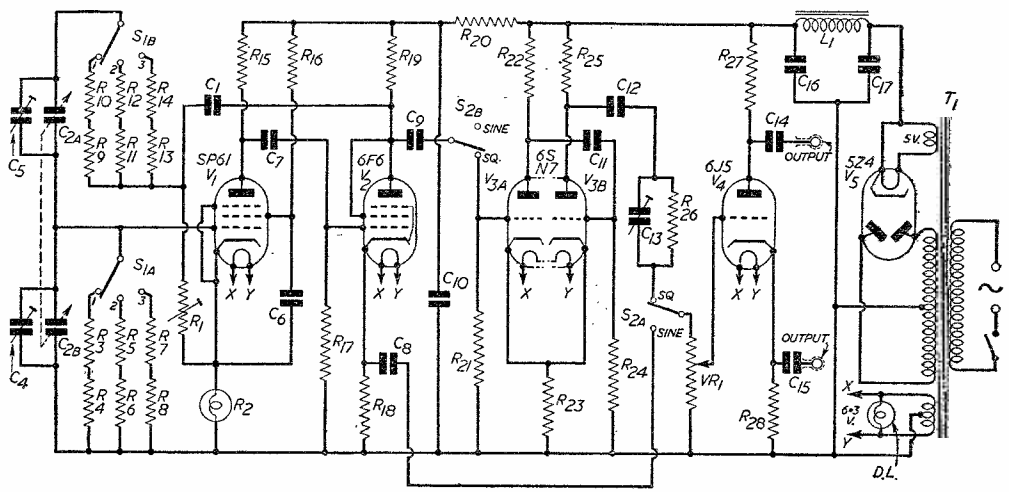


Fig. 1.—Theoretical circuit of the signal generator. A List of Components will be found on page 11.

the inphase component of the feedback voltage varies with frequency is shown in Fig. 4.

Oscillation will occur at the frequency for which the feedback is max., i.e., $1/2\pi CR$. By simultaneously varying either the capacitors or the resistors the frequency of oscillation can be varied. In practice a variable capacitor is usually employed as the main frequency control, and switched resistors provide the various frequency ranges. A variable capacitor can quite easily cover a ten to one range, which means that full audio-frequency coverage may be obtained with three ranges. In the feedback network it is most important that the values of R and C are closely matched in the upper and lower branches, and for this reason a ganged variable capacitor is preferable to a ganged resistor for the main variable control.

It is necessary to improve on this simple feedback system. There is sufficient feedback for oscillation

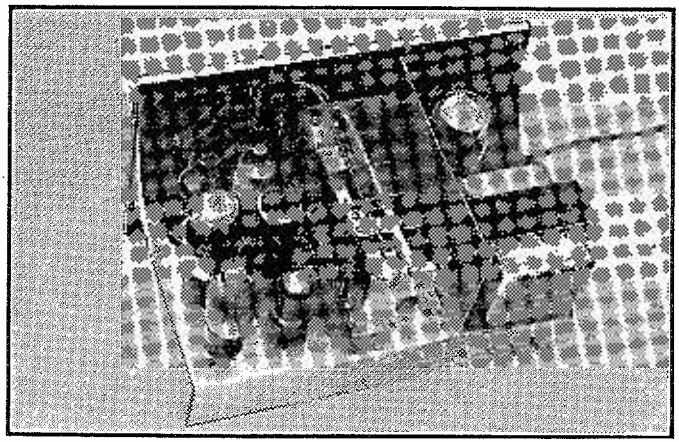


Fig. 3.—A view of the finished unit.

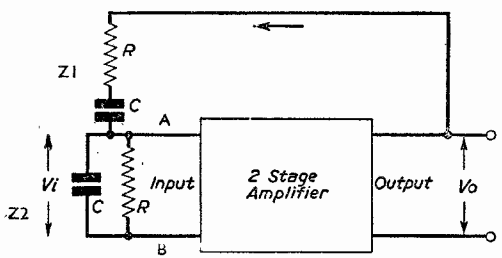


Fig. 2.—Amplifier with R.C. feedback.

over a wide frequency range, so waveform and frequency stability will be poor. Suppose, however, that a fixed amount of negative feedback is applied in addition to the positive feedback—an amount of negative feedback that is just sufficiently less than 33⅓ per cent. to allow oscillation to take place only at the peak frequency $1/2\pi CR$. The effect of this is shown by the horizontal line in the graph (Fig. 4). The total feedback is now the difference between the positive (variable) and negative (fixed) feedbacks and is either positive or negative according to which of the two is predominant at any given frequency. Overall positive feedback now occurs only over a narrow range in the vicinity of the oscillation frequency, and only at this frequency itself is the feedback sufficient for oscillation to occur. To any other frequency the overall feedback is negative. This means that harmonics of the oscillation frequency are actually degenerated and excellent waveform is thereby achieved.

In the interests of good waveform the amplification must be high, since the higher the gain the nearer the negative feedback can be made to approach 33⅓ per cent., and the greater the degeneration at harmonic frequencies. In obtaining high gain, however, the linearity of the amplifier must not be sacrificed. Analysis indicates that a reasonable minimum value for the amplifier gain is about 30.

Feedback

Since a two-stage amplifier was specified to permit the application of positive feedback through the RC network, the negative feedback must be applied to the cathode of the first stage. This is done in the manner shown in the skeleton circuit diagram of Fig. 5. The resistor R_2 is the bias resistor

LIST OF COMPONENTS

R1—2500Ω preset w.w. variable, 5 watt.
R2—230 volt, 15 watt Pygmy lamp (vacuum).
R3, R4, R9, R10—39 kΩ, ½ watt, 5% tolerance.
R5, R6, R11, R12—390 kΩ, ½ watt, 5% tolerance.
R7, R8, R13, R14—3.9 MegΩ, ½ watt, 5% tolerance.
R15—27 kΩ, 1 watt.
R16, R22, R25—47 kΩ, ½ watt.
R17, R21—1 MegΩ, ¼ watt.
R18—560Ω, 1 watt.
R19—10 kΩ, 2 watt.
R20—2.2 kΩ, 10 watt.
R23—3.3 kΩ, ½ watt.
R24—4.7 MegΩ, ¼ watt.
R26—3.3 MegΩ, ¼ watt.
R27—68 kΩ, 1 watt.
R28—2.7 kΩ, 1 watt.
VR.1—1 MegΩ volume-control.
C1, C10—32 μF., 450v., electrolytic.
C2—4-gang 500 pF., connected as 2-gang 1,000 pF.
C4, C5—115 pF. ceramic trimmer.
C6, C7, C9, C11, C12—0.5 μF., 500v.
C13—30 pF. ceramic trimmer.
C14, C17—16 μF., 500v. electric.
C8, C15—50 μF., 12 V.W.D.C.
S1—2-pole 3-way ceramic switch.
S2—D.P. 2-way toggle switch.
S3—D.P. mains switch.
L1—20H. 60 mA. choke.
T1—350-0-350, 60 mA., 6.3v. 2.5a., 5v. 2a.

VALVES

V1—SP61, EF50, 6AC7.
V2—6F6, 6V6, 6G6, 6Y6, 6B4, 6L6, etc.
V3—6SN7.
V4—6J5, 6C5
V5—5Z4 (or any 5v. rectifier).

of the first valve and R_1 is a preset variable resistor whose value must be rather more than twice that of R_2. If R_2 is a non-linear device whose resistance increases with increasing voltage, an increase in the amplifier output will produce greater current in R_2 and its resistance will rise, thereby increasing the negative feedback and reducing the gain of the amplifier. In this manner some stabilisation of the amplitude of the output is achieved. A suitable non-linear resistor for R_2 is a low-wattage lamp.

Now consider the design of the amplifier itself. We have already seen that the gain should be high. The detailed design of the first stage is largely governed by the resistance of the lamp selected for R_2. The valve must have that value of anode load which will provide correct biasing conditions with the lamp in the cathode circuit as bias resistor. R_2 will generally be fairly low (about 600 ohms under working conditions in the actual design), and this means that a low anode load is necessary. To obtain adequate gain a high-gm tube should be used in this position. Television type pentodes are very suitable, but the curvature of the characteristics of variable-mu valves prohibits their use in this type of circuit.

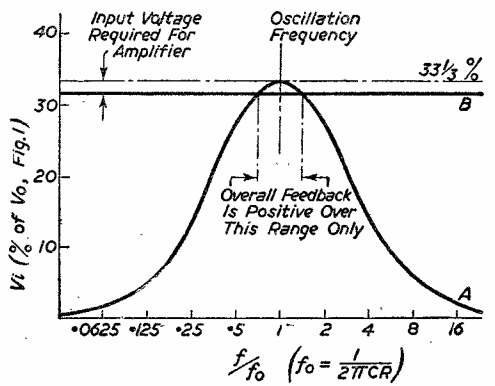


Fig. 4.—Variation of feedback with frequency. Curve A: Positive feedback via R.C. network (inphase component); Curve B: Fixed negative feedback via R_1R_2 (Fig. 5).

In the case of the second stage the AC load is very small, being almost entirely that of the low-resistance negative feedback network. Thus a valve should be chosen which will deliver a large voltage swing into a small load. Output pentodes and triodes are the logical choice for this purpose. The coupling capacitor C_3 must have a low reactance at the lowest oscillation frequency to avoid the introduction of appreciable phase shift. The actual reactance must be small in comparison with the load impedance, which may be of the order of 1,000 ohms or so. A 32 μF electrolytic capacitor has a reactance of about 200 ohms at 25 cycles. This value will be satisfactory. The reduction of phase shift also means that the coupling time constant between the two stages should be long, and the coupling capacitor will be of larger size than would be employed in normal amplifier practice.

Practical Design

Having covered the fundamentals, the features of the actual design may be considered. The main frequency control is a standard four-gang 500 pF capacitor, with the sections paralleled to give a two-gang 1,000 pF unit. Note that the common terminal of the capacitor is not at chassis potential, so the frame of the unit is insulated by mounting the whole unit on small porcelain stand-off insulators. The drive to the shaft must also be effected through an insulating coupler. The stray capacitance of such an arrangement is high, but this is relatively unimportant. What is important, however, is that these strays are unbalanced, so a large capacity trimmer (100 pF) is connected across each section of the capacitor. This still permits a 11 to 1 capacitance swing, which in turn allows a 10 to 1 frequency variation in each range, with 10 per cent. allowance for overlap. If we assume the max. capacitance to be 1,000 pF and the minimum required frequency to be 25 c/s, we obtain 8 megohms as the value of R on range 1. This value can conveniently be made up of two 3.9 megohm resistors in series. The two values of R should be closely matched, and if possible checked on an ohmmeter before assembly. If available close tolerance resistors should be

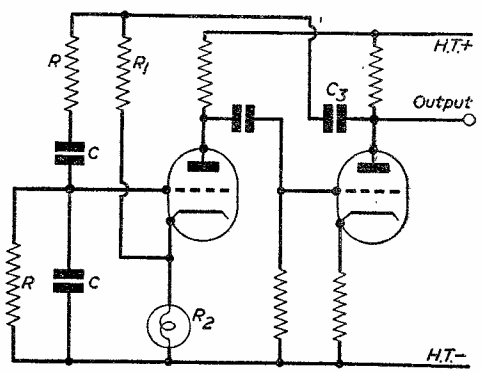


Fig. 5.—Basic oscillator circuit.

employed. Correct matching is of more importance than strict adherence to the specified value, within limits. If, however, the deviation from the correct value is excessive there will be gaps between the different ranges.

Resistance values for the two higher ranges are obtained by dividing those for the lower range by 10 and 100 respectively, giving values of 780 kΩ and 78 kΩ for these two ranges. Again, each of these is made up by combining two resistors. Since on the low-frequency range the resistance values are high, inadequate insulation will cause unbalance. The wiring should be well clear of chassis and panel, and a ceramic switch, although not essential, is desirable. The same remarks apply to the actual capacitor insulation, ceramic being recommended.

The non-linear bias resistor actually used is a 230 volt 15 watt vacuum lamp, and the preset-negative feedback adjustment is provided by a 2,500-ohm wirewound potentiometer. This component is mounted on the chassis and, once adjusted, need not be touched again unless either the lamp or one of the valves is changed.

(To be continued)

On your Wavelength

by THERMION

Radio Bromwich

THE Show has come and gone, and its sponsors will be able to assess the results of their experiment in transporting the Exhibition from its natural home in London to the purlieus of Birmingham. There was general complaint amongst exhibitors and visitors from London of the awkwardness of the location. One arrived at Birmingham and then had to make arrangements for a further six miles' journey. Apart from that difficulty there was that of accommodation, the shortage of which was acute, and compelled many exhibitors and others to take accommodation ten or more miles away, which further added to travelling time.

It is doubtful whether the Midland people really wanted the exhibition. No doubt a deciding factor in holding it at Bromwich was that people in the West of England would be anxious to see the television exhibits; another deciding factor was the cheaper rate at which the hall could be hired for the purpose as compared with Olympia. As these Exhibitions are intended to run at a profit the organisers must have been disappointed, for there were less than 100 exhibitors and there was nothing spectacular in the way of gate. However, these experiments have to be tried, and I understand that next year the exhibition will be held in London.

I have always felt it to be a mistake to tie the name of an exhibition with a particular building. Radiolympia is a nice euphonious portmanteau word which describes the nature of the exhibition and its location at once. When, however, the exhibition is located elsewhere the difficulty of a fresh title arises, and I think the organisers have been wise to alter the title to National Radio Exhibition, which leaves them free to hold it anywhere. Thus, should the owners of exhibition buildings prove too grasping in their financial demand they have not in their hands the powerful weapon that the name of the exhibition is tied to the building.

The organisers this year did a splendid job of work, but it seemed to me a much smaller exhibition than hitherto; it lacked the atmosphere of previous shows, and on the whole was disappointing in its results. Perhaps too much emphasis was laid on television, which is selling itself in the Midlands area and was therefore not in need of the powerful fillip which an exhibition gives to a particular demand.

Earls Court is to be the venue of the next exhibition, and this is better than Olympia in that it has better parking arrangements, and is roomier. It remains to be seen whether the industry can fill such a vast space, for it creates a bad impression when an important industry is stowed away in the corner of a large building. Earls Court is to be the venue for 1951, 1952 and 1953—if a succession of strikes of stand fitters, electricians, gasmen, busmen, railmen, dockers, and electrical workers does not prevent them. And, of course, there is always the possibility that a strike of papermakers or printers may prevent us from fulfilling our function of reporting them!

B.B.C. Interference

I AM not referring to interference of an electrical source, but to the manner in which the B.B.C. is interfering in matters which are not their concern, such as language and religion. If we are not careful the B.B.C. will entirely change the English language, and may produce a bible of its own. It has already produced a vocabulary of its own and decided upon pronunciations which do not agree with any standard dictionary. Who is to decide which is right—the Oxford Dictionary or the B.B.C.?

Parsons have been teaching the agreed interpretation of the Bible and its various parables. The B.B.C. in some religious broadcasts has given interpretation to some passages in the world's best seller which does not agree with any of the accepted religious creeds.

There should be some clause in the B.B.C. Charter to prevent this interference with national beliefs and with our national language. The pronunciation of the English language should be decided by Englishmen alone, and not by Scotsmen, Irishmen, Welshmen, or foreigners.

A School's Research Centre

THE announcement that a School's Television Research Centre is to be established at Stratford Green Secondary Boys' School intrigues me, in view of its aims, which are:—

1. To study the physical conditions in which television can best be used as a Visual Aid in schools.
2. To test current production models, and projection models as they become available, and to report in the visual aids and educational press upon their suitability for school use.
3. To act as a proving ground for prototype equipment.
4. To measure objectively the response and retentivity value of specific programmes, and thus try to discover how children can best learn from the medium of television.
5. To collate and pass on to the Schools Broadcasting Council the results of all such research, in order to ensure a good start on the right lines for the Schools Television service.
6. To create a cadre of teachers with a knowledge of the technical and educational possibilities and limitations of the medium, to ensure thorough liaison with the programme planners and producers of the Schools Television Department when this is formed.

I do not know the self-appointed savants at the Stratford Green Secondary School, nor do I acknowledge that they are qualified to set themselves such a task.

T.1083 Coil Unit

Modifications for Use as an Aerial Tuner

By A. W. MANN

THE writer recently carried out a series of experiments with an ex-service type plug-in transmitter coil unit. The classification of this unit is officially as follows: Trans. T.1083, coil M.O., range A 15,000 kc. to 10,000 kc., Ref. No. 10D/8469.

When I first examined one of these units, its possibilities as an aerial tuner for use with the R1116A and R1155A receivers were obvious. Some modification was, of course, necessary. The latter having been carried out, tests were run. Used in conjunction with the above receivers and the folded V beam indoor aerial the results obtained have proved most satisfactory.

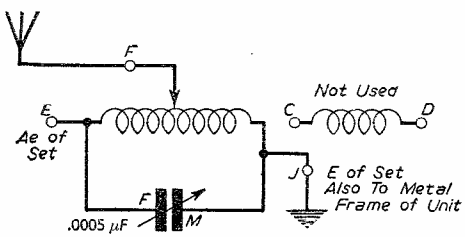


Fig. 1.—Circuit of the Coil Unit.

The Original Unit

In its original form, the unit consists of a metal panel with two small dials marked M/O Tuning and Coupling, respectively. The metal front panel, and a back plate of insulating material, together with four plated spacing rods, form a cradle, within which is mounted the supporting frame of a 2½in. double-spaced coil of heavy-gauge, silver-plated wire.

So far as the writer is concerned, the most interesting feature of this unit is the mechanical arrangements which enable one to tap the coil at any point. A coarse pitch screw passes through the insulated centre spindle. By turning the control knob marked M/O Tuning a wipe contact arm travels from end to end of the coil.

Coupling

The knob marked Coupling operates a five-turn coupling coil. This swings in two bearings, and is adjusted by worm and worm wheel mechanism. A tapping switch is fitted to the coupling coil.

Calibration

The scale of the M/O tuning control is engraved 0-340-0. An 0-to-12 revolution counter is also incorporated. The coupling control dial is 0 to 9, and the scale of the spindle revolution counter is 0 to 10.

The two coil dials can be locked at any setting.

Behind the panel is a two-pin plug. Other components mounted on the framework are a small H.F. choke, a five-plate air-spaced fixed condenser, and a .00007 μF. fixed condenser.

Modification

Unsolder all leads to the above components, and after doing so remove them. Unsolder all leads to the pins A, F, E. C, D, J should be left as they are, J being coupled to the frame by a short lead. Unsolder the fixed taps to the outside of the silver-plated coil.

As it now stands, we have the main tuning coil, coupling coil and controls. Obviously, to use this unit to full advantage it should be tuned. Between the top edge of the metal panel and the end plate of the coil former there is a depth of 2in. Sufficient space to mount a small tuning condenser of suitable capacity.

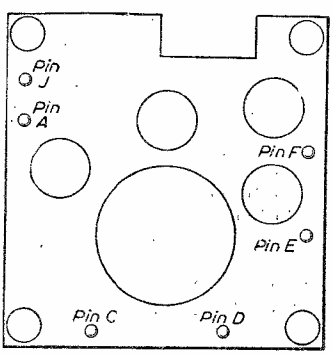
While mica dielectric type tuning condensers are not recommended for short-wave receivers, there is no reason why one should not be used in this tuner. If you have an air-spaced one which will fit in the space available, use it. I have used one of the former type because it was to hand.

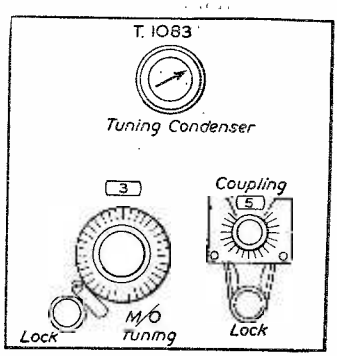
The Theoretical Circuit

Let us now examine the theoretical circuit shown at Fig. 1. We have the silver-plated coil tuned with a .0005 μF. variable condenser. As shown, the aerial down lead is clipped to pin F. The latter is coupled via a short lead to the adjustable tap at the rear of the coil former. One end of the coil is coupled to the aerial terminal of the set, via pin E. The other end to earth via pin J.

This tuner can be used with or without the earth connection, but with the earth connection tuning is sharper.

In the present model I have not used the coupling coil. To the doublet aerial user it may suggest possibilities. There are a number of ways in





Figs. 2 and 3.—Rear and front of the 1083 Coil Unit.

which it might be used, and these may be investigated at some future date.

Marking Out

No difficulty should be experienced in wiring up the unit. All joints, however, should be soldered. Care should be exercised in marking out and drilling the hole in the metal panel for the tuning condenser mounting.

Tuning Dial

In the original model I have used a plain or direct drive tuning knob, as a suitably small slow-motion dial was not available. While the latter type is not essential in this case, I would prefer this kind. If you happen to have one to hand, by all means use it.

Fig. 2 shows the end plate, lettered A, J, C, D, E

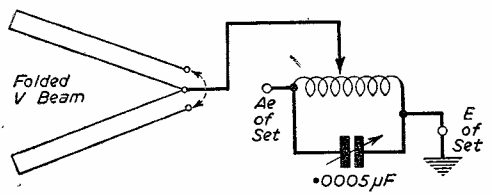


Fig. 4.—The Unit connected to the indoor aerial recommended by the author for short-wave working.

and F. These pins could later be replaced by sockets or terminals, according to choice. Fig. 3 shows the front panel, complete with condenser tuning knob. Also the "turns in circuit" counter, and coupling coil shaft revolution counter, together with the dial locking mechanism.

The Tuning Coil

Looking at this coil it appears at sight to be of fourteen turns. As stops are fitted to prevent overrunning of the slider, only twelve turns are used.

Former Construction

When making the low-loss built-up type of coil former it is amateur practice to wind the required number of turns over the outside in suitable slots. The former used in this unit is slotted on the inside pillars, the coil being sprung into the slots and clamped into position.

The adjustable wipe contactor, which slides round the inside of the coil, removes once and for all the usual difficulties associated with tapping clips and ensures perfect contact, both mechanically and electrically.

Fig. 4 shows how the tuner is used in conjunction with the folded V beam indoor aerial. In this instance the down-lead is coupled to the centre tapping position. It can, of course, be used clipped to the ends, individually, or with them bridged via a short length of wire as shown by dotted line.

The R1116 Receiver

Assuming that the receiver is the R1116 or 1116A, the tuner may be stood on top of the metal case. The earth lead of the tuner being taken to the nearest bolt of the receiver case.

Quite apart from its performance on the short-wave broadcast bands this tuner is very effective on the amateur bands. Tapping points are as follows: 80 metres, eight turns; 40 metres, four turns; 20 metres, one and a half to two turns.

Tuning Procedure

Set tuner variable condenser to zero position, i.e., moving vanes fully out. This gives us minimum capacity. Tune in the desired signal on the receiver (R1116). Switch out A.V.C. Tune the aerial tuner to resonance point, i.e., maximum signal lowest noise. Now make a slight adjustment to the aerial tuning condenser of the R1116 receiver. This will result in a slight increase in signal strength. Switch A.V.C. in again.

With a little practice the operator will find it unnecessary to switch out the A.V.C. Equally good results have been obtained so far as extra signal gain is concerned, using an R1155A receiver. The folded V beam aerial being used with this and the R1116 receiver. In addition, tests were also carried out in conjunction with a 75ft. vertical aerial. There is no reason why this tuner should not be used with any type of short-wave receiver and aerial.

Aerial tuning units appear difficult to operate at first. This one, however, is not difficult, and there are no tapping clips to adjust.

The folded beam V aerial is an efficient system, as a recent letter in the correspondence columns written by an American reader implies. Those who can obtain and modify one of the units specified will have to hand the means whereby its efficiency can be further improved.

The writer has received an ex-service unit of a different type, which should prove equally suitable for conversion on similar lines and, should experiments and results justify it, it will be dealt with in detail at some future date.

For test purposes, using the modified unit outlined in this article, readers may use spring clips for connection between the various leads and associated pins. For permanent use, however, plugs and sockets or alternatively terminals are recommended.

Giant Model Valve

A FIVE-FOOT, cut-away model of a modern Mullard miniature, all-glass television valve, will be included in a special Exhibition for the Blind and Partially Sighted which is to be held at the Science Museum, South Kensington, London, S.W.7, from November 11th to December 10th.

This exhibition has been organised by the Science Museum in co-operation with the National Institute for the Blind, and a selection of exhibits covering a wide field of popular science and engineering subjects will be available for examination by the blind visitors.

It is thirty times as large as the actual valve, and every detail is exactly to scale. It is specially cut away to show the complex, multi-electrode system inside. It will thus be possible for the blind visitors to feel the various parts, and with the aid of a descriptive label, transcribed in braille, they will be able to learn about the construction of the very latest valves used in television receivers.

Radio Valve Review—6

Output Valves are Dealt With This Month

THE early-stage valves in a receiver are concerned with abstracting from the R.F. signal received at the aerial the audio-frequency information comprising the programme material, and with amplifying the A.F. signal thus obtained. Amplification in the earlier stages is thus voltage amplification, and no considerable amount of power has to be dealt with by the valves concerned.

In the final stage of a receiver, however, sufficient audio-frequency power must be provided to operate the sound-reproducing unit—the loudspeaker.

When, in the early days of broadcasting, headphones were the normal form of sound reproducer, the amount of audio-frequency power required was very small—a matter of a few milliwatts, and the final or "output" valve could well be of the same general-purpose type as used for voltage amplification. With the coming of the loudspeaker, however, much greater power output was necessary, for three reasons. In the first place the moving system of a speaker is, of course, larger and heavier than that of a headphone and requires more power to move it; secondly, the greater volume of sound expected from a loudspeaker obviously demands a larger A.F. power input; and thirdly, it was soon recognised that although the *average* power corresponding to reasonable volume for normal listening might be something under half a watt, *peak* values of several watts are required for adequate reproduction of certain parts of the programme—particularly the sudden sounds known as "transients," such as those corresponding to the commencement of the crash of cymbals or a drum beat.

Unless, therefore, the output valve is capable of giving substantially linear amplification up to this extra power when needed, the reproduction will be unnatural.

Thus it came about that special "power" and later "super-power" valves were developed. To-day these terms are seldom used, final-stage valves being generally referred to as "output" valves.

The essential requirement for an output valve is that the audio-frequency power generated in its anode circuit shall be exactly proportional to the audio-frequency voltage applied to its control grid within the power range required by its particular application.

A secondary requirement, which is to some extent bound up with the main requirement, is that the desired power output should be produced for as small an input signal voltage as possible.

The peak power output required for a normal mains-operated broadcast receiver can be taken as between 1¼ watts and 5 watts. Other things being equal, the higher the output rating the more natural will be the reproduction, but it must be remembered that the characteristics of the loudspeaker, the values of the circuit components (particularly the time-constants of resistance capacity combinations) and the linearity of the preceding voltage amplifying stages are equally important factors.

For battery-operated equipment, output valves rated at from ¼ to ¾ watt output are normal, the limitation being imposed by the cost and bulk of H.T. batteries.

Concerning linearity, it is customary to quote values of power output at which the total distortion does not exceed a certain value—usually 10 per cent. It cannot be emphasised too strongly that a power output rating for which the corresponding distortion is not quoted is of no practical value.

The sensitivity of a power valve is best expressed, for practical purposes, as the A.F. signal voltage [V_{in} (R.M.S.)] which must be applied to the control grid to produce the rated power output.

Triodes Versus Pentodes

The power output of a valve is expressed in watts, and is equal to the R.M.S. value of the A.F. voltage across the anode load multiplied by the R.M.S. value of the A.F. component of the anode current.

It is clear, therefore, that a given output power can be represented either by a large A.F. voltage drop across a load in which a small A.F. current component flows, or by a much smaller A.F. voltage drop across a load in which a large A.F. current component flows.

Early output valves were triodes; and triodes, being essentially low impedance valves, must have comparatively small anode loads. The useful output of a triode therefore corresponds to a large A.F. current swing and a small A.F. voltage swing. Moreover, triodes are comparatively insensitive and to obtain a large A.F. current swing in a triode, a comparatively large A.F. grid voltage is required.

With the coming of the pentode, however, other and important possibilities emerged. In the first place the pentode is essentially a high impedance valve and must work into a comparatively large anode load. Its useful output therefore corresponds to a comparatively large A.F. voltage swing and a comparatively small A.F. current swing—which makes for economy in H.T. supply. Furthermore, pentodes are inherently more sensitive than triodes, and the desired A.F. current swing can be obtained with a comparatively small A.F. grid input, which makes for economy in the amount of voltage amplification required in the earlier stages.

Thus it is that preferred types of output valve to-day are invariably pentodes, although a few of the earlier triodes are still available for maintenance purposes.

In the following tables the essential data for output valves is listed. Only valves of types suitable for use in domestic broadcast receivers are included, no reference being made to valves suitable for the output stages of public address

or other large amplifiers, or for time-base output valves in television receivers. This data represents recommended operation conditions for normal receivers. First selection of a pentode for a specific application should, of course, be on the basis of its output rating, taking into consideration the percentage distortion. Of two or more valves of equal output performance, that having the highest sensitivity (lowest value of V_{in}) is to be preferred.

Type	Description or Application	Construction and Base	V_f (V)	I_f (A)	V_a (V)	V_{g2} (V)	$-V_{g1}$ (V)	R_k (Ω)	I_a (mA)	I_{g2} (mA)	R_a (KΩ)	V_{in} (V) r.m.s.	P_{out} (W)	D_{tot} (%)
	Mullard													
	(1) BATTERY TYPES													
	Equipment Types													
DL66	Sub-miniature pentode	B5A ..	1.25	0.015	22.5	22.5	1.4	—	0.3	0.075	75	0.85	0.0027	10
DL71	Sub-miniature pentode	B8D ..	1.25	0.025	45	45	1.25	—	0.6	0.15	100	0.88	0.0063	10
DL72	Sub-miniature pentode	B8D ..	1.25	0.025	45	45	4.5	—	1.25	0.4	30	2.65	0.0195	10
DL92	Miniature pentode ..	B7G ..	2.8	0.05	90	67.5	7	—	6.1	1.1	8	5.0	0.235	12
			1.4	0.1					7.4	1.4			0.27	
DL94	Miniature pentode ..	B7G ..	2.8	0.05	90	90	4.5	—	7.7	1.7	10	3.2	0.24	7
			1.4	0.1					9.5	2.7			0.27	
	Replacement Types													
DL33	Pentode	Octal ..	2.8	0.05	90	90	4.5	—	8.0	1.0	8	3.2	0.23	8.5
			1.4	0.1					9.5	1.3			0.27	6.0
DL35	Pentode	Octal ..	1.4	0.1	90	90	7.5	—	7.5	1.6	8	5.3	0.24	10
KL35	Pentode	Octal ..	2.0	0.15	135	135	4.5	—	5.6	—	19	3.0	0.34	10
KLL32	Double pentode ..	Octal ..	2.0	0.3	120	120	10.2	—	3.3	0.45	16	7.3	0.94	2.5
PM2A	Triode	4-pin ..	2.0	0.2	135	—	6.0	—	5.0	—	7	—	0.15	—
PM2B	Class B double triode..	7-pin ..	2.0	0.2	120	—	0	—	3.0	—	14	—	1.25	—
PM202	Triode	4-pin ..	2.0	0.2	150	—	14.0	—	14.0	—	3.7	—	—	—
PM22A	Pentode	5-pin ..	2.0	0.15	135	135	4.5	—	5.6	—	19	3.0	0.34	10
PM22D	Pentode	5-pin ..	2.0	0.3	135	135	2.4	—	5.0	0.8	24	—	0.3	—
QP22B	Double pentode ..	7-pin ..	2.0	0.3	120	120	10.2	—	3.3	0.45	16	7.3	0.94	2.5

Type	Description or Application	Construction and Base	V_h (V)	I_h (A)	V_a (V)	V_{g2} (V)	$-V_{g1}$ (V)	R_k (Ω)	I_a (mA)	I_{g2} (mA)	R_a (KΩ)	V_{in} (V) r.m.s.	P_{out} (W)	D_{tot} (%)
	(2) A.C. MAINS TYPES													
	Equipment Types													
EBL31	Double diode pentode	Octal ..	6.3	1.5	250	250	6.0	150	36	5	7	3.6	4.3	10
EL32	Pentode	Octal ..	6.3	0.2	250	250	18	—	32	5	8	10	3.6	10
EL33	Pentode	Octal ..	6.3	0.9	250	250	6	150	36	4	7	4.2	4.5	10
EL41	Pentode	B8A ..	6.3	0.7	250	250	7	170	36	5.2	7	3.7	4.2	10
EL42	Pentode	B8A ..	6.3	0.2	225	225	12.5	360	26	4.1	9	7.2	2.5	10
EL91	Pentode	B7G ..	6.3	0.2	250	250	13.5	680	16	2.4	16	5.3	1.4	10
	Replacement Types													
EBL21	Double diode pentode	B8G ..	6.3	0.8	250	250	6	150	36	4.5	7	4.2	4.5	10
EL22	Pentode	B8G ..	6.3	0.7	250	250	7	140	44	5.2	5.75	4.7	5.2	10
EL3	Pentode	P base ..	6.3	0.9	250	250	6	150	36	4.0	7	4.2	4.5	10
EL35	Pentode	Octal ..	6.3	1.35	250	250	15.5	—	72	8.0	2.5	13.0	6.0	10
ACO44	Triode	4-pin ..	4	1.0	300	—	38	760	50	—	2.3	28	3.5	5
DO30	Triode	4-pin ..	4	2.0	500	—	134	—	60	—	6	—	11	—
PM24A	Pentode	5-pin ..	4	0.275	300	200	22.5	—	20	4.5	15	—	2.8	10
PM24M	Pentode	5-pin ..	4	1.1	250	250	17	—	30	5.7	7	9.0	2.8	10
PEN4DD	Double diode pentode	7-pin ..	4	2.25	250	250	6	—	36	5.0	7	3.6	4.3	10
PEN4A	Pentode	7-pin ..	4	1.95	250	250	5.8	145	36	5.0	8	—	3.8	10
PEN84	Pentode	7-pin ..	4	2.1	250	275	14.0	175	72	7.0	3.5	8.2	8.8	10
	(3) D.C./A.C. MAINS TYPES													
	Equipment Types													
UL41	Pentode	B8A ..	45	0.1	170	170	10.4	—	53	10	3	6.0	4.25	10
	Maintenance Types													
UBL21	Double diode pentode	B8G ..	55	0.1	200	200	13	200	55	9.5	3.5	6.2	4.8	10
CBL1	Double diode pentode	P base ..	44	0.2	200	200	8.5	167	45	6.0	4.5	5.0	4.0	10
CBL31	Double diode pentode	Octal ..	44	0.2	200	200	8.5	167	45	6.0	4.5	5.0	4.0	10
CL4	Pentode	P base ..	33	0.2	200	200	8.5	167	45	6.0	4.5	5.0	4.0	10
CL33	Pentode	Octal ..	33	0.2	200	200	8.5	167	45	6.0	4.5	5.0	4.0	10
PEN36C	Pentode	7-pin ..	33	0.2	200	200	8.5	167	45	6.0	4.5	5.0	4.0	10

Designing Your Own Receiver—3

Advice and Guidance for the Beginner

By STANLEY BRASIER

WITH the position of all components decided upon, fixing holes may be marked or pricked on to the graph paper and it will be noted that the marking of points which demand measurement are greatly facilitated by the 1in. squared paper, which is subdivided into eighths. When all the fixing holes have been marked the required diameter of each hole is marked beside each point and the paper is now ready to be used as a template for cutting and drilling the metal. At this point it will be noted that the chassis may be drilled in its flat state, a fact which anyone who has drilled a made-up chassis will appreciate. Another advantage of the template is that location points are merely punched through on to the metal and, especially in the case of a front panel, obviates scribing lines on any surface.

Chassis

The bending of the sides of the chassis should be undertaken with some care, and may be facilitated by the intelligent use of suitable wood blocks acting as clamps and held together by coachbolts. The wood should be about 3in. wide and 1in. thick and suitable lengths are drilled along the centre line of their width with holes spaced about 1½in. apart to take the bolts. Thus, any length of metal may be sandwiched between the wood, the end bolts tightened, and the centre portion gripped in a vice or an ordinary wood clamp.

Tools

Such work as the building of a receiver entails should not be beyond the capabilities of the average handyman given a fair selection of tools. These should include, among the more general ones, a hand drill complete with the necessary drills up to ¼in. diameter (above this size ⅜in. and ½in. are useful) and a hand brace. In connection with the latter a tank cutter is a most useful tool for cutting out circles for valveholders, meters, etc., and is adjustable for apertures between 1in. and 4in. diameter approximately. Taps and dies from 2 B.A. to 8 B.A. are practically a necessity, together with an assortment of flat and half-round files for metal work. An automatic punch, shears, straight and possibly curved, together with a hacksaw will be required. A very useful saw which is handy for small work is the junior hacksaw of the type where the blade is sprung into the frame.

Soldering

A soldering iron of medium size is also a necessity, as also is the ability to acquire the art of soldering. Since this acquisition cannot be bought, however, it is essential that the constructor should learn the correct technique. One badly soldered connection in a receiver can cause a whole lot of trouble and it is easy to avoid such things if the correct methods are observed. Liquid fluxes of the "killed spirit" variety should be avoided in any form of electrical wiring, although it is useful for soldering joins in chassis, etc., and for "tinning" the working area of the soldering iron bit. This is the first essential, and if necessary the copper bit should be cleaned or filed to present a bright surface on all its aspects. Then after dipping in liquid flux, the bit is heated to approximately working temperature and again plunged momentarily into the flux. Solder is then quickly applied so that it spreads thinly and evenly over all surfaces, again dipping into the flux if necessary.

When making joints Multicore resin-cored type of solder is most convenient and efficient. Nevertheless, it should not be thought that its use disposes of the idea of cleanliness with regard to the surfaces being soldered. For flux, however efficient, does not dispose of dirt or oxidisation already at the site of the joint. It merely prevents oxidisation of a clean surface during the process of soldering. In other words, any surfaces to be soldered should be perfectly clean before an attempt is made and it is sometimes advisable to "tin" each surface before bringing them together. Often, tinned copper wire, which is used for wiring, etc., has a slightly oxidised surface and it is necessary to clean and "tin" the end separately before making the actual joint. Some wire-ended resistors also need this treatment.

The heat of the iron is also an important factor and in this respect one of the electric type is always efficient. The appearance of a good joint cannot be mistaken. It should run almost instantaneously and present a perfectly smooth and bright appearance—as opposed to the bad joint where the surface is uneven, pitted and sludgy. Receiver building should not be attempted until one is proficient in the art of soldering.

Wiring

The wiring of a receiver must be undertaken with great care. The push-back type of insulated wire may be used, but usually a neater effect is obtained by using tinned copper wire insulated by lengths of special sleeving. In general, wires should be taken via their shortest route, but "cold" wires may be taken by a more circuitous route if necessary. Grid and anode leads should not run parallel to one another, but if the layout has been arranged with foresight, this question will not arise. Earthing points should also be short and direct and in this respect it is useful—especially when using an aluminium chassis—to fix a thick copper wire down the centre of the underside of the chassis, firmly clamped in the centre and at each end by 4 B.A. bolts and nuts. This provides a convenient and efficient earthing point which is handy for all components. It will be appreciated later that certain items should not be soldered into position too permanently during the initial wiring process. These consist of resistors which may need substituting.

Components sometimes depend upon their mechanical fixation to the chassis for their electrical

(*Continued on page* 21)

connection, and in such cases much trouble can be caused if the contacting surfaces are not clean or free from oxidisation. Faults arising from such omissions are particularly elusive. Ganged tuning condensers come into this category and it is always advisable to take advantage of the earthing strips usually provided.

One should not rely too much upon the practice of suspending components in the wiring; tag strips, which are easy to fix, ensure safe and convenient anchorage for "free" connections. Rubber grommets should be used where wires pass through the chassis and make for a neat appearance together with the primary object of avoiding any chafing of insulation. The polarity of electrolytic condenser connections should be particularly noted.

It is essential, when making connections to mains dropping resistors, to wind the wire around the large soldering tags provided before soldering. Owing to the considerable heat generated by these components there is always the danger of the solder partially melting and of the lead coming adrift. And since the wire may be at mains potential it is as well to guard against this consequence. If holes are provided in the connection tags it is much better to rely on the nut and bolt method of fixation.

It should be made a rule to check panel components which are to be mounted on metal, to ascertain that their connecting points are isolated from fixing bushes, etc. Finally, the completed wiring should be carefully checked.

The professional receiver designer would probably have prepared layout and wiring diagrams from his theoretical circuit but this is not essential in the case of the amateur and we will now assume that the receiver has been built and wired ready for the great moment of testing. This immediately brings to mind testing instruments, and while it is possible to get the receiver working fairly efficiently without such aids, their use facilitates the procedure to an enormous extent. In any case, if the amateur is at all serious minded he will appreciate that at least certain instruments will be essential in the need to pursue his hobby. For this reason the subject will be dealt with at a later stage in this series.

Testing

Before connecting the receiver to the mains it is very advisable to take a resistance reading check across the smoothing condensers. The needle of the ohm-meter should give a momentary "kick," then fall back to a reading of something slightly less than a megohm. This will ensure that no low resistance path or short circuit exists across the rectifier—thus preventing the component from premature damage. It should be remembered that if there is a fixed potentiometer feed to one of the valve electrodes this must be considered when taking the ohm-meter reading.

The receiver may now be connected to the mains supply and aerial, and time given to allow the valve cathodes to warm up. During this period attention should be directed to (usually) the underside of the chassis to ascertain that no immediate harm is taking place.

(To be continued)

Dual Diversity Reception

FOR consistent reception over long ranges, where fading can cause an interruption in signal strength, diversity reception is of great assistance. Broadly this idea consists of the use of two receivers connected to aerials situated some distance apart, and the output of the two receivers is mixed or passed to special circuits so that a more or less steady signal is received on 'phones or speaker.

A modern installation making use of this arrangement is now available from the Plessey Company, and is built to International Acradio Specification. It is primarily designed for ground/air communication, but may be used wherever consistent reception over long range is essential, in the frequency band 2.20 Mc/s.

The complete equipment comprises two identical H.F. receivers, an electronic switching unit—each with an integral power supply—and a local loudspeaker unit. All units may be mounted in a standard 19in. rack.

The superheterodyne receivers cover the operating band in four ranges by plug-in tuning units which incorporate their own calibrated tuning dials. They are designed basically for crystal-controlled operation, the crystal oscillator operating on its fundamental over the entire range. For frequency diversity reception each receiver functions as a crystal-controlled unit on the frequency selected. When it is desired to operate a space diversity system, both receivers are controlled by a common R/F oscillator. The R/F oscillator in either receiver may be selected for this purpose by a switch mounted next to the oscillator coil in each. This switch also provides a change-over from crystal control to manual tuning.

Gating Circuit

The audio output from each receiver is fed into the electronic switching unit via a gating circuit which is controlled by an electronic switch. This switch is in turn controlled by amplified A.G.C. voltages received from the two receivers, and ensures that the strongest incoming R/F signal is selected at all times. The audio component of this signal is thus passed through the gating circuit and the succeeding A.F. stages to the loudspeaker.

With the exception of the loudspeaker unit, all units have a hinged front cover providing ready access to valves, plug-in tuning units, etc. These latter have staggered pin arrangements, making it virtually impossible to plug the unit into a wrong position.

Quality Amplifier for Record Reproduction

An A.C. Unit Incorporating a 3-channel Tone-control Circuit

By F. BENSON

THIS amplifier was to be built as cheaply as possible, and it was therefore decided to adhere to a circuit whereby most of the material, especially valves, could be obtained on the ex.-W.D. market, and also to use components on hand. The cost was just under £10.

In the circuit diagram V1 is the pre-amplifier, being fed by a lightweight pick-up coupled by a matching transformer. V2, V3 and V4 is a 3-channel tone-control circuit, V2 being a fixed bass boosting circuit, and V3 variable bass boosting. V4 is a variable treble cut circuit.

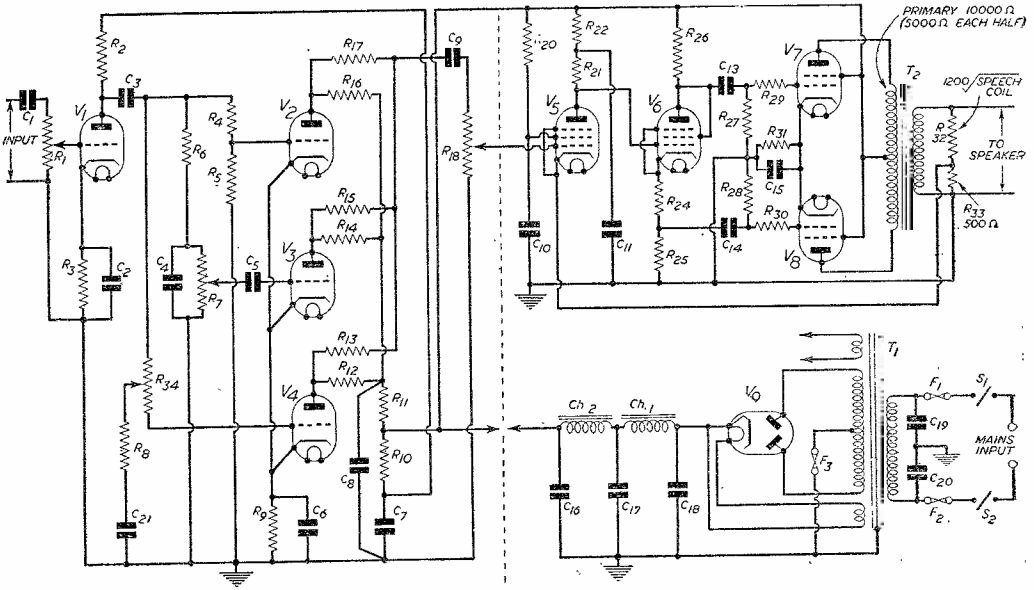


Fig. 1.—Theoretical circuit.

LIST OF COMPONENTS

R1, C5, C9, C13, C14, C19, C20	.1 μF	450 v. working
C2, C6	.1 μF	500 v. working
C3	25 μF	25 v. working
C4	.25 μF	450 v. working
C7, C8, C11, C18	.05 μF	450 v. working
C10	8 μF	500 v. working
C15	.5 μF	450 v. working
C16, C17	50 μF	50 v. working
C21	16 μF	500 v. working
	.001 μF	450 v. working Mica
R1	.5 M Ω	Pot'meter—Pre-amp. Control
R2	50 K Ω	½ w.
R3	2 K Ω	½ w.
R32	1200 Ω	Speech Coil
R4	1 M Ω	½ w.
R5	33 K Ω	½ w.
R8	10 K Ω	½ w.
R7, R34	.25 M Ω	Pot'meter Bass and Treble Control
R12, R14, R16, R25, R26	100 K Ω	½ w.
R9	1,750 Ω	1 w.
R10, R11	10 K Ω	1 w.
R13, R15, R17	500 K Ω	½ w.
R18	1 M Ω	Pot'meter Volume Control
R20	1 M Ω	1 w.
R21, R27, R28, R6	.25 M Ω	½ w.
R22	20 K Ω	1 w.
R24	5 K Ω	½ w.
R29, R30	500 Ω	½ w.
R31	250 Ω	5 w.
R33	500 Ω	1 w.
V1 — 6J5	T1—300-0-300 v. 120 mA. 6.3 v. at 5 a., 5 v. at 2 a.	
V2, V3, V4 — 6C5	T2—Speaker Transformer Anode to Anode 10,000 Ω	
V5 — 6J7	S1, S2—D.P.S.T. switch	
V6 — EF39	F1, F2—1.5 amp. fuse	
V7, V8—6V6	F3—150 mA. fuse	
V9 — 5Z4	20H 120 mA.	
CH1, CH2		

10 octal valve holders.
1 octal plug.
2 — 2 pin sockets (pick-up and speaker).

V5 is a further stage of amplification feeding the phase invertor V6. The push-pull output stage incorporates negative feedback from the speaker field to the cathode of V5. The output derived from this circuit will be approximately 8.5 watts. Various values for R32 and R33 can be tried depending on the amount of feedback required, but if R33 is short circuited to earth the output will be 10 watts.

The output transformer should be a good quality component and I suggest type M.O.15, price 35/- obtainable from the Premier Radio Company.

As an old discarded radio-gram cabinet was to house the amplifier, it was necessary to construct the power pack and main amplifier on one chassis, and the pre-amplifier with volume and tone control circuits on a smaller chassis. The large chassis was mounted at the foot of the cabinet and the pre-amplifier on the motor board. The speaker was mounted in a speaker chamber. The dotted line on the circuit diagram represents the boundary between the main amplifier and the pre-amplifier.

All grid leads were screened to ensure a minimum of hum, but this may not be necessary except in the case of the grid lead to V5. The grid leads from V6 to V7 and V8 including C13, R29 and C14, R30 should be kept well away from one another if not screened, as slight instability may occur if they are brought together. Should oscillation occur when the negative feedback circuit is employed, the secondary leads of the output transformer should be reversed.

Finally, a T.R.F. tuning unit was constructed to match this amplifier, but as local conditions vary throughout the country it is not proposed to go into details about this unit.

However, for those interested and wishing to experiment, two valves were used. The first being

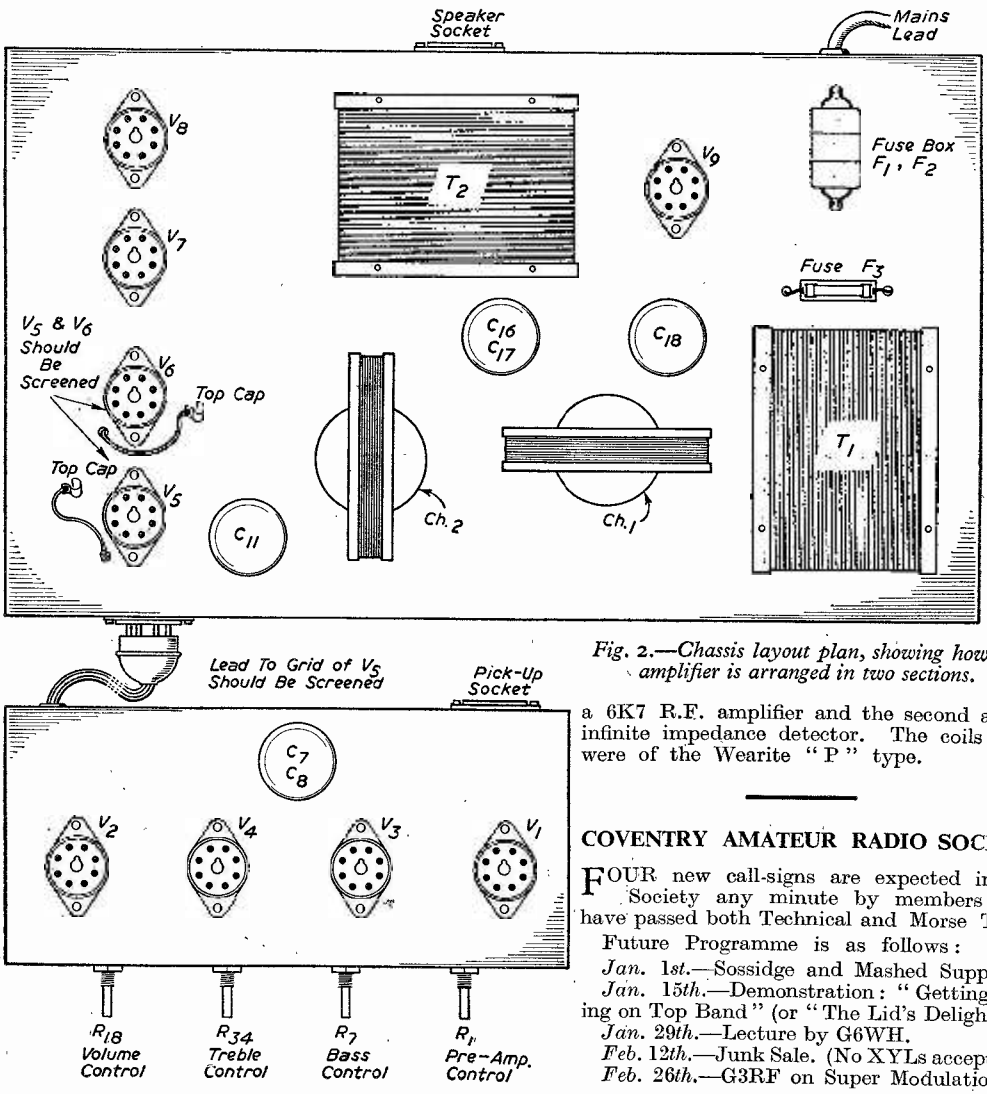


Fig. 2.—Chassis layout plan, showing how this amplifier is arranged in two sections.

a 6K7 R.F. amplifier and the second a 6C5 infinite impedance detector. The coils used were of the Wearite "P" type.

COVENTRY AMATEUR RADIO SOCIETY

FOUR new call-signs are expected in the Society any minute by members who have passed both Technical and Morse Tests.

Future Programme is as follows:

Jan. 1*st.*—Sossidge and Mashed Supper.

Jan. 15*th.*—Demonstration: "Getting Going on Top Band" (or "The Lid's Delight").

Jan. 29*th.*—Lecture by G6WH.

Feb. 12*th.*—Junk Sale. (No XYLs accepted.)

Feb. 26*th.*—G3RF on Super Modulation.

Making a Com

A Self-contained Vibrator Power

By P. D.

ORIGINALITY of design is not claimed for this set in any way, the article being written only to give details of the special items required, since these details can only be obtained by experiments which can take considerable time. Compactness is of paramount importance, so midget components are used wherever possible and for simplicity only the medium waveband is used.

The Receiver

The receiver is as simple as it can be for reasonable results, and is intended to give good entertainment on the more powerful stations; it is not intended to receive hosts of "foreigners." Examination of the theoretical circuit (Fig. 1) will show that it is a superhet with an H.F. stage. It will be noticed that only the aerial stage and the oscillator are tuned, the H.F. stage is coupled to the frequency changer grid with a resistance-capacity circuit. This arrangement gives increased signals without the complication of three tuned circuits. Obviously, the layout of the components is important in order to get them in as well as for stability and efficiency. The practical layout photograph (Fig. 2) gives all the information required. The detailed chassis drawings (Fig. 7) are for the components quoted in the components list, any deviation from this will mean alteration to this layout. The circuit described is for a 12-volt negative earthed supply, since this is most common on British cars. However, it is quite easy to modify the circuit to suit a 6-volt supply, and details are given later in this article. The H.F. valve is a 12SG7; the frequency changer a 12K8, the I.F. amplifier is another

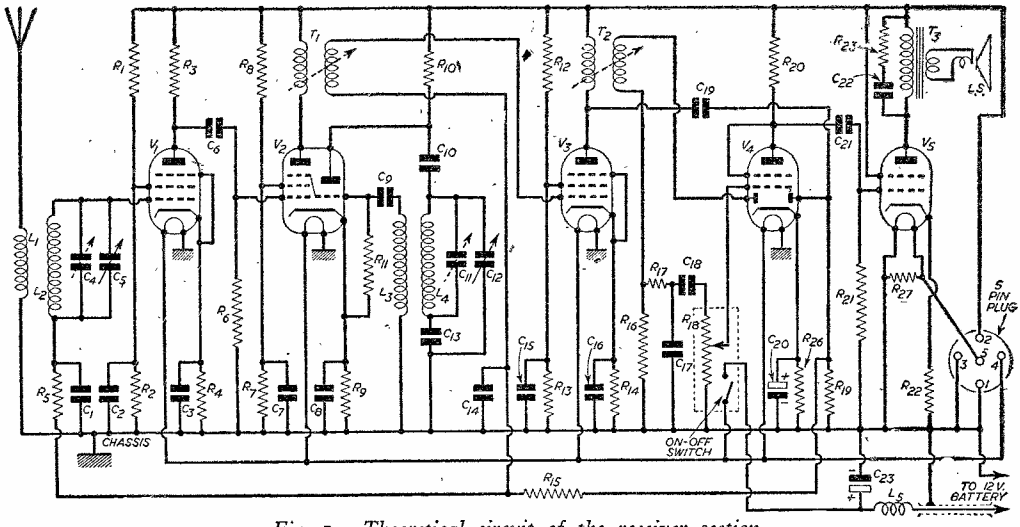


Fig. 1.—Theoretical circuit of the receiver section.

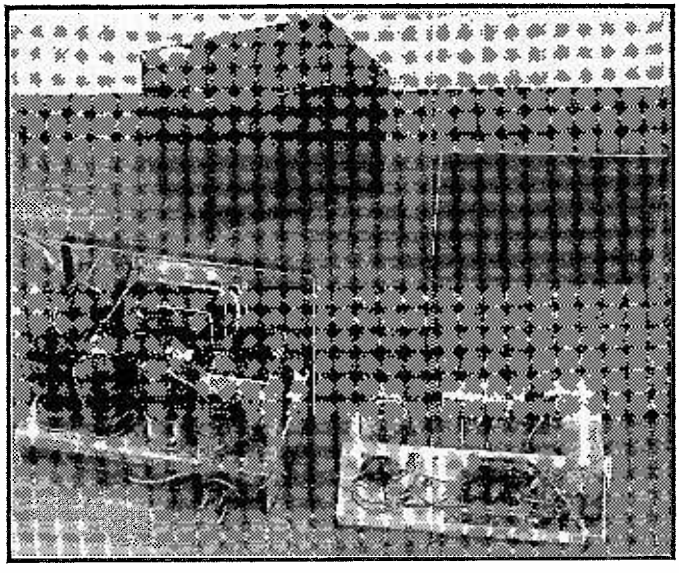


Fig. 2.—The receiver and power pack and their containing cases.

act Car Radio

Receiver, for 12-volt Operation

ERIDGE

The output valve is a 6V6, the heater of which is connected in series with the 6X5 rectifier, situated in the power pack. A 40 ohm ½ watt resistor is connected in parallel with the 6V6 heater in order to match the heater current with that of the 6X5.

A 3½in. speaker is used with the appropriate

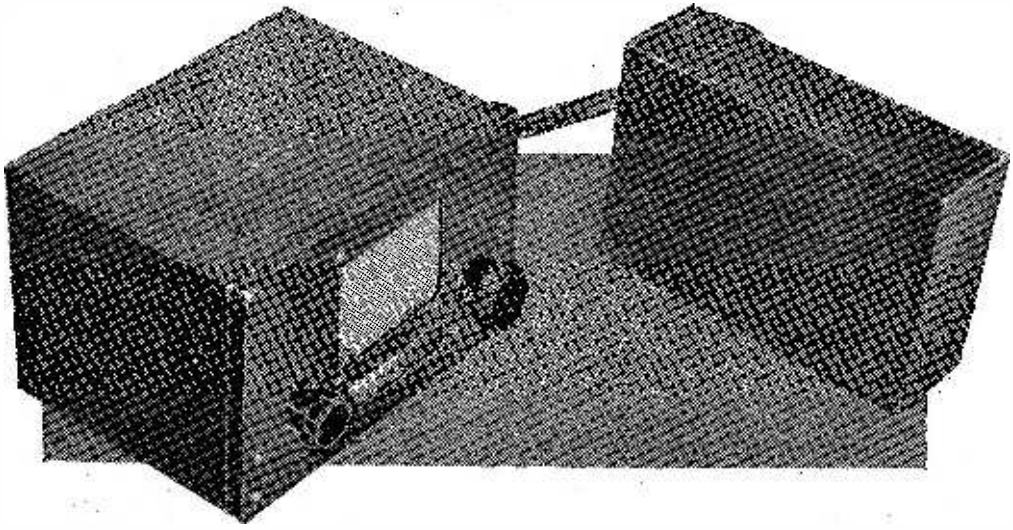


Fig. 3.—The outward appearance of the complete equipment.

12SG7, the detector and A.V.C. valve is the diode section of a 12C8, whilst the pentode section of this valve is connected as a triode to become the A.F. amplifier. This 12C8 was used because they are obtainable on the surplus market. A 12G7 can be used instead but note the change of base connections.

output transformer. The depth of the speaker controls, to a large extent, the overall depth of the completed set, and it may be found that the case and chassis dimensions, as well as the grille aperture and fixing holes, may have to be altered to suit individual speakers.

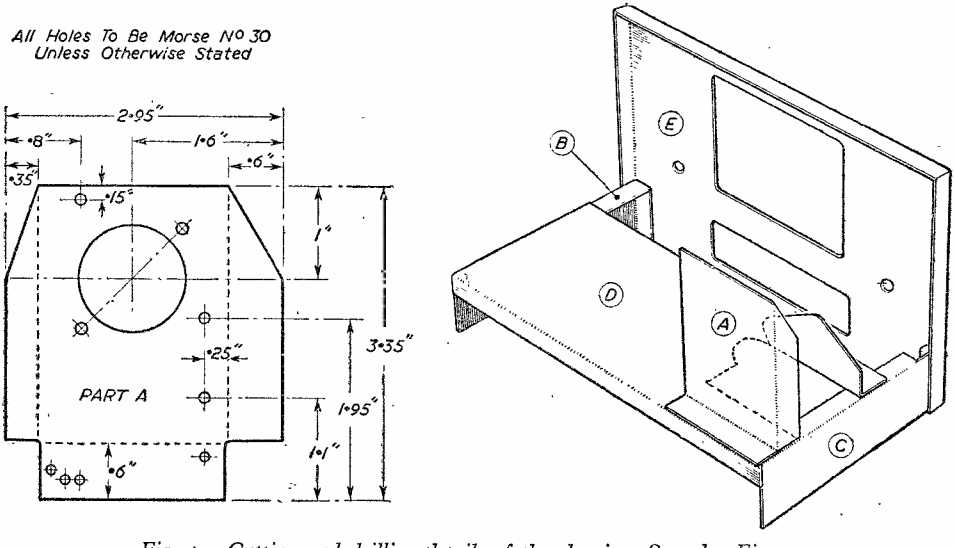


Fig. 4.—Cutting and drilling details of the chassis. See also Fig. 7.

Chassis

The chassis is made from 20G. aluminium, the details of which are given in Fig. 7. It is built up from four pieces—the main platform, two end pieces and the vertical support for the H.F. valve. All four pieces are attached to one another with 6B.A. screws and nuts. It is a good idea to put spring washers and soldering tags under all these screws to form convenient earth points. The case, consisting of the front, with the dial mechanism and cover, is also made of 20G. aluminium. If it is possible to get the corners of the cover welded it makes a neat job of it; if not, angles riveted with $\frac{1}{16}$in. rivets into the corners is a satisfactory alternative. The finish on the case will obviously be carried out to suit individual taste. Covering with leatherette seems to be the obvious choice, in colours to match the car. The leatherette is easy to stick on to metal if "Bostik" adhesive is used. Bostik can be purchased in tubes or tins. Copper or brass wire gauze is used for the speaker grille. The overall size of the set illustrated is 7½in. x 5in. x 5in. deep, with an extra 2½in. if the power pack is mounted on the back. The five-pin plug should be fixed to the back of the chassis in such a position to match the socket on the power pack. This enables the two units to be mounted together if space permits, or separately and joined electrically with a

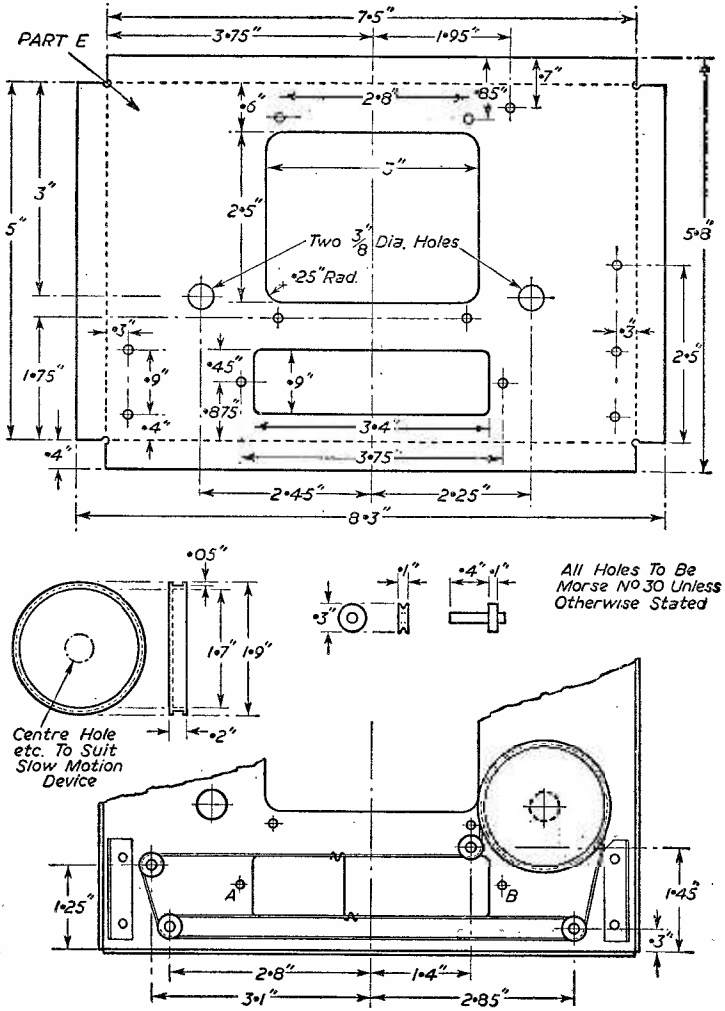


Fig. 5.—Panel drilling layout and the dial drive mechanism.

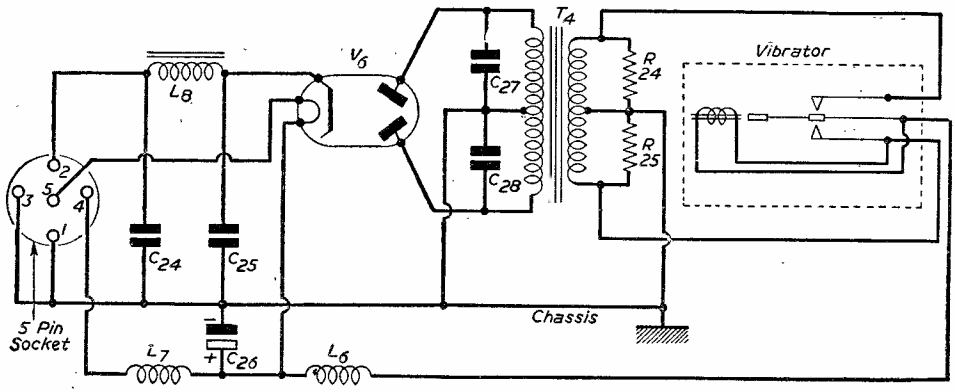


Fig. 6.—Theoretical circuit of the vibrator power pack.

five-way screened lead having a plug on one end and a socket on the other. The length of this lead is unimportant providing the gauge of wire used is sufficient, 14/36 flexible is suitable. *Earth the screening.*

(To be continued)

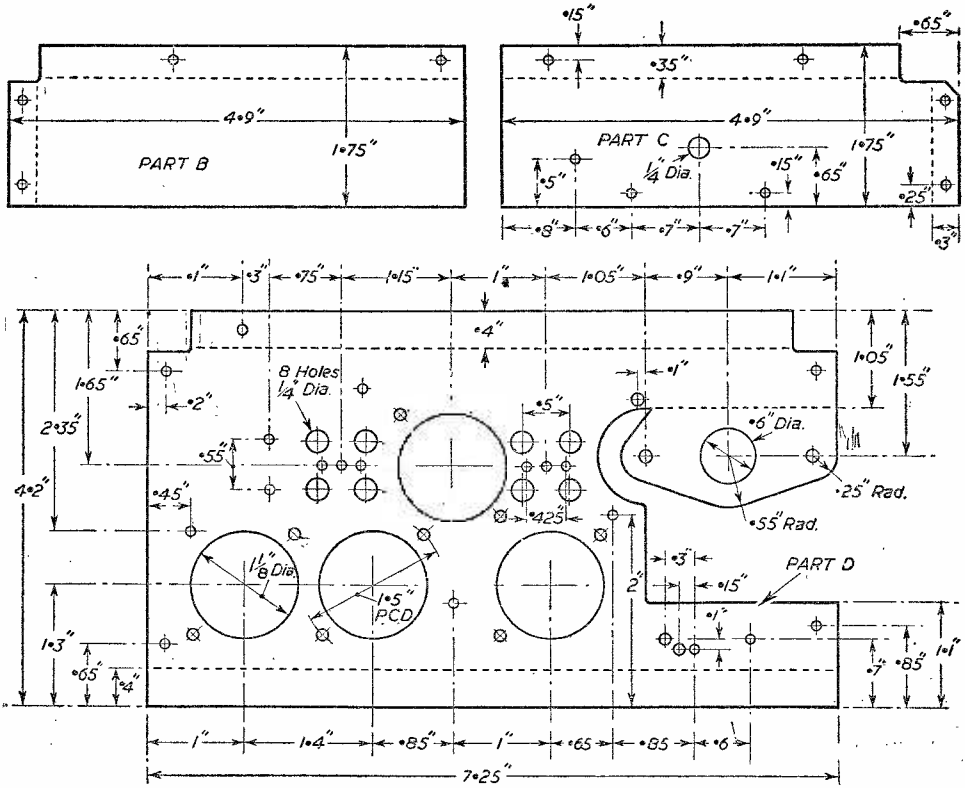


Fig. 7.—General details of the chassis. See also Fig. 4.

COMPONENTS LIST

L1 and 2, Wearite PA2 coil
L3 and 4, Wearite PO2 coil.
L5, 6 and 7. See text.
L8, 8-10 henry 30 mA. choke.
T1, Wearite M400B, I.F. transformer.
T2, Wearite M401B, I.F. transformer.
T3, transformer to suit speaker.
T4. See text.
2 5-pin plugs or bases from old valves.
2 5-pin valve holders.
6 international octal valve holders.
1 4-pin U.X. holder.
2 12SG7 valves.
1 12K8 valve.
1 12C8 valve.
1 6V6 valve.
1 6X5 valve.
1 Wearite vibrator, type N.S.B.
1 3½in. speaker.
24in. x 24in. 20G aluminium sheet.
18in. x 18in. 20G, tinned steel sheet.

R1 100kΩ.
R2 100 kΩ.
R3 47kΩ.
R4 330 ohms.
R5 10 kΩ.
R6 470 kΩ.
R7 100kΩ.
R8 100kΩ.
R9 220 ohms.
R10 50 kΩ.
R11 50 kΩ.
R12 100 kΩ.
R13 100 kΩ.
R14 470 ohms.
R15 470 kΩ.
R16 100 kΩ.
R17 10 kΩ.
R18 250 k. variable, with switch.
R19 MΩ.
R20 100 kΩ.
R21 250 kΩ.
R22 100 ohms.
R23 5.6 kΩ.
R24 40 ohms.
R25 40 ohms.
R26 1.5 kΩ.
R27 40 ohms.

C1 .1 μF.
C2 .01 μF.
C3 .01 μF.
C4 6-80 pF trimmer.
C5 .0005 μF variable, ganged to C12.
C6 100 pF.
C7 .01 μF.
C8 .01 μF.
C9 100 pF.
C10 500 pF.
C11 6-80 pF trimmer.
C12 .0005 μF variable, ganged to C5.
C13 100-500 pF trimmer.
C14 .1 μF.
C15 .01 μF.
C16 .01 μF.
C17 100 pF.
C18 .01 μF.
C19 50 pF.
C20 10 μF 10 volt electrolytic.
C21 .01 μF.
C22 .005 μF.
C23 25 μF 25 volt electrolytic.
C24 16 μF 350 volt electrolytic.
C25 8 μF 350 volt electrolytic.
C26 25 μF 25 volt electrolytic.
C27 .01 μF.
C28 .01 μF.

All resistors ½ watt. The 40 ohms may have to be made up with a 10 ohm + 30 ohm.

All condensers 250 volt working unless otherwise stated.

Transportable All-mains 4

A Simple Personal Type A.C./D.C. Receiver

By F. G. RAYER

FOR the constructor who is looking for a circuit which is not too difficult to build, yet which will provide results equally as good as those obtained from the average ready-manufactured mains receiver, the four-valver described here should prove of interest and use. It will operate from any A.C. or D.C. mains of 110 to 250 volts and the volume is ample for all domestic purposes. Due to the use of reaction, sensitivity is approximately equal to that obtained with a five-valve mains superhet circuit, while a good degree of selectivity is obtained so that interference from neighbouring stations is not troublesome.

It was also found that the hum level of the receiver is low, and a fairly compact form of construction has been adopted so that a cabinet of moderate dimensions can be used. The receiver can therefore be carried into any room and plugged into any mains supply point. An earth lead is not required and a small indoor aerial consisting of a few yards of insulated flex placed along the picture rail or otherwise extended as convenient will provide all that is necessary in the majority of cases.

Fig. 2 shows the theoretical circuit and tone control is provided by the 50,000 ohm variable resistor and .03 μF. fixed condenser wired across the speaker transformer. A volume control is also provided, in addition to the normal tuning, reaction and wavechange controls. On-off switching is provided for by the small toggle switch and this enables the volume and tone controls to be left at any desired setting. If it is desired to incorporate the switch with either tone or volume control, then the toggle switch should be omitted and a potentiometer with internal switch obtained.

Chassis and Panel

A metal chassis 11in. by 8in. by 2in. deep is the most convenient size, and a plywood panel 12in. by 9in. is bolted to the front. To obtain the maximum quality and volume of which the set is capable, a midget speaker is not recommended. A 6½in. model can be accommodated. It is a permanent-magnet type with transformer for mains output pentode.

Many different types of tuning dial are available,

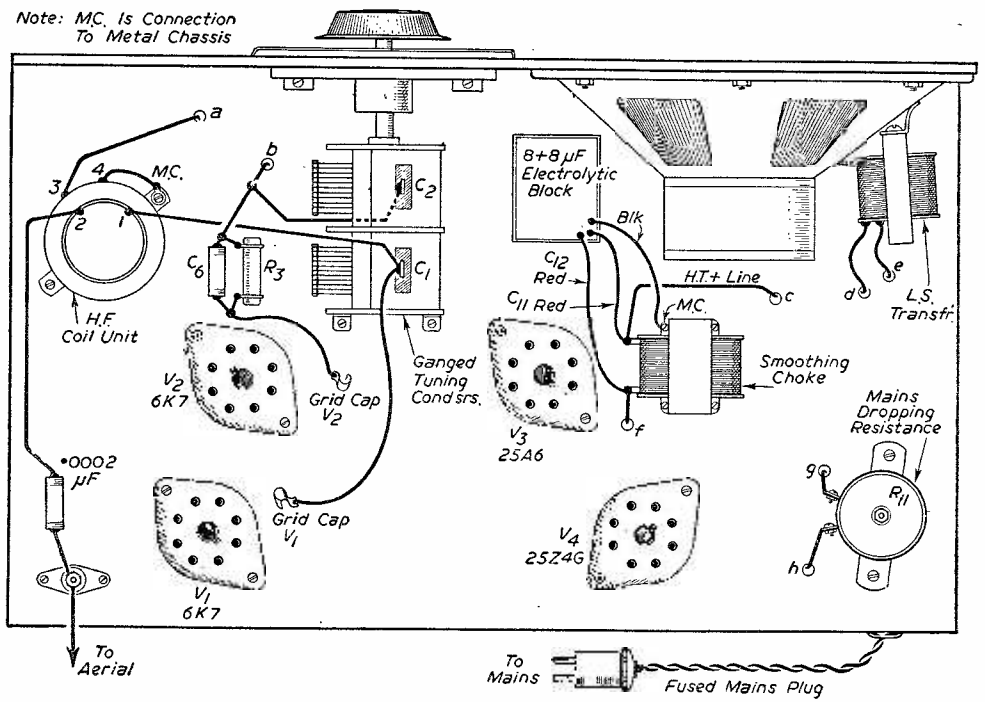


Fig. 1.—Components and main wiring above chassis.

and the user may be influenced by price or what is most readily obtainable, and any good dial is suitable. When the panel has been marked out for the dial and speaker, the holes necessary for these items should be cut with a fretsaw or small pad-saw. After glasspapering, varnish the panel. When dry, glue a square of speaker-fret silk behind the speaker cut-out. The speaker can then be mounted, together with the other panel components.

The metal bush of the on-off switch should not be in contact with the metal chassis, but as this part is mounted on the wooden panel no trouble in this direction will arise unless other leads are allowed to touch the switch. Similarly, if the tuning dial has a metal escutcheon this should be screwed to the wooden panel. When the receiver is finally enclosed in a cabinet it will then be perfectly safe, even if operated by children. The speaker is secured by small wood-screws from the back.

Components Above Chassis

Figs. 1 and 4 illustrate all parts and connections. The valveholders are bolted in clearance holes (about 1¼in. in diameter). It will probably be necessary to cut a clip from thin metal to hold the 8 plus 8 μF. smoothing condenser, though some manufacturers supply such clips with the condenser.

The twin-gang tuning condenser should be located accurately in line with the tuning drive bush, washers being added between condenser and chassis if necessry. A small stand-off insulator is used to support the aerial lead and .0002 μF. condenser.

Wiring should be carried out exactly as shown in Fig. 1, and insulated connections are preferable throughout. The quickest way of making a neat job is to use 20 S.W.G. tinned copper wire in conjunction with insulated sleeving. Note that resistor R3 and condenser C6 are joined directly to the one valve cap. A very short wire here will prevent hum being introduced with the signal reaching the valve grid.

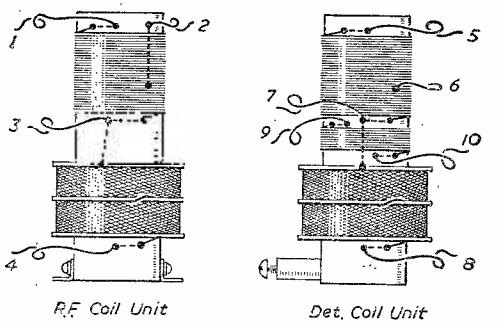


Fig. 3.—The two tuning coils.

The mains-dropper is at the extreme right, near the rear of the chassis, and as this will get fairly hot it should be placed so that it is not very near cabinet or receiver back.

Below the Chassis

As Fig. 4 shows, connections here are perfectly straightforward, but care should be taken to assure each wire is taken to the proper points as it is put on. It is also important to note the way in which the key-ways of the octal valveholders face, and they should be located as shown.

No parts or joints should be allowed to come

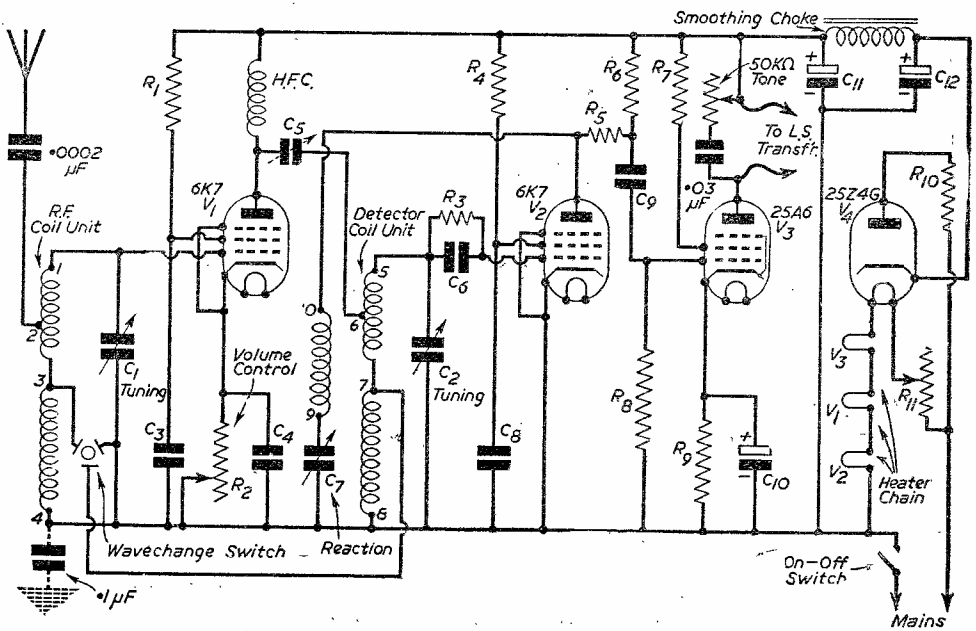


Fig. 2.—Complete theoretical circuit of the receiver.

near the chassis, except for points marked " M.C." in both Figs. 1 and 4. These points are joined to the chassis itself by means of a small nut and bolt, and a proper joint should be assured.

Connect C10 in the polarity shown. The 8 plus 8 mfd. condenser above the chassis must also have its polarity observed, but the other condenser

Cut out six cardboard washers 1¾in. in diameter and glue them near one end of the formers with ¼in. spaces between. When dry, commence from point 1, securing some 32 s.w.g. enamelled wire by passing it through two small holes. Wind on 50 turns, then make a loop to bring out through a hole as shown to form point 2. Wind on a further 30

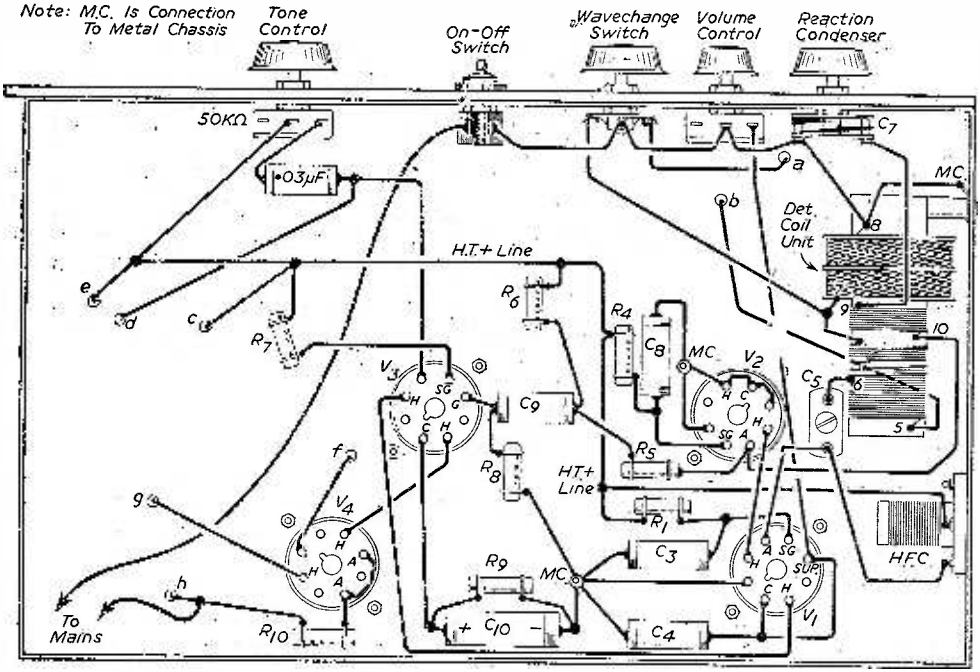


Fig. 4.—Under-chassis principal wiring.

and all resistors can be connected either way. To avoid hand-capacity effects, the *moving-plates* tag of the reaction condenser C7 should be wired to point 8 on the coil.

Only a few leads pass through the chassis. The one from the wavechange switch goes to point 3 on the coil. The lead from point 5 on the second coil goes to R3 and C6, and also to the fixed-plates tag of the tuning condenser, forward section. The other leads are clear; no special direction of connection need be observed with either R11 or speaker transformer.

The mains plug should be connected to a length of good-quality twin flex. Either a two or three-pin plug may be used, according to requirements, or an adapter if power is to be taken from a lighting circuit. The approximate consumption of the receiver is 60 to 70 watts.

The Tuning Coils

These may be wound as shown in Fig. 3 or purchased ready-made. If the latter, follow the manufacturer's data regarding tag connections.

The coils shown in Fig. 3 are wound on paxolin tubes 1¼in. in diameter by 3in. long. One coil has two small brackets for feet and is mounted above chassis (see Fig. 1); the other is mounted below chassis by means of a bolt with spacing bush.

turns, finishing this section off at point 3. The pile-windings are also commenced from this point, using 32 s.w.g. double-cotton-covered wire. Wind 120 turns in each slot between the washers, making a total of 240 for the pile-winding. Finish off at point 4.

The second coil is wound in *exactly* the same way, following the above details. When this has been done, add the reaction winding, between points 9 and 10. This consists of 60 turns of 36 s.w.g. enamelled wire situated as near the uppermost card washer as possible. By referring to the numbers given in Fig. 3 and the other diagrams no confusion in the coil connections can arise.

Cabinet Details

A cabinet about 13in. by 10in. by 8in. deep will be required with a front cut-out so that the receiver can be pushed in from the back and a number of screws run in to hold the panel in position. When the receiver has been found to function satisfactorily, this cabinet should not be omitted. Besides avoiding any danger of shocks, it will improve quality of reproduction, especially increasing the lower-register output. A plywood back may be made for the cabinet, and it should have several rows of ½in. diameter holes so that air can circulate.

(To be continued)

More Power Supply Problems

Further Facts About the A.C. Mains-fed H.T. Supply

By W. J. DELANEY (G2FMY)

THE article published a short time ago on the problems of H.T. supply produced a large number of questions from readers concerning other aspects of this part of a modern mains receiver, and indicated that to many constructors this presents the greatest difficulty in either design or operation. One point which is not often covered in published designs and which appears a stumbling block is the use of safety fuses. In many receivers these are omitted, but it is a simple matter to provide such a safeguard, although they do not always give full protection.

In the ordinary type of mains unit a very common cause of trouble arises from a choice of the wrong type of electrolytic condenser at the point shown in Fig. 1. Before all valves have attained maximum heater temperature the rectifier may be putting out

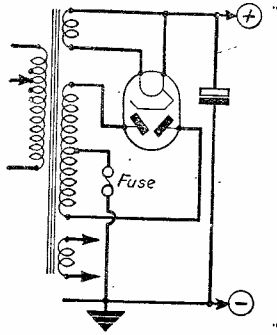


Fig. 1.—A fuse as shown will protect not only the valve but also the transformer.

quite a high voltage. This fact can easily be verified by including a good meter across the H.T. terminals of the receiver before switching on, and then watching the reading. It may be found that upwards of 100 excess volts are delivered soon after switching on, and this reading drops to normal only after an appreciable period. The result of this initial voltage is that the condenser is overloaded, and eventually it breaks down—not as an open-circuit, but as a short-circuit, and this direct short-circuit across the rectifying valve quickly results in that also breaking down. Thus, two replacements are needed—one of them quite an expensive item. The trouble should not, of course, occur if the condenser is correctly chosen, but if an electrolytic condenser is used at this point, then the precaution of including a fuse as shown is a very cheap safeguard. It should be placed as close to the mains transformer winding as possible, and it will protect this component also against burnt insulation, which also may result from a short-circuit such as that just described. The rating of the fuse will depend upon the output of the valve and the total current taken by the receiver. It should obviously be rated at slightly more than the total current taken by the receiver, and if too low will blow every time the set is switched on, whilst if too high will not prevent the surge from damaging the condenser.

Input Fuse

The majority of home-made receivers are connected to a power point or mains socket through a length of flex, and the on-off switch is mounted in the actual receiver or chassis. In many cases, the mains point is not switched—all on-off switching being carried out at the receiver. This means that the length of flex to the mains socket is always "alive" insofar as a voltage is present across the leads right up to the switch on the receiver. The house fuses will take care of any short-circuit which reaches a sufficiently high rate of discharge, but it is possible that such a short might produce an arc which will ignite the cotton coverings of ordinary lighting flex. Plastic-covered "flex" thus offers some protection in such cases, but it is safer to switch off if the lead is very long or the set is to be left unattended for long periods. A short-circuit between the switch and the primary of the mains transformer can produce a similar trouble and therefore a fuse in the lead or leads between the transformer and the switch will guard against this. It is preferable that each lead should be fused, placing them as shown in Fig. 2. Again, the rating will depend upon the total load of the receiver, and usually .5 or 1 amp. ratings will be required.

Stability

So much for safety. Another major problem concerns that of stability and the use of decoupling components. Many constructors spend money on unnecessary decoupling electrolytics on the L.F. side to cure instability—whereas it may be found that a small condenser costing only a few pence is all that is necessary.

In Fig. 3 is shown roughly the H.T. feed supply of an ordinary receiver employing one or more H.F stages with a detector and output stage or two L.F. stages. The decoupling for the latter is shown on the right, but one of these stages could probably be left without the decoupling. H.F. may be getting into the H.T. supply line and causing instability, but by the simple expedient of connecting a .1μF condenser between earth and the H.T. positive line, at the point where that line passes from the H.F.

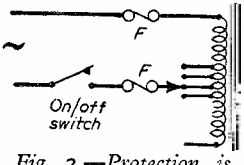


Fig. 2.—Protection is afforded by fuses on the input side.

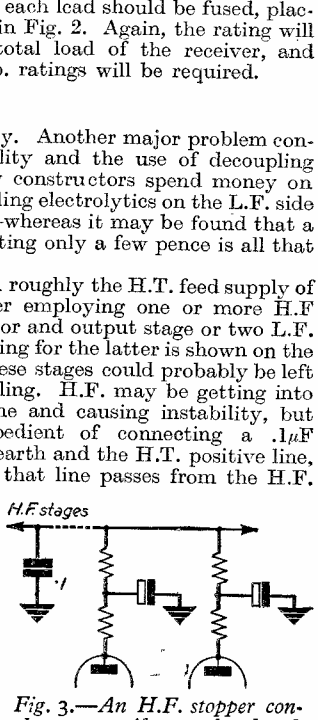


Fig. 3.—An H.F. stopper condenser may, if properly placed, avoid the necessity of some L.F. decoupling.

to the detector or L.F. stages, trouble might be prevented. It may not be necessary even to include a series resistance in that line, although results are generally improved by using a resistor of from 2 to 5 kΩ.

High Current Supplies

In some receivers—especially modern television equipment—quite high current demands are made on the power pack, and it is sometimes found that the required output is greater than that which can be obtained from a single rectifying valve—or the

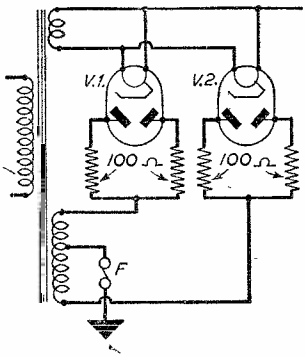


Fig. 4.—Stopper resistances, as shown, should always be used when rectifying valves are connected in parallel.

constructor may have two low-rating rectifiers of similar type which he desires to use. It is quite in order to use two rectifiers in parallel, but a precaution often overlooked in such cases is the inclusion of a limiting resistor in the anodes of each valve. The arrangement is shown in Fig. 4, and to protect the valves, due to the fact that the heaters may not rise in temperature evenly, a resistor of 100 ohms should be included as shown—and the resistors should be soldered to the actual anode terminals on the rectifier valveholders. They will, of course, be of high rating—again the exact values depending upon the valves in use, and the heater winding of the transformer must be capable of supplying the heater current of both valves added together. A typical instance of this particular arrangement is in the modern television receiver in which an output of 350 volts at 200 to 250 mA is called for. There is, at the moment, only one rectifier available which will give this, but two standard 350 volt 150 mA rectifiers may be used to obtain the required 250 mA.

Smoothing

Finally, there arises the problem of smoothing and the removal of hum. Some constructors seem to have the greatest difficulty in getting rid of the last traces of hum in spite of the use of N.F.B. There are two considerations at this point—space available on the chassis and the amount of cash in which may be spent. It is thus possible to use one good choke with a condenser of 60 μF or so, or alternatively to use two small low-priced chokes, with two small value condensers—on the lines shown in Fig. 5. In general this circuit will provide better smoothing than one choke and a large condenser, but there are one or two precautions to be observed. Firstly, the two chokes must be so arranged on the chassis that there is no inductive coupling between them or between either of them and the mains transformer. This means that they have to be widely spaced apart and it will not generally be found a simple matter to place three large components such as these to be at right-angles to one another. Next, the fact must be borne in mind that each of the chokes will be carrying the full current of the receiver, and it is usually the current rating of a choke which governs its price—due to the gauge of wire which has to be used. The inductance of each choke may be less than would be required for a single component, but two chokes at half the inductance rating of one, with the extra smoothing condenser between them as shown will, in general, afford better smoothing than the single component.

Another point about smoothing is that it is not always necessary to use a choke for this purpose, and most modern mains "personal portables" which have only a moderate current requirement, employ a small fixed resistor in place of the choke, resulting in the saving of a fairly expensive component, and a big saving of space. This fact may be borne in mind when it is desired to split the H.T. supplies to a multi-valve receiver, using such resistors not only for smoothing but also for the purpose of breaking down the voltage to a required value. Similarly, when a resistor is employed in place of a choke, and hum difficulties are experienced, the simple expedient of replacing the resistor by a choke should be tried, remembering that usually an L.F. choke has a very low D.C. resistance, and

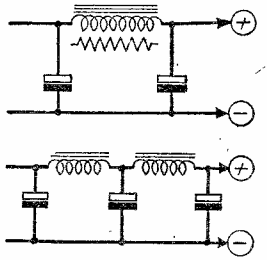


Fig. 5. — Smoothing circuits. Better smoothing is provided by the lower circuit.

therefore it may be found necessary to include a further resistance in series in order to break down the H.T. supply to a required value.

Finally, it is necessary to remind constructors concerning a safeguard in laying out a power unit. Electrolytic condensers must be protected from heat, and the average rectifying valve runs at quite a high temperature. Therefore, an attempt should be made in the layout to keep the rectifying valve on the outside edges of the chassis and well clear of the condensers, and for the same reason, a mains unit should not be enclosed in a box unless adequate ventilation is provided to avoid an undue temperature rise.

The Institution of Post Office Electrical Engineers

THE Junior Section, London Centre, has recently inaugurated a Radio Group within the framework of the Institution. The group—consisting of a number of sections within the London telecommunications region—was formed to further the knowledge of its members in the radio and television side of telecommunications. In pursuance of this aim manufacturers and retailers are being invited to provide technical demonstrations of radio and television equipment to members.

A New Valve Tester

High-speed Testing by Non-technical Personnel

HIGH-SPEED accurate valve-testing by non-technical personnel is now possible by means of a new automatic valve-tester introduced by Mullard and known as the Mullard High-Speed Valve Tester.

The new instrument has been specifically designed to satisfy all the exacting requirements necessary for the accurate testing of valves in dealers' shops and service departments in accordance with approved test specifications.

It is compact, reliable in operation, damage-proof and easy to service, and the accuracy and effectiveness of the tests are unequalled by any similar tester available in the world. The speed and simplicity of operation are of a degree hitherto believed unattainable. Non-technical assistants can accurately test any popular radio or television valve in a few moments, thus augmenting the existing technical staff.

Another particularly important feature of the new instrument is the provision of a cathode-ray tube and a coloured scale for visually indicating the condition of the valve under test. This means that there is no expensive meter to burn out or get out of adjustment, and the assessment of the valve performance under all the conditions of test is extremely simple, especially since no reference to valve data and no calculation is necessary.

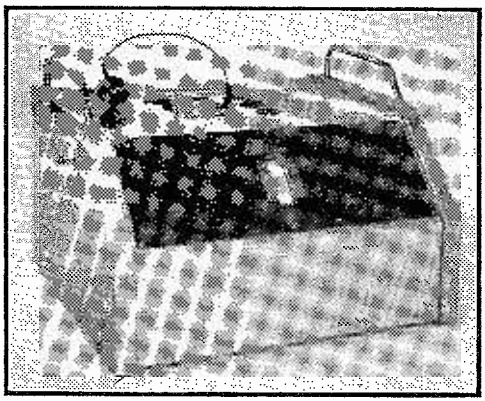
If the valve is within the specified limits, the spot on the screen is deflected to the green part of the scale. If, on the other hand, the valve fails to meet the test requirements, the spot is deflected to the red part of the scale. A reading in the intermediate yellow portion of the scale indicates that the valve, although still giving reasonable performance, will probably need early replacement

No Adjustments

The tester also has the advantage that the correct testing conditions are applied automatically. The selection of the correct test voltages is quite simply performed by inserting in a multiple gate switch a punched card which corresponds to the type of valve under test. Numbered cards are included to cover the popular radio and television valves of all makes, and other cards are available on request.

A printed list is also provided giving the valve types and reference numbers of the corresponding cards, so that selection is easy and rapid. Once the instrument is set up, there are no adjustments to make, and it is virtually impossible to damage the instrument or valves under test. The cards are specially made of bakelite to be durable and slide easily into the card slot. They are also specially shaped so that they cannot be inserted in the wrong way.

The new tester is extremely compact and solidly constructed, and all internal components are readily accessible for servicing by removing one or more sections of the case. The top panel carries a complete range of valveholders to accommodate all current types of valve. A flying lead for top-cap connections is also provided.



The New Mullard Tester

The gate switch is operated by depressing the right-hand carrying handle. It consists of 130 pairs of specially designed silver contacts which function individually and are automatically selected by the punched card appropriate to the valve under test.

High Standard

The accuracy of the instrument is of the highest order, and it will give the same results as if the valve were similarly tested by a valve manufacturer. The tests include the following:

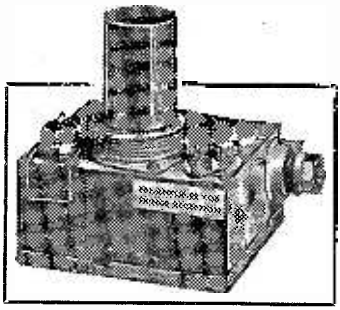
(1) Filament or heater continuity.
(2) Electrode insulation with H.T. not applied.
(3) Heater-cathode insulation.
(4) Electrode insulation with H.T. applied.
(5) Grid current.
(6) Emission.
(7) Electrode open circuit.

These various tests are applied by simple operation of a rotary switch and four push-buttons.

The instrument has been designed to operate from a 50 c/s 180-260-volt A.C. supply. Adjustment for voltages within this range is by means of 20-volt tappings on the mains transformer located on the control panel, in conjunction with an eleven-position rotary switch operating in 2-volt steps. This is also located on the control panel and is marked "MAINS ADJUST."

The instrument is less than 12in. high and requires a bench space of no more than 16in. square, and is easily transportable. The price to the dealer, including a library of cards sufficient for testing more than 600 valve types, is £65 0s. 0d.

To the busy service engineer the new instrument is a tremendous time-saver. In a matter of a few minutes it is possible for a non-technical assistant to test all the valves in sets brought in for service, and replace all doubtful valves before proceeding with the diagnosis of further faults.



Programme Pointers

This Month MAURICE REEVE Deals with Some More Recent Programmes

CRITICISM has recently been offered on two very prominent parts of our radio programmes, namely, week-end programmes collectively and the 9 o'clock news. I was interested to hear Mr. Stephan Bone, in "The Critics" discussion, suggest the same point with regard to the news bulletins that I made here recently, namely, that there is no earthly need to read, verbatim, a whole 15-minute bulletin twice over, within the space of three hours. When not a single new event has been reported since the previous bulletin the facts should be stated, the previous headlines only should be repeated and the remaining 11 or 12 minutes be given to something far more interesting. Sometimes 70 or 80 per cent. of the news gets read and re-read in all the bulletins throughout the day, in quiet, rather dull tones. This is too much. Either headlines only should be repeated or, if the worst must come to the worst, greatly abbreviated versions should be specially written up.

(Note.—If the B.B.C. should one day adopt this policy, will they please avoid the repeat to satiety of the same one or two stop-gap records. We get this frequently now in fill-ups of two to three minutes; with longer periods the remedy might become worse than the disease.)

Week-end Programmes

I was rather in disagreement with the general trend of opinion on the week-end programmes as a whole. True, there is an awful lot of bands, cinema organs, variety—in or out of a bandbox—dance orchestras, tea-time music, etc., etc. I totted up 460 minutes of it on one Saturday only—recently—between 1 p.m. and the close down. But as I hate all that sort of thing anyhow, anywhere, any time, I may be a bit too prejudiced to write dispassionately. There were only five hours sporting commentary on the same day, which I, personally, didn't think any too much, though I do grumble at its division. (After all, we can, and do, have the other stuff 365 days in the year, which is plenty. And how!)

It was announced that the commentaries would be divided, though the better expression might be "would range." Cricket, Varsity match at Lord's; rowing, Henley Regatta; and lawn tennis, Wimbledon championships. The actual division of the five hours was two flash visits to Lord's of less than five minutes each, two to Henley of less than 10 minutes each, and the whole of the remainder at the Centre Court.

On a second glance at *The Radio Times* I see that there were a further 65 minutes of other cricket—county matches—on the Light, and the weekly sporting half-hour.

The Ring

I suppose the most important broadcast of the month, so far as the one needing the most careful technical and engineering manipulation is concerned, was the relay of Wagner's Ring cycle from Covent Garden. What I was able to hear of it seemed admirable, with any faults being those inherent in the production. Its greater success over most operatic broadcasts can probably be divided between the supreme greatness of the works themselves, the illustrious cast, and the lesser acuteness of the absence of the visual side of the operas due to the greater familiarity of most of us with much of the music in the concert room.

An Expedition

The Kon Tiki Expedition—the publication of the book of which has been one of the literary sensations of the year—might have been written for radio, or for the cinema or the theatre, for that matter. Such stuff doesn't come along every day. David Thomason adapted and produced the story of Thor Heyerdahl's amazing expedition very well. This type of programme seldom goes wrong. By sailing across four thousand miles of the Pacific on a raft built of balsa logs on ancient lines, the expedition conclusively proved that the races which settled thousands of years ago in the East Indian Islands and got there from somewhere—no one knows where—could easily have done the same.

Naples

Good marks were also earned by Wynford Vaughan-Thomas and his co-adjutors for their Naples programme. This most colourful melting-pot of the human race, probably only rivalled by Cairo, Baghdad and Shanghai throughout the world, needed rather more than the B.B.C. had up its sleeve for bringing out the full pungency and acridity of this beautiful and amazing city; but they did it well, none the less.

Not Historical

"The Island Fortress" was fairly good. So much of the spirit of those days has gone—let us hope temporarily—that their evocation is bound to smack of unreality. It is too close and personal to us to have become historical. The opening music was atrocious—"There'll always be an England." A dreadful tune. I'll always maintain that that "Hang Out the Washing on the Siegfried Line," and the one Gracie Fields sang—I forget its name though I could write the notes easily enough—form a triptych of as awful tunes as were ever perpetrated. We never looked like winning the war until they were discarded and discredited, and Lili Marlene, with one or two others, took their places.

Mrs. Roosevelt brought a delightful personality to the microphone in the "Childhood Days" series. No wonder she is one of the most sought-after radio star talkers in her own country.

"A Midsummer Night's Dream"

How can one describe the production, by Peter Watts, of "A Midsummer Night's Dream"? As I said earlier on regarding "The Ring," this enchanting masterpiece, in common with similar great works, half wins the battle for everyone before

it begins. I enjoyed it immensely. And after giving Master Will at least half the credit, all came through with enhanced reputations.

"Auld Acquaintance"

The new version of van Bruten's "Auld Acquaintance" seemed an improvement on last year's, but Edward Thompson's "Essex and Elizabeth" fell rather flat, chiefly, I think, owing to the lack of a dominating personality like Flora Robson's in the part of the Queen. For some reason or other, the cast for this occasion was not published in *The Radio Times*, and if it was given out at the end of the performance I turned off too soon and missed it.

Studio Audiences

I wish W. E. Williams's remarks in the *Observer* on studio audiences, and on the B.B.C. for allowing them, could be read by everyone. Is nothing going to be done about it ?

News from the Clubs

THE BRIGHTON AND DISTRICT RADIO CLUB

Hon. Sec.: L. Hobden, 17, Hartington Road, Brighton.

THE autumn programme arranged by the club includes several interesting talks and lectures, amongst which are: "Principles of Radar" and a compact Top Band Tx. Membership remains around the 80 mark. New members are very welcome. Informal evenings are held frequently so that members can get down to personal "ragchews." All Sussex Hams and friends were invited to a Hamfest held recently at the "Golden Cross" Hotel, Western Road, Brighton. Further details from hon. sec.

SOUTH MANCHESTER RADIO CLUB

Hon. Sec.: G. I. Wilks (G3FSW), 57, Longley Lane, Northenden, Manchester.

OUR numbers are still on the increase and meetings are still held regularly at the Church Schools, Northenden every other Friday at 7.30. Prospective members will find a warm welcome. Results of the RAE were very gratifying and a high proportion of our members obtained successes. The big event recently was, of course, the Hamfest, held at Parker's Café, Gatley. As seating had been strictly limited very few tickets were available to non-members. In November the first inter-club DX contest was held, when members competed for a Cup presented by G3BMF and other trophies.

EDINBURGH AMATEUR RADIO CLUB

Hon. Sec.: David A. E. Samson (GM3EQY), 56, Elm Row, Edinburgh.

THE Annual General Meeting on 13th September started the new season, this being the second year of the club's existence, and meetings will continue throughout the winter, weekly, on Wednesdays at 7.30 p.m. in Unity House, 4, Hillside Crescent, Edinburgh.

It is hoped to have the club transmitter on the air for the full night every second meeting, and the alternate evenings to be devoted to lectures, etc.

The address given is still more or less a temporary home and attempts are being made to get permanent premises and this will enable the club to get under way the constructional classes which many members wish for, and it will also give the club station a chance of going on 'phone, this not being possible in the present location.

CARMARTHENSHIRE COMBINED PROBATION AREA

G. J. Jones, Probation Officer, County Probation Office, 21, John Street, Llanelly, Carm.

A RADIO club for boys has recently been formed in Llanelly.

RADIO AMATEURS' EXAMINATION CENTRE

A COURSE covering the syllabus of the Radio Amateurs' Examination of the City and Guilds Institute is being held at the Brentford Evening Institute, Boston Manor Road, during the 1950-51 session, and commenced on 19th September. The Course will continue up to the date of the summer examination and the fee is 5s.

RICHMOND AND DISTRICT RADIO SOCIETY

Hon. Sec.: W. Crossland, 1, Spring Grove Road, Richmond, Surrey.

THE meeting of the Richmond and District Radio Society, held recently at the Richmond Community Centre, was well supported by members and visitors who showed great interest in an informal lecture on "Radio Valves," given by V. Copley-May, Esq.

The next meeting of the Society which has been arranged will be a talk, illustrated by slides, on "Early Amateur Radio Personalities." Other future activities include regular morse classes.

Interested readers are invited to communicate with the honorary secretary, at the above address.

WEST MIDDLESEX AMATEUR RADIO CLUB

Hon. Sec.: F. F. Blomfield, 213, Harrow View, Harrow, Middlesex.

RECENT meetings of the West Middlesex Amateur Radio Club, have been devoted to a number of interesting items including the following lectures, "Airborne Radar," "Aerial Problems," and "A Home Constructed Cathode Ray Oscilloscope." A very successful "Junk Sale" was also recently held.

Future meetings of the Club will include a general discussion in which, it is hoped, members will be persuaded to talk about "My Interest in Radio," and also an exhibition of "Home Constructed Equipment."

Prospective members are cordially invited to attend the meetings which are held on the second and fourth Wednesdays of every month at the Labour Hall, Uxbridge Road, Southall, Middlesex, at 7.30 p.m. A Morse Class is held from 7 to 7.30 p.m.

READING RADIO SOCIETY

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

THURSDAY, October 12th, was "Electricity Evening," with a talk and film show on the subject of the electricity supply. The representative of the local electricity board who was present took note of the worst examples of the service, and has already had some action taken.

On Saturday, October 28th, there was firstly a discussion over a piece of circuitry given at a previous meeting, which had been disputed. This was followed by a "Junk Sale."

The future programme is as follows:

December 9th: Instructional Section.
December 14th: C. &. G. Quiz.
December 30th: "In Lighter Vein."

All meetings are held at Abbey Gateway, commencing at 7 p.m.

STOKE-ON-TRENT RADIO SOCIETY (Affiliated to R.S.G.B.)

Hon. Sec.: J. R. Brindley G3DML, "Elston," Albany Road, Harpfields, Stoke-on-Trent.

WEEKLY meetings are still held at the Club H.Q.: "The Cottage Inn," Oakhill, Stoke-on-Trent, on Thursdays at 8 p.m.

A "Bunfight" was held on Friday, November 3rd, and a good time was had by members and friends present.

VHF Activity is on the increase, with G3UD and G3EHM, having a go at 70 cms. and 10 metres under close observation.

The Club QRP TX is seriously handicapped by using indoor aerial, but QSO's have been held with all parts of the country.

Listen for G3GUB club call at 8 p.m., Thursdays, on 3,540 mc/s, please.

New members always welcomed.

THE CITY OF BELFAST Y.M.C.A. RADIO CLUB

Hon. Sec.: S. H. Foster (Gi3GAL), 31, Belmont Park, Belfast.

THERE was a good turn-out of members at the annual meeting, when satisfactory reports were submitted by the Hon. Sec. and Hon. Treas. Morse classes will be held on Wednesday and Thursday evenings. Club night will be on Wednesday. Competitions for our S.W.L.s will be held during the season. Two TXs are ready for operation under the club call sign Gi6YM, both are 150 watts, one for CW, one for phone. They will be "on the air" on club nights to give members an opportunity of seeing and hearing a station in operation. New members will be welcomed.

WALWORTH (MEN'S INSTITUTE) RADIO CLUB

Ass. Sec.: J. Gibbs, 22, Caspian Street, Camberwell, S.E.5.

WALWORTH (Men's Institute) Radio Club once again have commenced their winter session, meetings being held on Wednesday and Friday evenings from 7 to 9 p.m. New members are welcomed and particulars are obtainable from the assistant secretary.

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).

Delivery Dates

SIR,—In reply to a letter concerning delivery dates printed in your August issue, I should like to present the manufacturers' point of view.

Mr. Gosling has no legal advantages, because the form issued by the B.V.A. for the return of a defective valve specifically states that:

"The examination of a defective valve necessitates the removal of the glass bulb and therefore valves so tested are not returnable."

Also:

"The acceptance of any valve for examination and test does not render the manufacturer liable to replace the valve."

Therefore, the manufacturer is not at fault, the fault lying with the retailer, who should not have submitted the valve to test, knowing that the guarantee had expired.—R. E. BRISTOW, jun. (Surbiton).

Programme Pointers

SIR,—PRACTICAL WIRELESS is an interesting and helpful magazine—except for one page, that by Maurice Reeve.

How that man has the cheek to write such rubbish I don't know. Doesn't he like anything? The way he runs down radio programmes is disgusting. It is more his own opinion than a criticism. Because he doesn't like all these things it doesn't mean that they are no good. Thousands of people do enjoy them.

And perhaps you would inform him that the signature tune of "Music In Miniature" is a Haydn String Quartet, and not written by Mozart as he says. That alone shows how ignorant he is!

I suggest he switches off if he doesn't like the programmes. Heaven help the television programmes if he starts criticising those.

I am sure his page could be given over to something more interesting.—(MRS.) ZOË BINNING (E.7).

["*This correspondent's letter reminds me of the famous 'Punch' cartoon portraying a woman 'listening' to the radio. On being asked her opinion of a certain item, her reply was terse and to the point: 'I really couldn't tell you. Although I had the wireless on, I'm afraid I wasn't listening.' It is humorously pathetic.*

"*Of course, my articles are my own opinions, and they will continue to express my opinions so long as I am favoured with the commission to write them.*

"*Yes, I dislike much of what the B.B.C. puts over, and more particularly its manner of presentation. But if Mrs. Binning will read the London Press as often, as widely, and as carefully as I do, she will notice that I am by no means the hardest puncher or the most adversely critical amongst the critics. As to what would happen to television if I started criticising it, I couldn't hope to compete with the critics who at present tear its programmes limb from limb every week.*

"*I plead guilty to having written that the signature tune to 'Music in Miniature' was by Mozart. They—he and Haydn—are so closely related, musically, that they have been mixed up far more frequently than your correspondent perhaps imagines. I am still willing, however, to pit my knowledge of music and composers against hers.*

"*I invite the lady to study concert, film and theatrical criticism for a bit; she will then rub her eyes and wonder whether anybody likes anything.*"—M. REEVE.]

Training Service Engineers

SIR,—Having been associated with the radio industry since 1932 I feel that I am entitled to quote with some authority, having been both an employer and employee. Firstly, then, I entirely agree with your editorial in the September-October issue that only experienced men should handle radio and television repairs. As with watchmaking it will take a full apprenticeship of five years, coupled with a good deal of theoretical study to produce a fully competent engineer. Can you seriously imagine that it is worth any young man's energy to complete such a course with the prospect of the present wage standard as laid down by the R.I.R.A.?

Let me point out that I am in no way under any delusion that radio repair work is a highly profitable business—it should be so, as it requires a high standard of skill, but surely the root of all the evil is the wage standard? Compare the average builder's labourer's wages of £6 a week with £5 10s. as laid down by the association for a competent radio engineer!

As an electrician admitted as a fully-skilled electrician to the E.T.O. I am able to earn over £7 a week at the union's rate. I am able to service any known (and unknown) make of radio receiver. I am able to quote the function of every part of a

radio receiver from a theoretical drawing in a theoretical manner and could pass any mechanic's examination, but I am hardly likely to contribute this knowledge to an employer for a wage well below a common wireman's earnings. I think there must be a very large number of men like myself with similar views on the matter.—D. F. C. SMYTH (Loughborough).

Bandspread for the R1116

SIR,—I have operated one of these sets for over two years with considerable success and have been very favourably impressed by its performance. Its main disadvantage, however, seems to be its lack of bandspread, especially on the 14 Mc/s. amateur band. After considerable time and experiment, I have devised a suitable arrangement which is both simple and effective.

This additional control needs only a 12.5 pF bandspread condenser and any small slow-motion drive. To accommodate these it is necessary to remove either :—

(a) The right-hand aerial socket and its associated wire ; or

(b) The " Select Max. Signal " control, its wiring to the wave change switch (L.F.) under the chassis and the two wires joining it to the D.F. loop plug. In order to do this it will be necessary to remove the screening can. After removing this the wire which was connected to it must be re-earthed, or the volume control will not work.

The removal of either of these will leave sufficient room for the condenser and slow-motion drive. The moving vanes will be automatically earthed so that only one connection will be necessary. This should be of single core screened cable, which should be led from the fixed vanes through a small hole drilled in the chassis (at any convenient point) to the tag on the H.F. side of the WAVEBAND SWITCH S3, part D. The latter is clearly marked and may easily be found by removing the base.—BRYAN C. CLARKE (Kennington).

Designing Your Own Receiver

SIR,—I feel that I must write to you in praise of the commencement of a series of articles intended to assist the beginner in the design of a receiver, but I also feel that I must criticise the formula given for parallel resistors and series capacitors in the article " Designing Your Own Receiver," appearing in the current issue of PRACTICAL WIRELESS.

In this article we are told

$$\left(\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}\right) = \frac{1}{\text{Total}} = R.$$

And similarly $\left(\frac{1}{C_1}+\frac{1}{C_2}+\frac{1}{C_3}\right)=\frac{1}{\text{Total}}=C.$

Now if the beginner realises that Total means the addition of the reciprocals given, and this will be a fraction, then he will get the correct answer and the last part of the equations will be correct ; that is $\frac{1}{\text{Total}} = R$ (or C as the case may be), but the first part of the equations cannot be correct for the sum of a number of fractions must equal the sum of their numerators expressed in terms of a common denominator, and will thus be equal to $\frac{\text{Numerator.}}{\text{Denominator}}$ Then $\frac{1}{\frac{\text{Numerator}}{\text{Denominator}}}$ will give the correct answer, but this last equation must be divorced from the first since they are two separate statements.

As a lecturer in radio I have to drum this into beginners time and time again, since I am a firm believer in the necessity for the basic practical and theory to be sound.

In this connection I would like to stress another point when dealing with Ohms Law. In my opinion this should be stated as follows : The current in a circuit is directly proportional to the pressure and inversely to the resistance, i.e. $I=\frac{E}{R}$. This, and only this, in my judgment, is Ohms Law, and whilst it is true that given any two quantities out of three that are related by an equation any mathematician can calculate the third quantity, one should be careful to keep laws from mathematical transposition.

Thus given the law $I=\frac{E}{R}$ it is true $R=\frac{E}{I}$ but if one is asked to state the law governing resistance of conductors, to give the last equation would be of little use.—J. R. MILLER (Colwyn Bay).

[*With reference to Mr. Miller's criticism regarding the formula for parallel resistors and series condensers in my article " Designing Your Own Receiver," I agree that they are justified.*

The expression was originally written in my notes thus, $\left(\frac{1}{C_1}+\frac{1}{C_2}+\frac{1}{C_3}\right)=\frac{1}{Total}$, *which I considered would be somewhat easier to follow, for the novice, than the usual expression* $\frac{1}{\frac{1}{C_1}+\frac{1}{C_2}+\frac{1}{C_3}}$.

However, when copy was typed, the final expression was dropped down level and thus appeared as $\frac{1}{C_1}+\frac{1}{C_2}+\frac{1}{C_3}=\frac{1}{Total}$ *Unfortunately, this was overlooked when checking the article and consequently appeared as such in print.*

Finally, may I point out that a printer's error occurred at the end of page 358, where it is stated " By applying Ohms Law $(I=C\times R)$ *the voltage drop," etc. This was given as, and should read,* $(E=I\times R)$.—STANLEY BRASIER.]

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Impressions on the Wax

Review of the Latest Gramophone Records

AMONG the highlights of recent releases is a set of records of Brahms "Symphony No. 2 in D, Op. 73" played by the Danish State Symphony Orchestra, conducted by Fritz Busch—*H.M.V. C*4006-9. The first movement is an enormous development of rich orchestral colour, with a coda that continues to make expressive use of horns—an instrument that plays an important part in the introduction. The slow movement starts with two themes, developed in a fairly complex pattern. In the next chapter Brahms heightens the interest with changes of key from major to minor, then reversing the process in a simple yet extremely effective design. The last movement is splendidly robust, its themes driven to a fine conclusion.

The pianoforte is to the fore with a recording by Benno Moiseiwitsch of Chopin's "Scherzo No. 3 in C Sharp Minor, Op. 39," on *H.M.V. C*4011. The Chopin of Moiseiwitsch leaves nothing to be desired, a fact so often displayed in our concert halls by this fine artist.

"The Bartered Bride" Overture, played by the Chicago Symphony Orchestra, conducted by Désiré Defaux on *H.M.V. DB*21088, provides a new version of a well-known orchestral piece. Its technique of introducing the several instruments of the string section, group by group, and then offsetting the accumulated result by wood-wind passages, has never ceased to be a source of high entertainment in the concert hall.

Another recording by the Kirkintilloch Junior Choir of young, mixed voices, trained and conducted by the Rev. J. R. Macpherson, will be welcomed by the host of people who have been charmed by previous performances. Getting away from Scottish airs on this occasion, the choir sings two favourite melodies from Handel's "Messiah" on *Parlophone E*11477. The titles are "I know That My Redeemer Liveth" and "He Shall Feed His Flock."

The Busch Quartet usually appear in the gramophone lists for large-scale quartets, but for their latest recording, *Columbia LX*1311, the Busch ensemble deals with an entertaining piece of Mendelssohn. "Capriccio in E Minor, Op. 81," carries a little group of works, and Andante and Scherzo, and a Fugue, all scored for strings.

Vocal

Seldom has a singer of 26 achieved so much success in so short a time as the Spanish soprano Victoria de los Angeles. Her fame in Great Britain was achieved by her H.M.V. records, which at once won her a large following. The two excerpts of Wagner on *H.M.V. DB*21095, "Elizabeth's Greeting" from Act 2, Scene 1 of "Tannhauser," and "Elsa's Dream" from Act 1, Scene 2 of "Lohengrin," offer her every scope for her lovely voice and dramatic abilities.

Lester Ferguson, the American tenor of "Your Song Parade" radio programme, makes a welcome appearance on *Parlophone R*3312, singing two perennial favourites. "Vienna, City of My Dreams," which dates from 1931, was composed by Rudolf Sieczynski and Edward Lockton, while the world-famous "Song of Songs," by Moya (Harold Vicars) and Clarence Lucas, was first published in 1914.

The bass voice of Ludwig Weber has been cast in a wide variety of operatic parts for gramophone excerpts in recent months, but none more interesting than Weber's "Der Freischutz" and "Schweig, Schweig," which he sings on *Columbia LX*1310. On the reverse side we have the scene in the second act of Verdi's "Sicilian Vespers."

Variety

It is welcome news that Flanagan and Allen have got together once again in the recording studio to make a new version of their old theme song, "Underneath the Arches." On the reverse side they sing "Hey Neighbour!" a number that suits their easy going style—*Columbia DB*2725.

"I didn't Slip, I wasn't Pushed, I Fell," is a new novelty song from America, while "You Go to My Head" is an established hit from the late 'thirties. Both of these are sung by Doris Day on *Columbia DB*2727.

In the harmony section there is the Five Smith Brothers singing "Dearie" and "A Load of Hay" on *Parlophone R*3290, the Tanner Sisters singing "Rosy Apples" and "Have I Told You Lately That I Love You" on *H.M.V. B*9957, and the Deep River Boys with their version of "Ashes of Roses" and "Bewitched" on *H.M.V. B*9960.

The latest record by song-stylist Steve Conway is notable for a unique blend of vocal and instrumental tone colours, for it marks the recorded debut of Steve with that popular broadcasting group The Star Gazers, plus the novel line-up of the Jackie Brown Quartet. Between them they give a nice rendering of "Sentimental Me" and "In a Boat On a Lake with My Darling" on *Columbia DB*2724.

Dance Music

All the latest hit tunes have been recorded featuring most of the tip-top bands. American trumpet-star Harry James with his Orchestra have recorded "Stella by Starlight" and "Mona Lisa" on *Columbia DB*2731, Joe Loss and his Orchestra have made "If I Loved You" and "June is Bustin' Out All Over" on *H.M.V. DB*6072, and Victor Silvester and his Ballroom Orchestra revive the popular, 25-years-old dance, the Charleston, with "I Wonder Where My Baby is To-night," and a slow foxtrot "Give Me You," on *Columbia FB*3574.

BOOKS

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

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

BRITISH SHORT WAVE LEAGUE, founded 1935, world-wide membership. Monthly publication, "B.S.W.L. Review" (members only), covering all short wave radio interests. Many services and activity departments. Full information on application to: B.S.W.L., 53, Victoria Street, London, S.W.1.

RECEIVERS & COMPONENTS

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