PORTABLE ELECTRONIC ORGAN

1/-

Vol. 29. No. 558
APRIL, 1953

EDITOR:
F.J.CAMM

PRACTICAL WIRELESS

IN THIS ISSUE:

A CHEAP MEASURING UNIT
SHORT-WAVE SECTION
THE "MODERN" FEEDER UNIT
RADIO CONTROL TRANSMITTER

ACCUMULATOR CHARGING
A PORTABLE 'SCOPE
AERIAL IDEAS FOR 21 MC/S.
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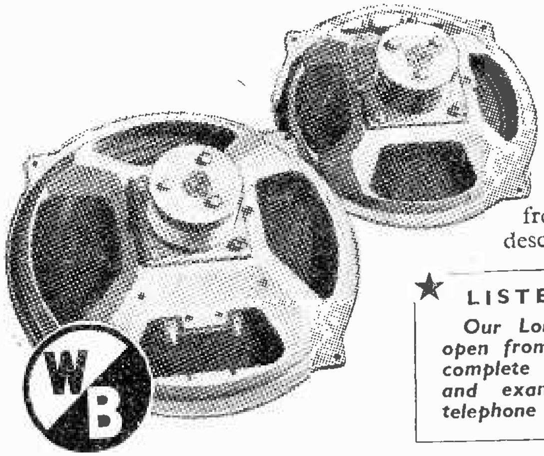

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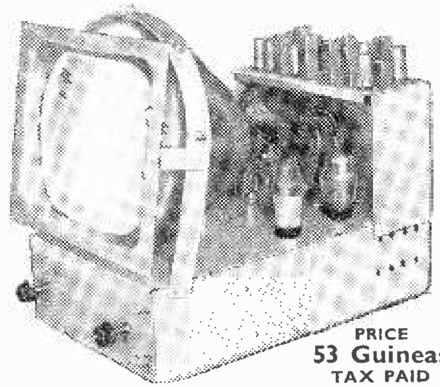

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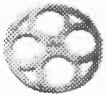

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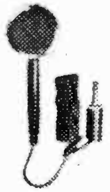

The microphone illustrated is the standard one supplied with the Simphonic 2B Recorder. It is a crystal type hand microphone, and has a particular appeal because it is ideally suited for speech applications with small recording equipments. Chief characteristic is its high sensitivity at comparatively low cost. Complete with 9ft. screened lead and jack plug, £2.10.0.

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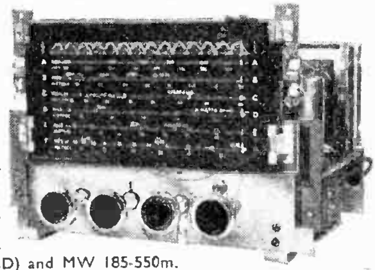

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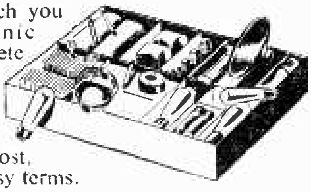

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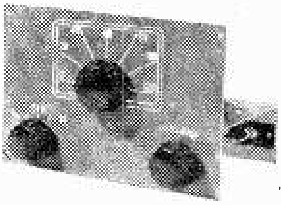

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Practical Wireless

EVERY MONTH
VOL. XXIX, No. 558, APRIL, 1953

Editor F. J. CAMM

21st YEAR OF ISSUE

COMMENTS OF THE MONTH By THE EDITOR

On Joining a Club

WE receive many requests from secretaries of clubs to publish their announcements and this we gladly do when we are assured that the club is a serious one and run on normal club lines. The old established clubs, of course, regularly send their notices which are inserted without question.

We are always anxious to encourage the club movement, but in the interests of our readers we need to be assured, in the case of a new club, that it is run on certain lines. Club secretaries, therefore, should, when sending in their reports for the first time, provide information on the following subjects:

1. Is the club run for profit?
2. Are the officers elected annually?
3. Are audited balance sheets provided annually?
4. What are the objects of the club?
5. When does it meet and where?
6. What is the annual subscription and what are the benefits of membership?
7. How many members?
8. What are the rules?
9. Who are the officers?
10. Are there any other clubs in the district?
11. Is the club affiliated to any other body, political or otherwise?
12. Is the club interested in receiving and/or transmitting?

If we consider the answers to these questions satisfactory we are prepared to accord free space to club reports, which should not exceed 250 words in length and be received here not later than the 14th of each month.

We should like to offer some advice to press secretaries. Do not include information which, by the time it reaches publication, will be valueless and do not include matter which every member already knows. The object of the report should be to summarise the discussions and acquaint other clubs with your progress. It should also inform members of the date of the next meeting. It is unnecessary to invite local enthusiasts to get into touch with the secretary. If a reader is keen he will do that automatically once he reads the name and address of the secretary.

It is necessary for us to make these conditions because of the experiences of some readers in the past who have joined clubs only to find that the founder of it is virtually the proprietor, who does not retire annually. Readers have also found that the subscription asked has not always been used for club purposes, and especially has this been the case when the subscription has been excessive. Avoid joining a club where a charge is made for technical advice and make careful enquiries as to what benefits you are to receive in the way of technical discussions and lectures. Assure yourself that the club is a live one and that it meets regularly.

Quite often a well-meaning local dealer will form a club, offering his premises as a meeting-place and naming the club after his business. There is nothing, of course, against this practice but we look with disfavour upon club titles which provide publicity for a particular firm.

It is always wise with a well-conducted club to have as a president someone well-known and respected locally, and a secretary known to be keen and having technical knowledge. This often sets a hallmark on the integrity of the club.

THIS YEAR'S RADIO SHOW.

PROVISIONAL dates for this year's Radio Show have been announced by the Radio Industry Council. It will be held at Earls Court from September 2nd to the 12th and will be open from 11 a.m. to 10 p.m. daily, of course, with the exception of Sunday. There will not, however, be a paid public admission on preview day, September 1st, when the Show will be open from 11 a.m. till 6 p.m. and admission be limited to those holding invitation tickets. As before, the BBC is co-operating and television will strike a predominant note. We still hope it will be possible for the components industry to be housed under the same roof this year instead of running a separate exhibition on its own. It might also be feasible to include an exhibit of historic receivers.

No doubt the R.I.C. has learned the lesson of last year and will see that adequate seating arrangements are provided and that the catering is much improved. Both of these left much to be desired last year.—F. J. C.

ROUND the WORLD of WIRELESS

Canadian Site

IT is reported that a site of 27 acres has been bought by Crompton Parkinson Ltd. in Canada, for the proposed erection of a factory covering 25,000 sq. ft.

The company intends to manufacture electrical goods for the Canadian market.

Redruth Home Service Transmitter

TO improve reception of the West of England Home Service in the vicinity of Redruth, Cornwall, the BBC proposes to add a third transmitter to its present station at Redruth, which already broadcasts the Light and Third Programmes. The new transmitter will be of 2 kW power and will share the wavelength of 206 metres (1,457 kc/s), which is already used by other stations radiating the West of England Home Service.

Chicago Council Request

THE Illinois State Legislature has been requested by the Chicago City Council to allow the city to license radio and television technicians.

This request, which was made at the end of last October, was not heard until the January meeting of the Legislature and cannot be made law until July 1st.

Record Company Managing Director

E.M.I. and H. Polliack & Co., Ltd., announced jointly some time ago the formation of a new company to manufacture gramophone records in South Africa. A large modern factory has been erected on a site near Johannesburg and is now in production.

J. S. Carr, M.B.E., has been appointed managing director of the new company—African Consolidated Sound Industries (Pty.), Ltd., and relinquishes his present position as commercial manager of E.M.I. Factories, Ltd., where for a number of years he has been responsible for the commercial activities of the company, and for contract work for the various Government departments. His services in the latter field won him recognition in the Birthday Honours List of 1951, with the award of the M.B.E. (Civil Division).

Telcon Telecommunications, Ltd.

MR. RICHARD ROBERT CAMPBELL RANKIN, O.B.E., a director of Mullard Equipment, Ltd., has been appointed a director of Telcon Telecommunications, Ltd. (owned jointly by Mullard, Ltd., and The Telegraph Construction & Maintenance Co., Ltd.), in place of Dr. C. F. Bareford, who has resigned from the board following his appointment as chief superintendent of the Long Range Weapons Establishment at Salisbury and Woomera, South Australia.

German-backed Company

GERMAN radio chief Max Grundig is behind the first German-backed company set up in this country since the war. Known as Grundig (Great Britain), Ltd., it began operations last October in a small factory and temporary offices at Kidbrooke, Kent.

The firm has contributed to Britain's export drive in radio and television receivers. First product of the organisation was the "Reporter" tape recorder, a line in which the company intends to widen its range in the next few years.

Broadcast Receiving Licences

THE following statement shows the approximate number of sound receiving licences issued during the year ended December, 1952. The grand total of sound and television licences was 12,859,473.

Region	Number
London Postal ...	1,781,470
Home Counties ...	1,497,165
Midland	1,365,451
North Eastern... ...	1,790,114
North Western ...	1,430,784
South Western ...	1,049,120
Welsh and Border ...	699,707
Total England and Wales	9,613,811
Scotland	1,139,927
Northern Ireland ...	212,903
Grand Total	10,966,641

The assembly line at Grundig, Ltd., of Kidbrooke. "Reporter" tape recorders are being assembled before passing through the exhaustive testing process. Although the designs used by the company are German, all staff and components are British.

Royal Patronage for the Show

THE Radio Industry Council announces that H.M. Queen Mary has graciously consented to be patron of the National Radio Show to be held in London in September. Her Majesty has been patron on each occasion since the war.

Details of the Radio Show may be found on page 183 of this issue.

Board Appointment

DR. THOMAS E. ALLIBONE, F.R.S., has been appointed to the Board of The Edison Swan Electric Co., Ltd., in the capacity of Director of Research.

Dr. Allibone will retain his position as Director of A.E.I. Research Laboratory, Aldermaston.

Third Programme Support

IN an article in the BBC Quarterly entitled "Broadcasting as the Author's Friend," Sir Compton Mackenzie praises the Third Programme and describes the "immense service" which it has rendered to drama, literature, music and poetry.

"Better to listen to the most excruciating precocity in that ghastly voice too often affected by the young intellectuals than be condemned to the cheap wise-cracks of those pseudo-comic half-hours in the Home and Light programmes," comments Sir Compton.

Radio Control for Foundry

MESSRS. STERLING METALS, LTD., of Coventry, have placed through the Vaughan Crane Co., Ltd., of Manchester, an order for one of the radio control systems developed by Heenan and Froude, Ltd., of Worcester, for the remote control of overhead cranes.

This equipment will be used in a magnesium foundry at Nuneaton for emergency and remote control of a furnace crane in the event of melting ladle failure so that, in such an emergency, the appropriate crane control can be effected remotely. Thus, no operators need be in close proximity to the leaking ladle.

Relay Expansion

IT is expected that more public companies, rather than private firms, will aid the development of radio relay services: the transmission of programmes by wire to individual homes from a main receiver.

There are about 1,000,000 subscribers to this method of listening, but as one "subscriber" may be a hospital or factory, the total number of "relay-listeners" is placed at 5,000,000.

Radio Audience

FROM a BBC reckoning it is revealed that the average radio audience listening in to the Home, Light and Third programmes on a week night is 9,000,000.

The average television audience is one-third of this figure.

The Cup Final

THE Football Association has announced that both halves of this year's Cup Final, to be played at Wembley on May 2nd, will be broadcast on sound radio and television.

New Honour for Veteran

MR. WILLIAM DAVIES, M.B.E., Radio Officer No. 1 in the records of the world's first marine radio company, The Marconi International Marine Communication Co., Ltd., has had a new honour conferred on him by the Veteran Wireless Operators Association of America.

This is the Marconi Memorial Medal of Service, awarded by the Association for "outstanding contributions to the wireless art," and was presented on the occasion of the Association's 28th annual dinner-cruise at the Hotel Astor, New York, recently, under the chairmanship of Mr. A. J. Costigan, Vice-President of the Radiomarine Corporation of America.

Egen Electric, Ltd., whose Canvey Island factory was surrounded by water as a result of the floods, was soon in production again—the first of the Island's industries to resume work. On the day after the floods took place a skeleton staff of 20 were at work in the factory on essential duties (above). Production recommenced in earnest on Wednesday, February 4th, when power was restored at 11 a.m., and a gradual build-up has taken place as members of the staff have been traced and have reported to work, until at the present time a quarter of the total labour force are again at their duties.

The plant suffered no damage whatever, although the inundation of the transport bay involved some lost of material. Hot meals from the mainland were loaded in lorries (right) and delivered for the staff.

A Portable Electronic Organ

A DESCRIPTION OF A READER'S MODIFICATION OF THE "P.W." ORGAN DESCRIBED IN OUR SEPTEMBER, OCTOBER AND NOVEMBER, 1952, ISSUES

By G. M. King, B.Sc.

I HAD been interested in electronic organ design for some time, and had already experimented with the original design published in 1947. As, however, my main interest was in a portable type of instrument, and complete constructional details were given in the 1952 issues, I experimented with a view to producing an instrument to suit my particular needs.

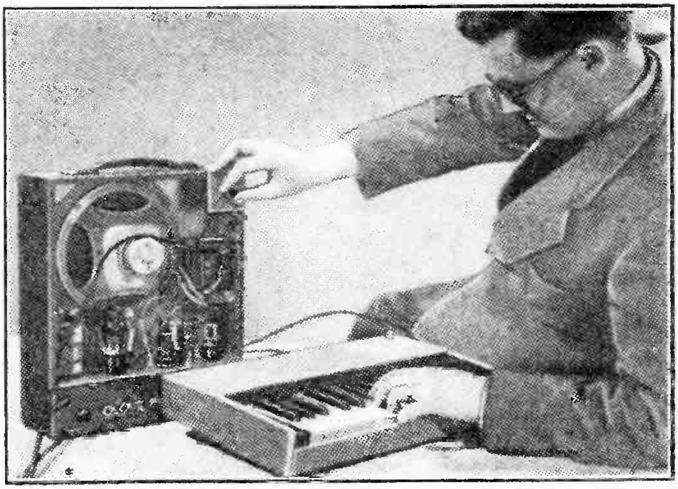
The complete equipment ready for use.

The organ about to be described went through various modifications until a reasonably versatile, compact and portable one was evolved. To do this presented several minor problems, the main one being to house the whole of the organ in one portable case. This was achieved by building the power pack and tone generators on one chassis and converting the transformer-fed A.C. circuit, into an A.C./D.C. one. To do this the 6SN7's were replaced by 12AH7's (ex-Government) and the EL33 and 5Z4 by a 25A6 and a 35Z4. The 12AH7's are only .15 amp. so the two were wired in parallel to make .3 amp. the heater chain current. The output of the 25A6 is only 2.2 watts but this has proved quite adequate for the majority of purposes.

Not being satisfied with the woodwind circuit I reverted to Mr. Blake's circuit and used a 6J5 as a buffer amplifier before the filter stage. Not only did this give a far greater volume but increased the effectiveness of the filters so that hitherto inaudible delicate tones were now audible. As can be seen the tone filters are the same as the original "P.W." organ, although I made minor alterations to suit myself. The octave range was extended to six octaves by altering the values of the oscillator charge condensers C, C5 and C6 to .0025, .01 and .04 μF respectively. This gave a range from 2½ octaves below middle C to 3½ octaves above middle C. The bass octaves at this point, although powerful, lacked that pipe organ quality, so a bass "mellower" was incorporated by using the disused woodwind switch to bring in a .1 μF condenser connected across the anode of the 25A6 and chassis.

The Keyboard

The keyboard was made from part of an old American organ. (The latter may be bought very cheaply—mine cost 14s.). The lowest note on this keyboard was F so that to give plenty of melodic scope, G, two octaves above this, was taken as the top note. The keyboard was easily taken off the main organ and sawn to the required length, care being taken to "trim" the top G flush with the end block, both of which were cut down to 2in. wide and refitted to the ends of the keyboard. Next came the problem of respringing the new keyboard. This was done using the pallet springs (found under the sound board, pressing on the pallets). They were shortened and refitted into small holes in the frame opposite the underside of each playing key, so that they pressed upwards on to the bottom edge of the keys (see photo). Care was taken to adjust the pressure of each key so that the touch was uniform. Next came the contacts and these were made out of 28 nickel-silver strips, 4/10in. wide and 3½in. long. These were screwed on to the frame under each key, and on depressing a key contacted a brass rod which was bolted to the frame



The Author adjusting the pre-set control pitch.

at either end and was held $\frac{1}{8}$in. away from the strips.

The resistance network to tune each note was placed under the oak-faced plyboard panel that covers the non-playing side of the keyboard. The notes were tuned by first adjusting a variable 50 kW. resistor (VRG) until G, an octave-and-a-half above middle C was in tune (octave switch at mid-position) with a piano. This done, condensers C4 and C7 were "padded" until on switching them in they were exactly two octaves above and below the tuned G.

If this is not done carefully then the octave ranges will be out of tune.

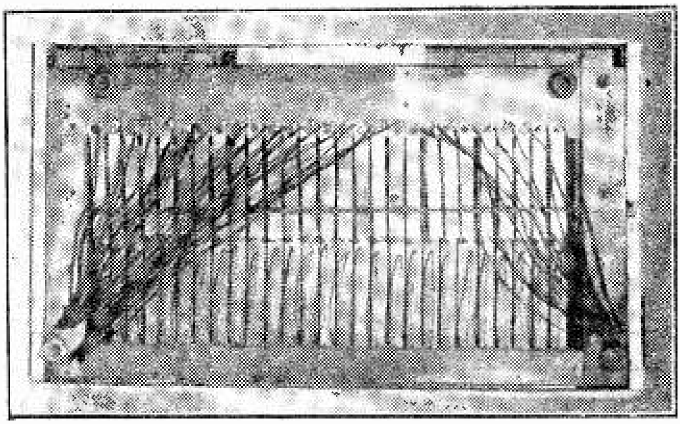
Tuning

Next comes the tedious task of tuning each note, and although a list of resistors is given much has to be done by trial and error. The notes are tuned in turn from top G (VRG) downwards to bottom F. In case of voltage fluctuations the 50 KΩ (VRG) was put on the top panel of the keyboard as a "temperament" control.

In order to tune the organ to different pitches (piano, organ, etc.) a tuning control was fitted on the main case. This was a 10 KΩ (VR4) variable wired in series with the 5 KΩ (R19) in the H.T.1 line, to vary the oscillator frequency. The keyboard was fitted with a miniature three-pin socket into which plugged a 3ft. length of twin coaxial connected to the main chassis.

Pedal Control

To give more realism to the effects, a pedal-operated volume control was devised. The general idea may be obtained from Fig. 2. Care must be taken to see that the thread connected to the boss on the volume control spindle is in two separate pieces, each fastened and twisted twice around the boss before being taken to the pedal, otherwise slipping occurs. The pedal should be quite stiff by seeing that the double spring washers at either side are well compressed. A four-pin miniature socket was fitted into which plugged a four-pin plug connected to the main chassis by a 3ft. length of twin coaxial, so that no confusion can arise between this and the three-pin keyboard plug.



Underside view of the keys, showing contact rod and springs.

Case

The case containing the speaker and chassis measures $12\frac{3}{4}$in. x 15in. x 4in. and is fitted with a suitable carrying handle. The speaker, a Goodman's 8in., was bolted to the top half of the case together with its transformer. The chassis (Fig. 3) was fitted with a wooden face panel to accommodate the tone switches, etc., so as to prevent any shocks that might be got from a live metal panel. For cheapness and size considerations ex-Government panel switches were used—any clicks they made not

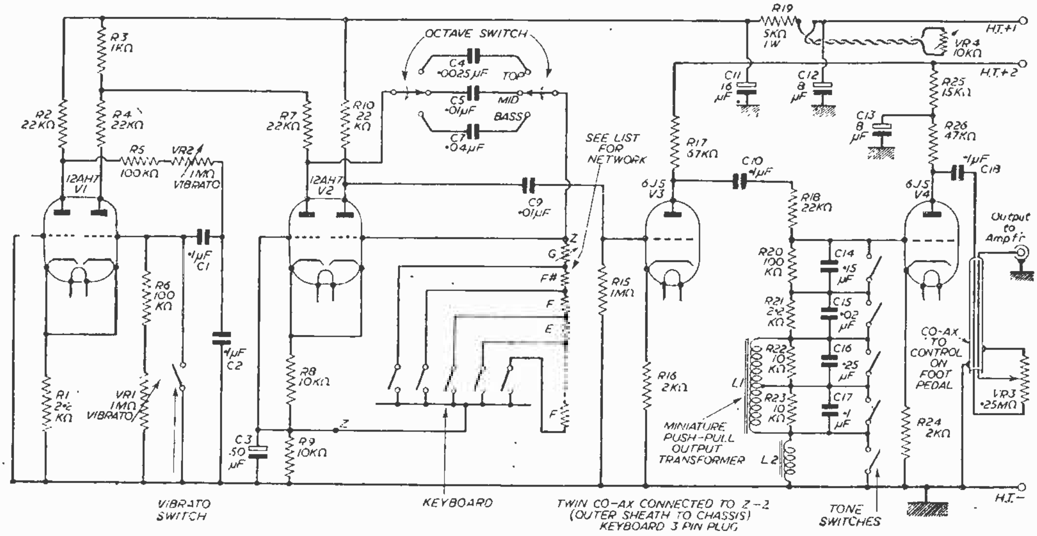


Fig. 1.—Theoretical circuit of the main portion.

being sufficiently audible to be a nuisance. The keyboard and foot pedal are carried in a small case and the whole organ has been easily taken to various places such as schools, churches, etc. It has also proved most useful in a small dance trio of drums, piano and organ. It is hoped that those who "have a go" at constructing the instrument will be amply rewarded by the results as indeed I have been.

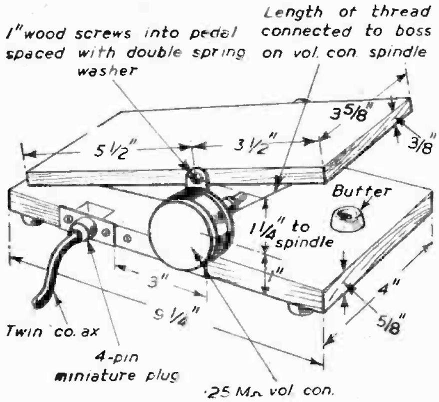


Fig. 2.—Details of the volume-control foot pedal.

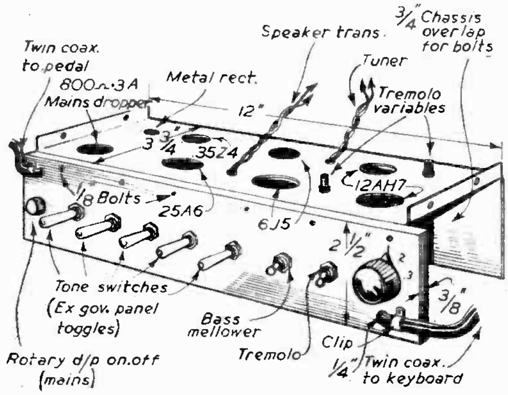
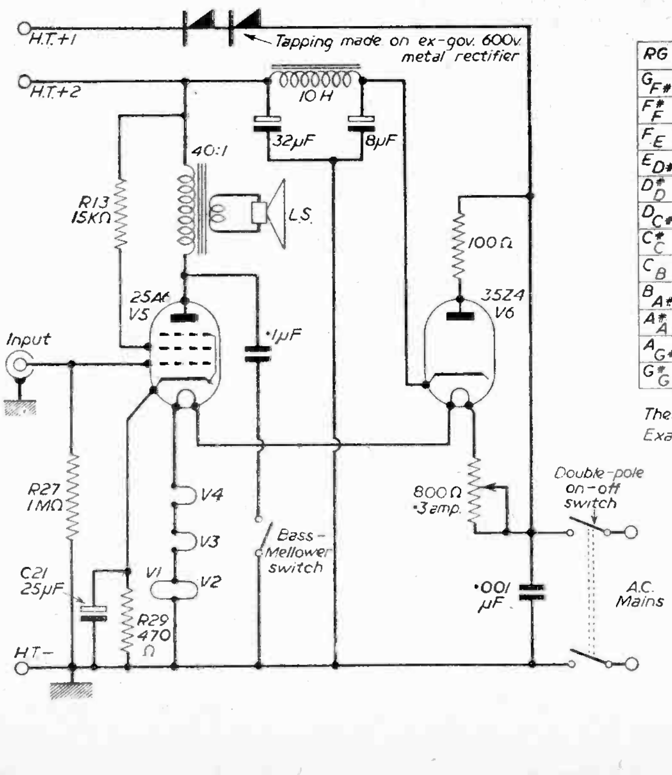


Fig. 3.—Details of the main chassis.

Keyboard Resistors

To assist readers who may be in difficulty in knowing what range of resistors may be required in making up the keyboard, a table is given below showing the values actually used in this particular model; but, as emphasized, these are only a guide and the exact values will vary in each individual model. This is due not only to stray capacities in the wiring, but also to the particular characteristics of the valve and to the normal tolerance variations in individual resistors. If a good resistance bridge or ohmmeter is available, one arrangement preferred by some constructors is to use a variable resistor in each position successively and measure the value found by trial and error. Even then it may be found difficult to find a fixed resistor with the required exact value, and again trial and error may have to be resorted to.



List of keyboard resistors

RG	50KΩ variable	$G_{F\#}$	4500Ω
$G_{F\#}$	2375Ω	$F^{\#}_{F}$	5000Ω
$F^{\#}_{F}$	2425Ω	F_{E}	5000Ω
F_{E}	3000Ω	$E_{D\#}$	6000Ω
$E_{D\#}$	3000Ω	$D^{\#}_{D}$	5500Ω
$D^{\#}_{D}$	2750Ω	$D_{C\#}$	5500Ω
$D_{C\#}$	3500Ω	$C^{\#}_{C}$	6000Ω
$C^{\#}_{C}$	3500Ω	C_{B}	7000Ω
C_{B}	3500Ω	$B_{A\#}$	8000Ω
$B_{A\#}$	4000Ω	$A^{\#}_{A}$	9000Ω
$A^{\#}_{A}$	4000Ω	$A_{G\#}$	10000Ω
$A_{G\#}$	4000Ω	$G^{\#}_{G}$	10000Ω
$G^{\#}_{G}$	5000Ω	G_{F}	12000Ω

These values are given as a guide. Exact tuning can only be done by trial and error.

Fig. 4.—Output stage, showing "bass mellower," and above, approximate values of the resistors used in the note generator stage.

On your Wavelength

by THERMION

Health and Static Electricity

FROM the earliest days of radio people have blamed it for storms, cataclysms, cyclones, disease, drought, poor harvests; now comes the announcement of the discovery of an inexplicable co-relation between human health and comfort and the electrical charge in the atmosphere. Unlike previous announcements, this one comes from a responsible body—the American Institute of Electrical Engineers.

According to the report a small generator of negative electrical particles powered from 110 volt mains can be used to bring the atmospheric charge or a house or a business into the balance of negative charges that Stanford University biologists believe are necessary for human comfort and resistance to disease. The report was made by Dr. H. H. Skilling, chairman of Stanford's Department of Electrical Engineering and an associate of Mr. John C. Beckett, an electrical engineer of a well-known American company. They said that detailed measurements of the effects of electrical charge on life were still being assembled. The tests indicate that for animals, at least, an atmosphere rich in positive charges (ions) is harmful and one rich in negative ions is beneficial. The cause of this has not yet been discovered, but evidence suggests that atmospheric ionisation affects the functioning of the pituitary-adrenal glandular system. For over a century reports have appeared in medical literature suggesting that electrical charges in the air might be co-related to disease or discomfort.

No absolute proof, however, has been forthcoming to date. Normally clean air contains between 400 and 1,000 ions of each polarity in each cubic centimetre with a slight excess of positive ions. If air is polluted, as in a small room full of people, the number of ions decreases because they attach themselves to dust particles, drops of moisture, etc.

This statement should bring comfort to the BBC, which is often blamed for sending people to sleep by the dullness of some of their programmes. In future, when Thermion nods, listening in to the Third Programme, he will know that there is an excess of positive ions in his room!

I'm 21 Too!

THE reminder in last month's issue that this journal attains its majority on September 28th this year is a reminder to your scribe that he, too, attains his majority as a contributor to this journal, although he has served under two masters. I was present at the birth of this journal and also of *Amateur Wireless*, which fell by the wayside some years ago, and whose readership was absorbed by PRACTICAL WIRELESS. *Amateur Wireless* was originally published by Cassell and Company as a result of a suggestion of mine in 1922 that the moment was ripe for such a journal. The only information on amateur radio up to that time was published spasmodically in perdiocals, such as *Work*, the radio correspondent of which paper was Ernest Redpath. I, at that time, was on the staff of a paper named *Everyday Science*, and it regularly ran a supplement entitled "Amateur Wireless." It was obvious in 1922 that radio was about to "break" as a regular daily transmission, replacing the once weekly half-hour transmission from 2MT at Writtle, Essex. Captain P. P. Eckersley was in charge as chief engineer announcer and general factotum.

So the supplement was lifted from *Everyday Science* and expanded into a weekly journal, which was somewhat coldly launched by the publishers, in the hope that it would get in on the ground floor, so to speak, and expand in circulation as radio grew in popularity.

There were few contributors in those days, and practically the whole of No. 1 was written by the staff, including the present writer. As we were preparing that first issue news came that a rival publisher, the Amalgamated Press, intended also to produce a journal, and there was the inevitable race to be out first. In point of fact, *Popular Wireless* (now defunct) and *Amateur Wireless* were published within 24 hours or each other, I suspect with a readership which largely overlapped. Both papers were an instantaneous success and contributors began to offer their services in increasing numbers. There was an immediate demand for books and blueprints, and I well remember (indeed, am I ever likely to forget?) producing a book on the construction of wireless components between Friday night and Monday morning. It consisted of 40,000 words and over 100 diagrams. I remained on the premises day and night, with lashings of coffee to keep me awake. Gangs of printer's devils snatched the copy sentence by sentence, and draughtsmen worked at top speed to prepare drawings as they came to be referred to in the text. By the time I had finished writing, the book was in galley form and the blocks were made. I then set to work making up the pages and indexing and on the Monday copies were on sale to the public. That was a journalistic feat, which is, as far as I know, without parallel. It sold 80,000 copies within a month, and went through several editions.

In the course of the years other rivals entered the field and, as readers of this journal well know, we were the last, thus proving that to have been first proves nothing but antiquity, but to have become first shows virility and merit.

Throughout these 21 years I have never missed a contribution and I estimate that in this feature alone I have contributed over 2,000,000 words. I have, of course, preserved bound volumes of every issue.

The first amateur radio paper came home to roost and was merged with PRACTICAL WIRELESS several years before the war.

However, I must not dilate upon this subject further, for the whole story will be told in the special birthday number to which I shall contribute.

The "Modern" High-power Quality Amplifier—2

FURTHER DETAILS OF THE 1953 VERSION OF THIS POPULAR AMPLIFIER, AND OF A TUNER UNIT FOR USE WITH IT

By R. Hindle

(Continued from page 130, March 1953 issue.)

FEEDBACK can now be restored. Perhaps a reminder should be given that if the connections to the output transformer secondary are the wrong way round positive feedback will result. Consequently set VR2 at maximum before applying feedback and if, when connected, the amplifier oscillates, switch off and reverse the connections to the transformer secondary. Now switch on again and if the oscillation has stopped all is well. If not, then probably the output transformer is unsuitable and a better one will have to be provided or the idea of feedback will have to be abandoned.

Now reduce VR2 gradually and note the improvement in tone and background. The amplifier gain will also go down, so it will be necessary to advance the feeder gain control at the same time to maintain the level of signal. There will be little point in reducing this resistance below 4 K. ohms (for 15 ohm output) or 1,800 ohms (for 3 ohm speaker). Again it will be sufficiently accurate to estimate this from the angle of rotation of the spindle. Continue to reduce the control however, as a test, to see that the onset of instability is not approached, and then return to the predetermined point. If the unstable point is reached, turn the control well back for normal operation.

Feeder Design

In order to show how to make use of the earth return arrangement, and to form the basis of a feeder design of a type not previously covered in the "Modern" series, Fig. 3 gives the circuit of a T.R.F. quality feeder that was actually designed for use with the prototype amplifier. It will be seen that a tone-control unit similar to that used in previous feeder designs is used except that the earth returns of the unit are connected to one point which is "floating" and does not come into contact with the chassis of the unit in any place. The earth return lead to the amplifier is connected to this floating earth line which is carried on via the input cable to the feeder proper. It will be noted that there is a D.C. path in the output of the unit via VR3 and R11, so that R22 in the main amplifier is unnecessary so long as the amplifier is not likely to be switched on without the interconnecting cable plugged in.

The feeder proper is a simple three-station, switch-tuned affair, giving, in the original, Light, Regional and Third programmes, all of which are reasonably near the set location and give good signal strength. A word of warning should be given not to attempt to use a T.R.F. circuit *for quality work* unless sufficiently near to the stations to ensure that, in all circumstances, the signal received is large compared with any other unwanted signal likely to be picked up by the aerial. A T.R.F. receiver can be made to give reasonably good selectivity, of course, but the measures used cannot be tolerated in quality equipment and, in fact, it may be necessary under certain circumstances deliberately to damp the circuits to ensure satisfactory bandwidth. If the stipulated conditions are unlikely to be present, the constructor will be well advised to decide on one of the superhet.

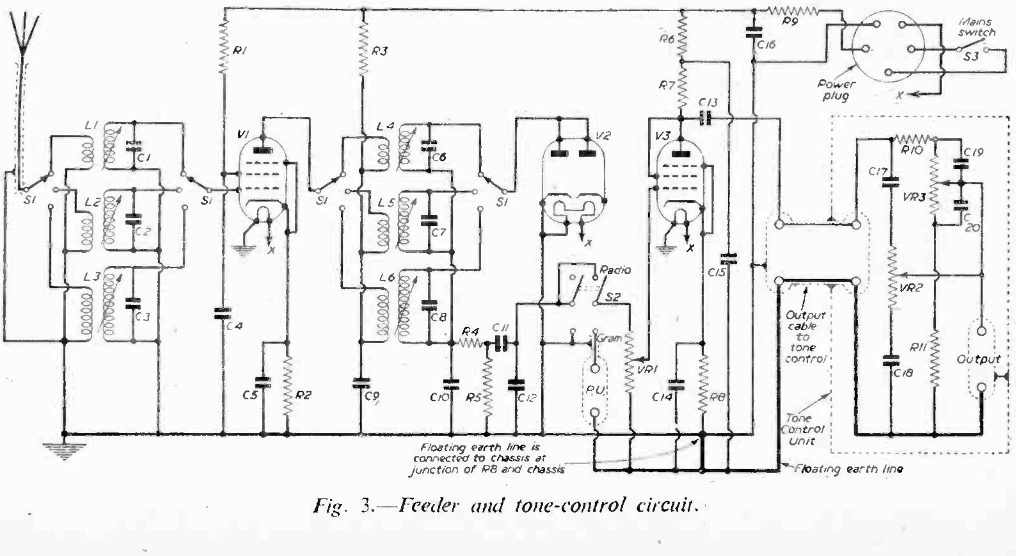


Fig. 3.—Feeder and tone-control circuit.

feeders already described as being capable of equal selectivity with better bandwidth. In the marginal case, where with the necessary flatness of tuning it is found that an interfering transmission breaks through, the use of the old-fashioned wavetrap device can be tried. This is conveniently available in the form of the Osmor "Station Selector," which is included in the aerial circuit between the aerial and the feeder and tuned to the unwanted station.

It will be seen that a straightforward screened pentode R.F. stage is used. No variable gain control, automatic or otherwise, is included in this circuit. The aim is to avoid any form of cross modulation, and the non-variable mu valve, whilst it has a shorter grid base, has within that limited range a straighter characteristic. It is not likely that the aerial will provide a signal sufficient to produce an overloading signal at V1 grid, and if it does suitable attenuation can easily be provided simply by using a small internal aerial.

A diode detector was chosen rather than the fashionable cathode-follower type because the diode damps the tuning to a degree, giving better bandwidth. Also, the cathode-follower type is prone to instability. The feedback at R.F. is not always the perfect negative type generally assumed with a cathode follower owing to the inter-electrode capacities which can convert it into something very like a Colpitt's oscillator. It is not so bad if the circuit is downright unstable because the fault is obvious and steps can be taken to clear it, but the danger is where there may be positive feedback but insufficient to cause oscillation. This is very much as though permanent reaction is being applied, and tone is not then all that it should be.

The radiogram switch provides muting for the radio section when records are being played. Any correcting filter recommended by the pick-up makers should be inserted between the pick-up input plug and the radiogram switch. Also, if the pick-up makers specify a load resistance lower than the ½ meg. of

COMPONENT LIST FOR FIG. 3. FEEDER CIRCUIT

Resistors	Condensors
R1—220 K Ω	C1
R2—1 K Ω	C2 } see text.
R3—10 K Ω	C3
R4—10 K Ω	C4—.1 μF
R5—1 M Ω	C5—.1 μF
R6—10 K Ω	C6
R7—47 K Ω	C7 } see text.
R8—1 K Ω	C8
R9—10 K Ω 1 Watt.	C9—.1 μF
R10—100 K Ω	C10—500 pF
R11—10 K Ω	C11—.1 μF
(½ watt except where stated otherwise)	C12—200 pF
	C13—.1 μF
	C14—25 μF
	C15—8 μF 450 v.
VR1—½ M Ω	C16—8 μF 450 v.
VR2—100 K Ω	C17—.003 μF
VR3—1 M Ω	C18—.02 μF
	C19—.005 μF
V1—Brimar 6J7GT	C20—.02 μF
V2—Brimar 6H6GT	(All 350 v. working
V3—Brimar 6J7GT	except where indicated)
L1, L2, L3 } Osmor Aerial Coils. See text.	L4, L5, L6 } Osmor H.F. Coils. See text.

VR1 it will be necessary to wire across the pick-up input terminals a resistance calculated to reduce the load to the correct figure. This must not be across the volume control because it must not be in circuit on radio.

V3 is a low-gain circuit intended to make up for the loss in the following tone control circuits. Very likely, in positions of high signal strength, if the tone-control circuits are to be omitted, this valve

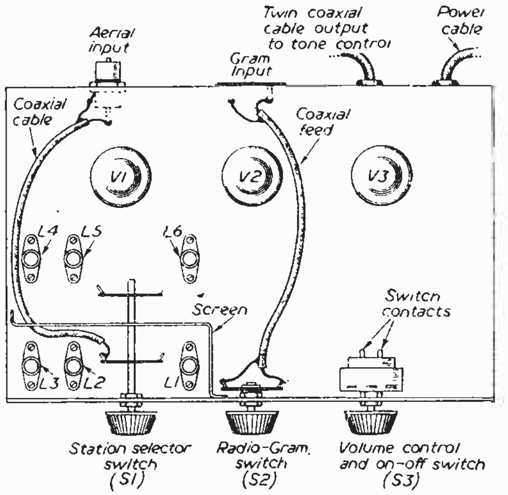


Fig. 4.—Layout of the feeder unit.

will not be required, in which case the signal from the slider of the volume control is fed to the output cable.

It will be noted that the earth returns of V3 are all brought to one point and that the earth return connection from the amplifier and the tone-control panel, conveyed via the two-core coaxial inter-chassis signal lead, is connected to the same earth point. This earth point on the feeder chassis is joined to the chassis, however, and this forms the only link with the chassis for the whole of the grid returns of this valve, including those in the tone-control unit and on the main amplifier.

Construction

Constructionally, the important thing to remember is the need for extremely good screening between the two tuned circuits. Again, it is not sufficient just to prevent instability. Positive feedback to a degree too small to cause oscillation will again give the effect of permanent reaction. This is all very fine for station-getting and no doubt accounts for the phenomenal results sometimes claimed for simple receivers, but it is no good for quality equipment.

The adjustable cores of the specified Osmor coils are used for tuning-in the stations required, and fixed condensers are wired across the individual coils to make them tune over a range to include the required transmission. For medium-wave stations the appropriate coil is type QA8 for aerial and QHF8 for the intervalve position. If a long-wave station is required, use in the appropriate circuit position QA9 for aerial and QHF9 between the valves. The exact capacity required will depend to some degree on the strays introduced in construction, but the following may be taken as a guide for the first trial :—

Below 250 M.	50 pF in aerial and H.F. position.
250/300 M.	100 pF
300/350 M.	150 pF
350/400 M.	200 pF
400/500 M.	300 pF
500/600 M.	500 pF

For the long-wave Light programme 200 pF will probably be right.

A single wafer, three-way four-pole switch can be used if a screen is fitted to extend right up to the switchplate, between the tags, but a better and safer layout will result if a two-wafer switch is used, with the screen extending between the wafers, one used for aerial coil switching and the other for the H.F. coil switching. A recommended layout using a two-wafer switch is given in Fig. 4.

There is no difficulty whatever in setting up this unit. All that is necessary is to connect it up to the amplifier, connect aerial and earth, switch on and adjust the cores of the appropriate coils in each switch range for maximum signal on the required station. If maximum signal is obtained with the core right out a smaller fixed condenser is required, but if the core is right inside the winding a larger condenser should be fitted. Two positions of maximum signal will be found within the range of the core, one where it links the coupling winding and one where it is in the tuned winding only. Both should be tried to see which gives best results in the particular circumstances. Incidentally, if only one maximum can be found, it is very likely that this is the position where the core is fully in, and a larger condenser is indicated.

In the unlikely event of hum being experienced, it will most likely originate in the tone-control unit, and therefore this should be left in position, but the wiring modified so that C13 goes direct to the amplifier. If hum is then absent, it will indicate that the screening of the tone control section is incomplete, or some faulty connection is present in it.

R.F. COUPLING

By Gordon J. King, A.M.I.P.R.E.

THE constructor is often faced with the problem of resolving optimum values for a resistor capacitor combination in conjunction with stage coupling. It may be necessary, for instance, to couple a voltage amplifying stage to a power stage in an audio amplifier or broadcast receiver, while at the same time maintaining a linear frequency response. Although the circuitry involved in coupling arrangements of this nature is extremely simple, many ambiguous functional theories dwell in the minds of constructors and experimenters. It is, therefore, the aim of this article to clear the air a little in this respect, and to shed light on the seemingly difficult problems which are sometimes associated with this very popular mode of stage coupling.

Two Sets of Conditions

First, then, let us examine the well-known circuit of Fig. 1. Here we have a triode, V1, which is an audio voltage amplifier coupled to a pentode V2, usually working as a power output valve, or in certain cases, as a second voltage amplifier. The audio voltage which appears at the anode of V1 is fed to the control grid of V2, but since, of course, the grid must be maintained at a negative potential, and the anode is of a necessity positive, we must employ a method of coupling that passes the audio-frequency component of the voltage, but very successfully blocks the D.C. component ; and this is where our coupling capacitor C1 serves a dual function.

Now we come to consider how the grid of V2 receives a D.C. bias voltage, for it is obvious that we cannot apply to this grid a negative potential direct from the bias source, otherwise the source impedance —which is very low—would tend to short-circuit the signal at the grid. For this reason a resistor of suitably high value is interposed between the bias source and the control grid, and this we call the grid resistor (R1 of Fig. 1), which forms the second element of our coupling network.

In Fig. 1 cathode bias is utilised ; and before going on it might be as well to clear this point which often bewilders the beginner. Grid-bias is always reckoned relative to the cathode of the valve, and is mainly provided by the potential developed across the cathode resistor R3 which, as can be seen, is returned to the earth end of R1, via the main earth line. This simply means, then, that the cathode of the valve will be more positive than the control grid ; which is exactly the same as saying that the control grid will be more *negative* than the cathode, at a potential dependent on the value of R3.

We can see now that the only reason we need to use a resistor and capacitor for coupling purposes is to satisfy two sets of conditions : one from the D.C. point of view, and the other from the audio or signal aspect. For instance, a perfect signal coupling would be achieved by connecting the anode direct to the control grid, but this would not allow the anode of V1 and the grid of V2 to be held at the different voltages that are essential for efficient operation. If, on the other hand, we connected the grid of V2 direct to the earth line, instead of through R1, we would

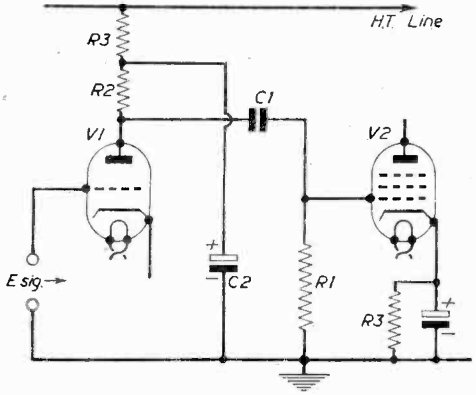


Fig. 1.—A typical R.C. Coupled Stage.

wholly satisfy conditions for grid-bias, but would prevent any signal at all from reaching the grid of V2.

This shows how important it is to ensure that the coupling capacitor is of perfect insulation, for a slight D.C. leak would most certainly upset the biasing of V2, either reducing it slightly or making the grid go positive governed, of course, on the magnitude of the leakage. The symptoms of a "leaky" coupling capacitor are severe distortion, coupled with excessive over-heating of the output valve, and in certain cases a reduction in H.T. line voltage brought about by the additional current passed by the valve under the faulty conditions.

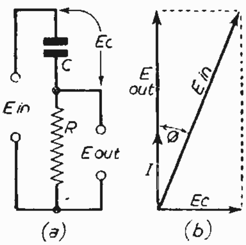
It is always advisable, in the first place, to check the coupling capacitor for leakage, even though distortion is barely discernible. The best way of performing this is by disconnecting the grid end of the capacitor and measuring the voltage, on a high-resistance meter, between the disconnected end of the capacitor and the earth line. By this method a more sensitive means is available of determining the insulation property of the capacitor under actual working conditions, than endeavouring to get a reading on an ohm-meter—a very slight voltage reading should be sufficient to demand capacitor replacement.

Element Values

Two main factors govern the value of R1 : one is the output valve itself, which controls the upper limit. For if the grid resistor is made too high, say, in the region of megohms, there is a risk that the output valve may pass grid current, even though the grid is maintained at a negative potential. Such an effect would result in a voltage drop across R1 and thereby alter the intended grid-bias potential which, apart from distorting the amplification of the signal, would rapidly cause the valve to lose emission.

For this reason valve manufacturers stipulate the highest recommended value grid resistor for certain valves operating under various conditions. As an example, a 6V6G valve may have an overall grid resistance as high as, but not greater than, 0.5 megohm when using cathode bias, and provided the heater voltage is not allowed to rise more than 10 per cent. above the rated value. With fixed bias the grid resistance must be considerably lower—not exceeding 0.05 megohm for the same valve working under similar conditions of operation.

The other reason for keeping R1 as high as allowable is to avoid having to make the capacitor C1 higher than is economically necessary for an extended low-frequency response. This will become clearer as we investigate the dynamic characteristics of the circuit. In this respect it is often best to consider the coupling from the signal point of view as a potential-divider. But before we do this we must bear in mind two important factors—namely, the influence created by the actual coupling resistor—or coupling impedance—R2, and the effect the anode impedance of V1 has on the general performance of the coupling.



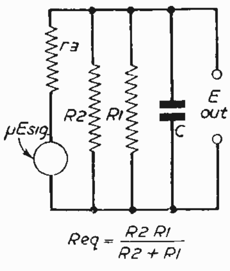


Fig. 2 (*left*).—(*a*) *Shows a potential divider circuit, and* (*b*) *the resulting phase shift.*

Fig. 4 (*right*).—*An equivalent circuit of Fig.* 1 *for the high audio frequencies.*

Although R1 provides a D.C. path between the anode and H.T. line, its equally important function is as a load for the alternating signal currents. This means that from the A.C. aspect the H.T. side of the resistor is connected to the earth line by virtue of the impedance of the decoupling capacitor C2, while the anode side is connected to the grid of V2, through C1 ; in other words, R2 should be regarded as being in parallel with R1, since the impedances of both C1 and C2 should be as low as possible. Furthermore, the anode impedance of V1 itself must be considered, and for our purposes can be represented by a corresponding value resistor in parallel with R2.

It is obvious, of course, that the capacitors are bound to yield a certain amount of impedance to the lower frequencies. This applies mainly to C1, for C2 is often a large value electrolytic capacitor that offers a negligible impedance. C1, on the other hand, needs to be a good quality paper or mica capacitor to maintain a high D.C. insulation, and for this reason a large value electrolytic capacitor must not be used for coupling purposes.

We can see, then, that the signal voltage at the grid of V2 is bound to be less than the signal voltage at the anode of V1 ; but this difference can be made very small by ensuring that the impedance of C1 is very small compared with the effective value of the grid resistance.

To facilitate our study in this direction, let us consider for the time being the individual function of the coupling comprising only the coupling capacitor C1 and the grid resistor R1. We can redraw this section as at Fig. 2a, and consider it better from the point of view of a potential-divider. But when we do this we must remember that, even though the signal current flows through C and R, the separate voltages developed across either element are 90 degrees out of phase with each other (the voltage across a capacitor lags the current by 90 degrees). This means that the signal voltage (Ein) equals the *vector* sum of the voltage across C (Ec) and the voltage across R (Eout).

Now, if we put this in the usual vector notation (Fig. 2b) we can clearly see that the impedance which the coupling capacitor offers, particularly to the low frequencies, consumes some of the low-frequency voltage that would otherwise be developed across the grid resistor. Nevertheless, it should be noted that as a result of the 90 degree phase shift, the voltage transfers between anode and grid shows a marked improvement over a potential-divider consisting of two purely resistive elements.

We know, of course, that the reactance of a capacitor enlarges as the frequency of the current in it reduces, according to the equation :—Xc equals $1/2\pi fC$. This means that a larger ratio of the input voltage will be absorbed across the capacitor at the lower frequencies, with a consequent reduction in output voltage. Therefore, when we are designing a linear coupling it is clearly necessary to make sure of a negligible coupling loss at the *lowest* signal frequency, which will produce even less attenuation to the higher intermediate frequencies.

Let us suppose, for example, that we are building an audio amplifier, in which no more than a 10 per cent. coupling loss can be tolerated at 50 c.p.s. With the aid of vectors we can draw a line representing the magnitude of Eout 10 per cent. shorter than Ein and, by completing the diagram, quickly determine the magnitude Ec. This resolves to something like 48 per cent. of Eout, which means the reactance of C at 50 c.p.s. should be 0.48 of R.

Now, for simplicity let us asume that the output valve demands a grid resistor not greater than 0.5 megohm, in which case the impedance of C at 50 c.p.s. must not exceed 240 kilohms ($0.48 \times 5 \times 10^5$) for the desired low-frequency response. This works out to make $C = 0.013\ \mu F$—or a more practical value, of course, being $0.02\ \mu F$.

Phase Shift

The coupling inevitably introduces a phase shift, which must be something less than 90 degrees (per coupling) owing to the effect of the resistive element. It is sometimes advisable to know the actual magnitude of phase shift, especially if negative feed-back is applied to the stage in question—for negative feed-back is often made positive by the influence of excessive phase shift. Obviously, the phase shift is maximum at low frequencies, and this is the reason why, in certain amplifiers, the application of negative feed-back tends to create "motor-boating"—much to the amazement of the constructor. If the phase shift introduced by a combination of couplings is slightly insufficient to initiate feed-back, bad low-frequency distortion frequently results.

It is extremely simple to compute the phase shift of a coupling by using just a touch of trigonometry. The phase shift is, for example, indicated on the vector diagram of Fig. 2b by the angle ø, so we can see that the cosine of the angle equals Eout-Ein, which in conjunction with the previously considered coupling works out to a little under 26 degrees.

The Response to High Frequencies

The most important property of the R.C. amplifier is the way in which the amplification varies with frequency. We have already considered the factors governing the low-frequency response, but equally important is the relative amplification given to the very high audio frequencies.

A frequency characteristic of a typical R.C. amplifier is shown in Fig. 3, and has as its distinguishing feature an amplification that is substantially linear over a wide range of frequencies. Nevertheless, a gradual decline in amplification is observed at 2,000 c.p.s., which is accelerated as the frequency is raised further. This reduction in amplification is caused by the valve and stray capacitances which shunt the coupling and grid resistors, and which have low enough reactance at high frequencies to reduce the effective load resistance. Before we continue, however, it will be instructive to see how a reduction in valve circuit constants produces a consequent attenuation in the voltage developed across the grid resistor.

Referring once again to the circuit of Fig. 1 we can easily discover the amplification provided by V1 to the middle audio frequencies by using the following well-known equation :—

Amplification equals $\mu \times Req/Req + ra$.........(1)

where Req is the equivalent resistance formed by R2 and R1 in parallel, while μ and ra represent the amplification factor and the anode resistance of V1 respectively.

Now, at high frequencies, the impedance offered by the coupling capacitor is so small as to be practically equivalent to a short circuit as compared with the grid resistor, but at the same time the effect of the shunt capacitances is enlarged. This can be better illustrated by using the equivalent circuit of Fig. 4. Here the capacitor C corresponds to the combined shunting capacitance presented by the wiring and valves, while the other elements, of course, are the circuit constants which virtually shunt the coupling resistor.

A study of this circuit will, therefore, make clear that the extent to which the high-frequency amplifica-

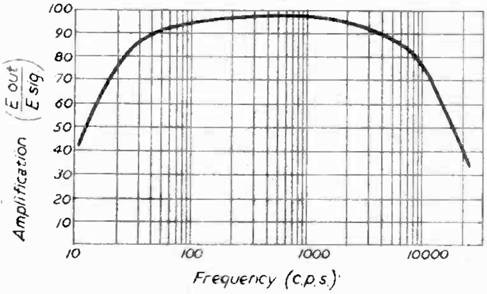


Fig. 3.—A frequency characteristic of a typical R.C. Amplifier.

tion falls off, is determined by the ratio which the reactance of C bears to Req. This simple means that as the reactance of C increases the effective value of Req reduces, and a reduction of Req, as shown by equation (1), will have the effect of lowering the relative amplification.

In conclusion it should be said that this article has been written from the practical aspect; there are, of course, equations which can be used to compute the amplification at various bands of frequencies, and can be found in any reference book. Even so, such a jumble of notation usually bewilders more than assists the constructor unless the principal of the circuit involved is fully comprehended.

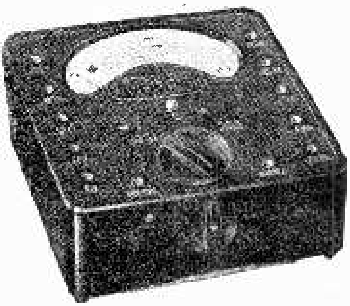
BRITISH STANDARD FOR RECORDS

BRITISH Standard 1928 : 1953 for Lateral-cut gramophone records and direct recordings is the first British Standard to deal with some of the requirements for disc recording or reproduction of sound by electro-mechanical processes.

The standard specifies the important dimensional features of the types of gramophone record generally available (78 and 33⅓ r.p.m.) and also deals with direct recordings on, for example, lacquer discs.

Requirements governing the recording characteristics, change-over frequency and the information that should appear on the label, are given, together with notes on the most suitable dimensions of reproducing stylus and diameters of turntable centre pins.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 24, Victoria Street, London, S.W.1. Price 2s. 6d.



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0—5 volts	0—25 ,,
0—25 ,,	0—100 ,,
0—100 ,,	0—250 ,,
0—250 ,,	0—500 ,,
0—500 ,,	

D.C. Current	Resistance
0—2,5 milliamps	0—20,000 ohms
0—5 ,,	0—100,000 ,,
0—25 ,,	0—500,000 ,,
0—100 ,,	0—2 megohms
0—500 ,,	0—5 ,,
	0—10 ,,

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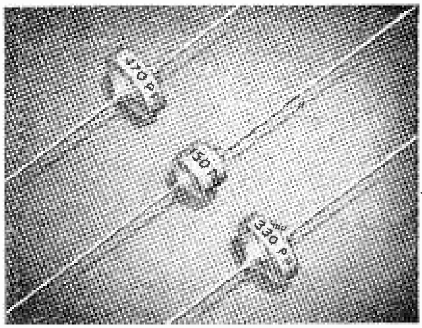
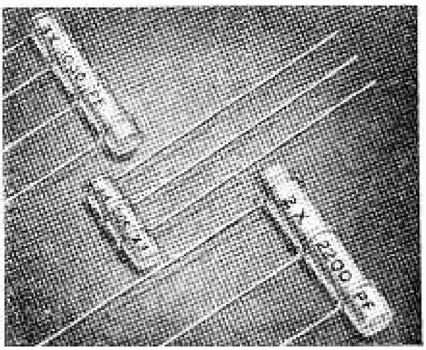
1·0	500	250	3·5 mm. to 7 mm.	5 mm. to 7 mm.	SPG 1
10·0	500	250			SPG 1
33·0	500	250			SPG 1
150	500	250			SPG 1
330	500	250			SPG 1
470	500	250			SPG 1

Hi-K MULTIPLE TUBULAR CERAMICS

Capacity pF.*	Wkg. Voltage D.C.	Wkg. Voltage A.C.	Dimensions Length	Dimensions Dia.	Type No.
2 · 500	500	250	10 mm.	4·5 mm.	2CTH 310/W
2 · 1000	500	250	10 mm.	4·5 mm.	2CTH 310/W
2 · 1500	500	250	15 mm.	4·5 mm.	2CTH 315/W
2 · 2200	500	250	22 mm.	6 mm.	2CTH 422/W
3 · 500	500	250	15 mm.	4·5 mm.	3CTH 315/W
3 · 1000	500	250	15 mm.	4·5 mm.	3CTH 315/W
3 · 2200	500	250	22 mm.	6 mm.	3CTH 422/W

* Guaranteed not less than stated values at 25°C.





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Radio Division: **North Acton, London, W.3.** *Tel: Acorn 0061*

A Cheap Voltage Measuring Unit

A HIGHLY EFFICIENT INSTRUMENT WHICH CANNOT BE DAMAGED BY OVERLOAD

By A. Blackburn

WHEN measuring voltages from high-resistance sources, such as the A.V.C. voltage in a superhet receiver, or the anode voltage of a valve with a high anode load, considerable errors may be introduced. For example, in Fig. 1 it is required to measure the voltage across R_2. If a meter of sensitivity 1,000 Ω per volt is used on the 100 v. range, it will have a resistance of 100 K Ω. The resultant resistance at the bottom of the chain is now 100 K Ω in parallel with 1 M Ω—approximately 100 K Ω. The voltage with the meter connected is, therefore:

$$\frac{100,000}{1,000,000+100,000} \times 200 = 19 \text{ v.}$$

It can be seen from this that the degree of error is too great to be ignored. The error would be eliminated if one could produce a voltmeter with an infinite resistance; the closest possible approximation to this condition is the valve voltmeter. In this instrument a valve is used, and the voltage to be measured applied between grid and cathode. In the simplest case, the resultant change in anode current is observed on a micro-ammeter. The input resistance of such a voltmeter is very high, of the order of tens of M Ω, because it is limited only by the insulation resistance of the valve. There are many variations of this principle, but in all cases a sensitive meter movement must be used. This obvious disadvantage could be offset by the use of an amplifier, but the stability of such a system is very poor, unless elaborate precautions are taken.

Performance equivalent to that of a valve voltmeter using a sensitive meter movement (1 mA. full-scale deflection) may be obtained by the use of the well-known magic eye tuning indicator, a fundamental principle of which is that the change in shadow angle is proportional to the volts applied between grid and cathode. By observing the change in shadow angle an indication of the applied voltage is obtained. No sensitive meter is required, but to calibrate the face of the magic eye direct would give a very poor accuracy. However, the magic eye can be used to indicate a balance between the unknown voltage and a reference voltage incorporated with the instrument. This internal voltage may be calibrated to any degree of accuracy that may be required.

The Circuit

A basic circuit is shown in Fig. 2. Before the voltage is applied the potentiometer, R_4, is set at the negative end. The points *aa* are connected to the voltage to be measured, and the potentiometer is moved from the negative end until the shadow angle on the magic eye returns to its original position. The voltage, e, therefore, is equal and opposite to the applied voltage, e_1. There is no provision for setting the shadow angle at any convenient point in this basic scheme. A circuit based on this principle and constructed by the author is shown in Fig. 3. This will measure voltages over a range of 1 to 500 v. D.C. and 1 to 250 v. A.C. over a frequency range of 30 c/s to 10 Mc/s., with neglible error. V_1 is the magic eye tuning indicator, and may be either an EM34 or Y61.

The reference voltage, as before, is derived from R_4, which is connected in a chain (R_3, R_5, R_6) across the H.T. supply. The valve, V_3, is a neon stabiliser providing a constant voltage of 180 v. R_7 is used for zero adjustment, and is used in conjunction with SW_3, the use of which will be described later. Voltage ranges are selected by SW_2 from a fixed potentiometer circuit R_{11}, R_{12} and R_{13}; the values indicated give 5 v., 50 v. and 500 v.; SW_1 selects A.C. or D.C. To avoid a blurred shadow edge, by-pass capacitors, C_1 and C_2, ensure that no A.C. pick-up is applied to the grid circuit.

For the measurement of A.C. a low-capacity diode rectifies the voltage which is further smoothed by the

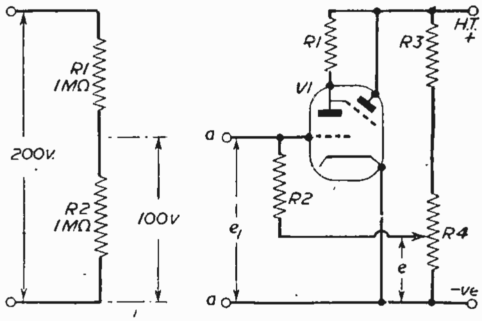


Fig. 1. (Left)—Diagram illustrating faulty readings.
Fig. 2 (Right)—Basic circuit of the magic-eye tuner.

filter, R_{11} and C_3, C_4 in parallel. C_4 has a low reactance at audio-frequencies, and C_3 has been added in order to ensure that adequate smoothing is provided at higher frequencies. Even with no voltage applied to the input terminals a negative potential of 1-2 volts, produced by the diode, is developed across the range potentiometer (R_{11}, R_{12}, R_{13}). In order to offset this effect, the grid is raised positive by returning the earthy end of the potentiometer, R_4, not to earth, but to R_3. On D.C. the cathode can be made sufficiently positive, by adjustment of R_7, to ensure balance in the absence of the diode contact potential.

Power supplies are provided by a 250 v. secondary on a mains transformer, the output of which is rectified by a half-wave metal rectifier, and smoothed by the two 8 μF electrolytic condensers, C_5 and C_6, and the 10 K Ω resistor, R_{15}. Heater supplies for V_1 and V_2 are provided by a 6.3 v. winding on the transformer.

The author's instrument was constructed in an ex-R.A.F. instrument case, approximately 8in. x 9in. x 6in., but little need be said about constructional details, as the layout of components is in no way critical and may be left to suit individual circumstances. A word may be said, however, about the diode, V_2, and its associated components. It is good practice to assemble these components in a small compartment connected by a lead to the main instrument. It should be made as small as is practicable, with the anode of the diode as near as possible to the input lead. The reason for this is that the accurate measurement of high-frequency voltages is considerably assisted by the use of very short leads from the diode to the point at which the voltage exists. C_7 must be a *low leakage* high quality condenser. This " probe-unit " is indicated by the dotted lines on the diagram. Four leads will be required from the output of this unit to the main instrument : (i) the high potential lead connected to SW_1 in the instrument. It is preferable that this lead be screened, and the screening earthed ; (ii) the low potential or earthy lead ; (iii) and (iv) leads for the heater supply of the diode, V_2.

Measurement Procedure

Direct Current

Switch SW_1 to the D.C. position, and set the wiper of R_4 at the earthy end. Close SW_3, and if movement of the shadow angle is perceptible on the eye, re-open the switch, adjust R_7 and close SW_3. If closing the switch causes a movement of the shadow angle, repeat the process until the shadow remains at rest upon opening and closing SW_3.

Now apply the unknown voltage to the test terminals, taking care that the polarity is correct, and set SW_2 to the appropriate range. The shadow angle will now have changed. Adjust R_4 until the shadow angle appears to be approximately in its original position, with no voltage applied. Put SW_3 to position 3 and if the shadow angle changes, adjust R_4, switch to position 2 and repeat the process until no change in shadow angle is observed when the switch is changed from position 2 to 3.

The voltage can now be read off on a calibrated dial attached to R_4.

Alternating Current

SW_1 should be set at position 1. The point " A.C. high " should be connected to the voltage to be measured, and " A.C. low " to earth. The same procedure is used as for the measurement of D.C. In the interests of economy no separate range switching is used on A.C., and the instrument would appear to be useful up to 500 v. A.C. R.M.S. However, under no circumstances should more than 250 v. R.M.S. be applied to the diode, otherwise it will spark over internally.

Calibration

The unit may be calibrated from an ordinary voltmeter. A voltage, either A.C. or D.C., is applied to the appropriate point. This voltage is measured with an ordinary voltmeter and, for each voltage applied, R_4 is set as described above and the voltage marked on the dial. The A.C. calibration may be carried out at 50 c/s and, consistent with careful construction of the probe, the calibration will hold up to 10 Mc/s.

Performance

On D.C. the input resistance is approximately 11 MΩ. On A.C. it is somewhat less, and will decrease proportionately as the frequency is raised in the usual way.

The accuracy was found to remain constant over mains variations of 200 to 250 v. Voltages below one volt produce insufficient change in shadow angle to be readable, but as the necessity for reading such low voltages does not often arise, this is not considered a serious disadvantage.

Component Tolerances

Slight variations in the value of components may be made in most cases, but the potentiometer R_4 should be of the largest diameter and best quality obtainable ; the larger the diameter, the smoother the control and, therefore, the greater the accuracy of the balance.

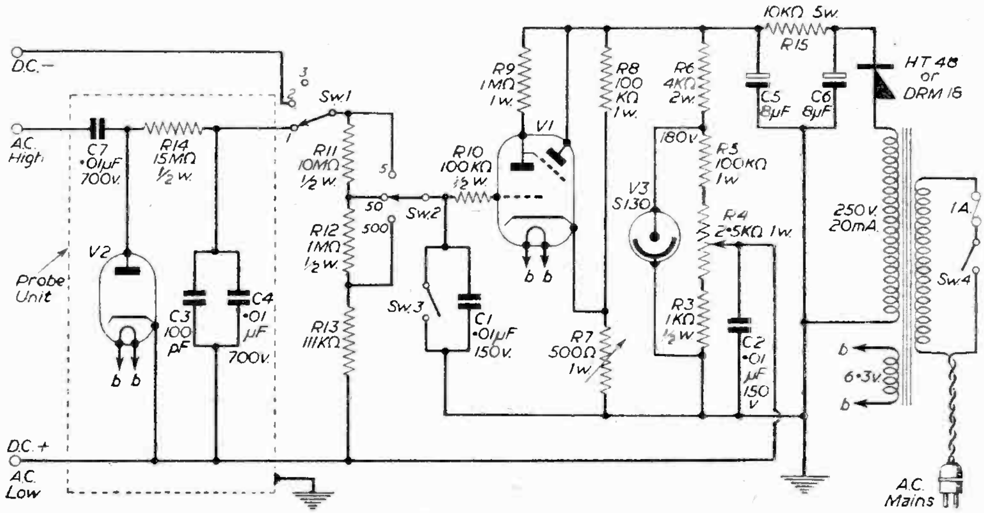


Fig. 3.—Complete circuit of the voltage measuring unit.

A Novel Baby Alarm

A CIRCUIT PROVIDING A CHOICE OF THE METHOD OF RAISING AN ALARM

By S. C. Murison

ALL the baby alarms which the writer has seen previously have been fundamentally amplifiers fed by a microphone near the baby and feeding their output to a loudspeaker near the "minder." This approach has two main snags. The first is that for persons who are hard of hearing the amplifier output has to be so large as to be a public nuisance. The second is that all noises in the nursery are reproduced, even if they are only minor ones giving no cause for alarm. The real need seems to be for a method which operates on noises above a certain level and which can raise its alarm by a method depending on the specific needs of the "minder."

One method by which the alarm might be given to someone who is hard of hearing is obviously a light. For such a person when asleep the problem is much more difficult; the only likely solution being a buzzer set to the frequency at which hearing is best. For normal persons, whether asleep or awake, the best method seems to be a bell.

Whatever form the actual alarm takes there are two main difficulties which beset any system which has an amplifier as part of it. These are hum picked up by the microphone wiring and mechanical buzz produced by mains transformer laminations. Balanced connections to the microphone can do much to minimise the former, while really tight laminations are the only cure for the latter. It should be pointed out in passing that providing the hum picked up by the microphone wiring does not approach the amplitude necessary to overload the amplifier, its effect can be reduced by severely restricting the frequency response of the amplifier to frequencies below 500 c/s. This solution admittedly only cures the symptoms, but it does not greatly affect the performance of the system, because almost all the frequencies contained in the cry of a baby lie above 500 c/s.

Circuit Details

The alarm whose circuit is given in Fig. 1 has the following main characteristics:

1. Only noises above a pre-set level affect it.
2. Any form of warning which can be controlled by a switch can be given by it.
3. No background noises are produced.
4. The total power consumption is less than 10 watts.

A trigger circuit is used which energises a relay when the input from the microphone exceeds a pre-set level. Such an arrangement leads to low-power consumption because of the absence of an output valve. This in turn results in the unit remaining cool and tends towards a more reliable device.

Pentode V1 is in a conventional voltage amplifier circuit. Although a type 6AC7 is specified, there is no reason why any other high-slope valve such as SP61, 6F12 or EF50 should not be used. It may not be out of place to mention in connection with the last two types, that the writer has found some specimens of these types to be microphonic.

Double triode V2 is in the form of trigger circuit termed a "flip-flop." This term is a reference to the behaviour of the circuit in which the steady state is disturbed (flipped) after which the circuit slowly returns to its steady state (flops). In the absence of any output from V1, the conditions in V2 are that the left-hand triode is conducting heavily because its grid leak R5 is returned to a positive potential set by the wiper of VR1. If we assume that the slider of VR1 has been set to a potential of about 20 volts, the left-hand triode draws about 4 mA. As a result the cathode potential rises due to the voltage drop across R7 and the anode potential falls due to the voltage drop across R6. The approximate voltages are thus 20 for the cathode and 100 for the anode, both relative to the earth. Because its grid leak R8 is returned to earth, the right-hand triode is cut off by the high bias across R6. This is the steady state in which the left-hand triode conducts heavily and by so doing cuts off current in the right-hand triode.

LIST OF COMPONENTS FOR FIG. 1

R1—470 K Ω
R2—220 K Ω
R3—1.2 K Ω
R4—330 K Ω
R5—2.2 M Ω
R6—47 K Ω
R7—4.7 K Ω
R8—1 M Ω
(All ½ watt ±20% carbon)
VR1—500 K Ω, carbon.
C1—.1 μF 350 v., paper.
C2—12 μF 12 v., electrolytic.
C3—.01 μF 350 v., paper.
C4—.05 μF 350 v., paper
V1—6AC7.
V2—6SN7GT.
TR1—Microphone transformer 100 : 1.
a=b=50Ω 1/10 watt if balanced input used.
RL=5,000Ω coil relay contacts to suit individual needs.

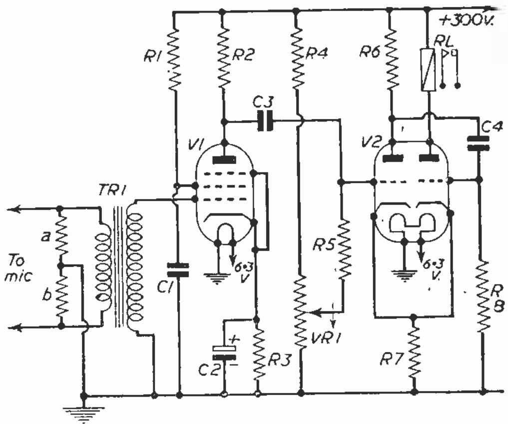


Fig. 1.—Circuit of the baby alarm described here.

The unsteady state arises when the output of V1 fed via C3 has a negative-going amplitude sufficient to reduce the current in the left-hand triode of V2. When this happens two effects occur simultaneously; the voltage drops across R6 and R7 both become less. Consequently, the bias on the right-hand triode becomes less at the very moment when a positive-going pulse (due to the reduction of the potential drop across R6) is fed via C4 to its grid. Thus, the right-hand triode draws a heavy current which, because its anode resistance is less than R6, is higher than that previously drawn by the left-hand triode. The current drawn is approximately 6 mA and the common cathode potential accordingly rises and by so doing cuts off current in R6. The resulting voltage change passed via C4 to the grid of the right-hand triode causes even more current to flow in that triode. The change from the steady state to the unsteady state takes place *very* rapidly by virtue of the regenerative action outlined above.

The return to the steady state takes place when the charge on C4 due to the change in anode current of the left-hand triode has leaked away through R8. During the time when this charge is slowly leaking away the grid potential of the right-hand triode is slowly falling, as is also the voltage drop across R7. Eventually, the voltage drop across R7 is insufficient to prevent current in the left-hand triode. Immediately this draws any current, however small, a voltage drop occurs across R6, which is passed by C4 as a negative-going pulse to the grid of the right-hand triode. This negative-going pulse tends further to reduce the current in the right-hand triode and the circuit returns to its steady state quickly once the action has started.

From the foregoing it can be seen that when the output from V1 exceeds an amplitude set by VR1, current immediately flows in the relay and continues to flow for a period set by the values of C4 and R8 at the end of which it ceases abruptly.

No relay contact wiring is shown in Fig. 1 because it is realised that these will vary with individual needs. The circuit shown in Fig. 1 closes its contacts for as long as the input exceeds the pre-set level. In practice with a baby crying in a more or less continuous manner near the microphone the relay opens and closes in a regular manner. For those who require that once the alarm has been given it should continue until deliberately reset, the circuit of Fig. 2 is given. In this, when the contacts RL1 close a continuous current flows through the coil, the 25 KΩ resistor and the press-button in series. With this arrangement the relay remains energised until the press-button is pressed.

An Alternative

Another arrangement which the writer has used successfully is to replace the relay coil with an electric bell having a coil of 2,000 ohms resistance in parallel with a resistor of 15 KΩ. The resistor is necessary to ensure that the anode circuit is not broken each time the bell contacts open. If this were allowed to happen, the flip-flop would return to its steady state the moment the bell started to operate.

The total H.T. consumption at 300 volts is between 8 and 10 mA while the heater consumption is about 1.1 amps. at 6.3 volts. It can be seen that a very modest power pack will serve these needs. Because of the low H.T. consumption resistive smoothing is very suitable. The writer has used several arrangements of which the easiest is probably a half-wave rectifier fed from a low current 350 volt winding. The smoothing in this instance consisted of two 2μF condensers and a 3 watt 15 KΩ resistor. The unit will operate satisfactorily from any value of H.T. above 250 volts. A unit has been run satisfactorily from a 450 volt smoothed supply but there is nothing

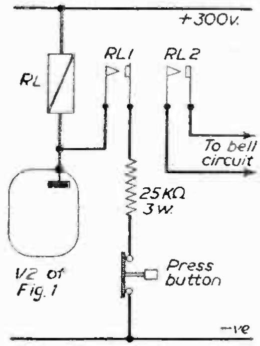


Fig. 2.—An alternative relay arrangement which will sound a bell and which will continue working until reset.

to be gained by such a high voltage, which of necessity leads to larger condensers because their insulation has to be better. It is not necessary to have a well-smoothed H.T.

Construction

There are no special precautions necessary in the construction of the unit. Attention to the usual matters such as keeping the microphone transformer as far as possible from the mains transformer is all that is necessary. In the matter of installation much depends upon whether the unit is to be near the baby or the "minder." The former is the easier if the alarm is to be given at several places. Whichever place is chosen, the writer is in favour of open flat twin wire for the microphone. This may seem odd when hum is known to be such a problem. The input circuit shown in Fig. 1 is of the balanced type in which the hum picked up by one of the wires is cancelled by that picked up by the other. In the writer's experience this is a better method than screened cable. This method has been used with no trouble with a microphone lead 70ft. long running parallel to mains wiring for more than half of the way.

To set up the device it is only necessary to arrange for a noise to be made near the microphone of about the level at which the alarm is required to close the relay. VR1 is turned clockwise (assuming that it is wired as shown by the direction of rotation arrow in Fig. 1) until the relay just closes. It will be found that when VR1 is fully clockwise, V2 operates as a cathode-coupled multi-vibrator and the relay opens and closes cyclically without any input. This is no disadvantage as this may be used as a simple test procedure if some means is available to allow the control to be reset easily.

A Small Portable 'Scope

By "Experimenter"

An article dealing with the construction of a small portable 'scope that can be built for a few pounds. The unit has provision for an external timebase, but only uses a 50-cycle sine wave for the internal one. Full details of its use are given.

ONE of the most useful pieces of equipment in the laboratory is the oscilloscope. On the mention of a 'scope, the average person thinks of highly complex devices costing about £100 and requiring a lot of technical skill to use. The writer has found from experience that for a lot of work on radio receiver repairs, a simple 50-cycle timebase run off the valve heaters is absolutely indispensable and by far the cheapest. This 'scope was designed for use in teaching radio servicing. As most students will only use a linear timebase and not learn to use the 50 cycle or external base, it was designed without one.

Simplicity of construction and operation were the themes; the tube is a Mullard DG7-5, which requires only a very moderate H.T.; 1,000 to 1,100 volts is ample. The H.T. supply is obtained from a voltage-doubling circuit, using two EZ41s. The use of this valve makes the unit very compact and only one heater supply is required for the valves and one for the tube.

The power supply circuit is shown in Fig. 1. The mains transformer used was an Elstone SR350, but if one was available with two 6.3-volt windings it would be better, as it would eliminate the use of the small auto transformer for the tube heater. The positive line smoothing consists simply of a 15 H. 50 mA. choke with an 8 μF reservoir and 16 μF smoothing condenser. The negative line is again 8 and 16, but, as the current is small, a 10 KΩ 1-watt resistor is used for the smoothing.

The tube supplies are shown in Fig. 2. There are two controls: focus and brilliance. It will be seen that the anode of the tube is not taken directly to the H.T. positive line, but to a potentiometer. This has the effect of reducing the voltage, but enables electronic shift to be employed on the deflection amplifiers. With the amplifier circuits used (Figs. 3 and 4) the deflector plates are taken directly to the anodes; this has the effect of biasing the beam of the tube and spoiling the focus, if this is too greatly different from the final anode voltage of the DG7-5. If, however, it is only slightly negative by about 10 volts the focus is improved.

The deflection amplifiers are of the self-balancing type, and the shift is obtained by varying the anode loads of the valve. This has the effect of increasing the voltage on one anode and reducing it on the other. As the circuit is self-balancing, the deflection due to the shift control whilst ample, is not as high as might at first be expected. The shift control does not affect the sensitivity of the amplifier. It will be seen that the only difference between the vertical and horizontal amplifier is the switch for selecting either 6.3 volts at 50 cycles from the heating winding or an external timebase.

The layout of the instrument is not critical, but the mains transformer should be placed at the rear of the tube. The valves can be placed at either side of the tube with the two rectifier valves as close to the base as possible in order that the electrostatic fields do not interfere with the deflection. The wiring does not call for any special steps except that the input wires should be kept away from those carrying A.C. and preferably screened.

Construction

The length of the chassis need not be more than 10in. from front to back and 6in. wide. The original was made on a chassis 10in. square, but it was later stripped down and rebuilt as the size was too great. The seven controls and the two input jacks can be mounted on the front panel which does not need to be more than 6in. square if the small type potentiometers are used. An extra 1in. will be required in the height if the normal sizes are used, unless the jacks are mounted on the side. The smoothing choke can be mounted under the mains transformer, providing that the laminations are at right angles. The heater transformer should be mounted where it will not interfere with the smoothing choke.

Operating

Having made the 'scope the next thing is to learn how to use it. The 50-cycle timebase is very useful

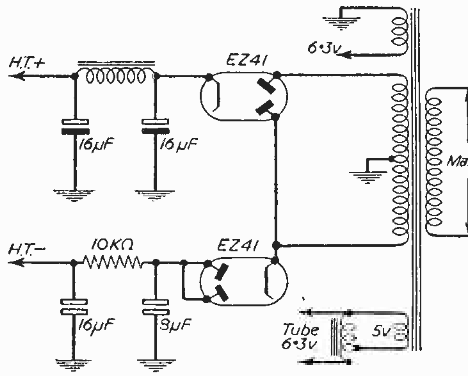


Fig. 1.—Power supply circuit.

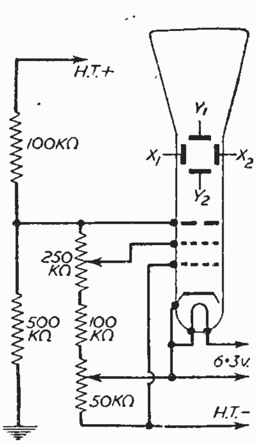


Fig. 2.—Circuit of tube supplies.

for checking the smoothing; also for checking hum frequency. It is difficult to tell the difference between 50 and 100 cycles when harmonics are present. Fig. 6 is the typical trace that would be found at the cathode of a double diode rectifier if it was functioning correctly. The gain would have to be turned well down. If, however, only half of the valve was functioning, the trace would be as in Fig. 7 or the reverse, depending on which half of the valve was functioning. The same trace would be obtained with an open circuit in one half of the secondary of the mains transformer. As there is an amount of phase shift present in the smoothing a bent figure of eight, as in Fig. 8, would result, but only if the smoothing was not too good. If it were perfect, the trace would be a straight line, as in Fig. 9.

Noise due to motor-boating will give a display that is not steady, whereas hum is synchronised by the use of the 50-cycle timebase.

Figs. 10, 11 and 12 are examples of 50-cycle displays depending on phase shift. If there is no shift that in Figs. 10 or 12 would result, the difference being opposite connection. Very often the smoothing of an A.C./D.C. set has to be checked at the rectifier. The wave will be as shown in Fig. 7, and if at the other end of the choke as in Fig. 13 or 14, if the electrolytic is either low capacity or high resistance. Again, if the smoothing is perfect a straight line will result. If the smoothing is in order, hum can be introduced in other parts of the circuit. A general idea of the point of introduction of the hum can be gathered from the amount of phase shift present. For example, if the hum is due to faulty heater/cathode insulation it will be in phase both at the cathode and anode of the valve, and, of course, amplified. If it were due to a capacity pick-up from the A.C. wiring it would appear as an elipse due to phase shift being present.

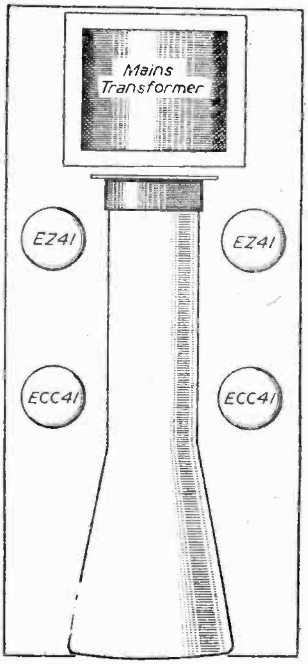
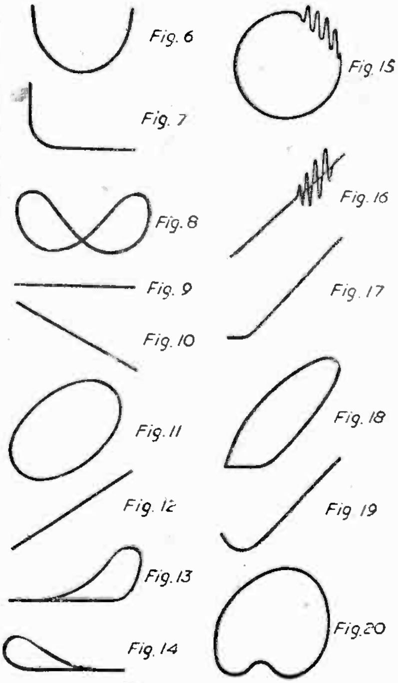
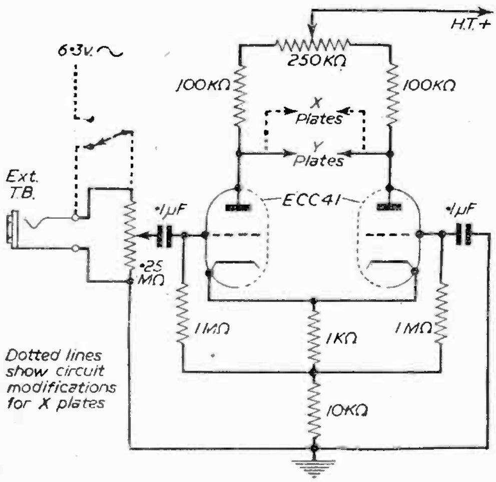


Fig. 5.—Main layout.



Figs. 6 to 20.—Typical oscillograms.

Amplifiers can best be checked for distortion and oscillation with the aid of a sine wave from an audio oscillator, and Figs. 15 and 16 are two typical traces. On these it will be seen that the oscillation is only present when the input is increased past a certain point. Incorrect bias is another type of distortion and causes a flattening of the trace, as shown in Figs. 17 and 18. Again, if there is sufficient iron in the output transformer traces such as those in Figs. 19 and 20 will result. It will be seen from the foregoing that a lot in the way of servicing can be done without the aid of a linear timebase, but, if one is required, a very good circuit appears in the Mullard Valve Reference Manual.



Figs. 3 and 4.—Amplifier circuit. Two separate schemes are combined in this diagram.

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Accumulator Charging and Maintenance

HINTS ON SIMPLE CHARGING AND BATTERY REJUVENATION

By W. J. Delaney (G2FMY)

ALTHOUGH there cannot be so many battery-operated receivers now in use, we receive a large number of queries concerning accumulator charging apparatus, and also for mains units for battery receivers. If a listener has mains facilities available, it is hardly an economical proposition to build a battery charger and retain the accumulator in use. Furthermore, it is not a satisfactory arrangement to try and operate the older type of battery receiver, using the two-volt type of valve, from a mains unit. These valves will be found very susceptible to mains hum, and it is better if these valves are to be retained, to use a trickle charger and keep the accumulator in good condition. Replacing the valves with the all-dry types will call for new valveholders, but their substitution by all-mains valves is generally unsatisfactory, owing to the higher efficiency of the latter type of valve. However, it would appear that a good many listeners do need to charge accumulators, and no doubt many of our readers who ask for such information are referring to the larger type of cells used in their cars.

Simple Chargers

All that is needed on D.C. mains, of course, is some form of series dropping resistor to cut down the voltage to that of the cell being charged. Lamps, fires, or any other electrical apparatus may be used, provided the cell is not over-run, but the arrangement is wasteful and costly unless the lamp or apparatus used as a dropper is at the same time performing some useful service. With A.C. mains, however, the arrangement is simpler, and all that is needed is a mains transformer, rectifier, and series resistor. An ammeter is desirable, but not essential, and in these days of ex-Service surplus a suitable meter should be obtainable quite reasonably. Fig. 1 shows the simplest circuit, and Fig. 2 a more elaborate arrangement using the bridge-connected rectifier.

Ratings of Components

The amateur usually finds difficulty in knowing the ratings of the various items, and these may be ascertained in the following manner. First, the rectifier should be chosen according to the voltage of the cell which it is required to charge. (It is assumed for the purposes of this article that only one cell is concerned, and that the reader does not wish to make a commercial charging station.) A two-volt rectifier should therefore be used with a two-volt cell and so on. The transformer should deliver a voltage slightly greater than the rating of the rectifier. Thus a two-volt rectifier would call for a transformer secondary of 3.6 volts, a 6-volt cell a secondary of about 8/9 volts, and a 12-volt cell would need 16 or 17 volts. The current rating of the secondary winding should be 1.125 times the mean D.C. output required. The resistance should be capable of carrying twice the current in the case of the half-wave circuit and 1.4 times in the bridge circuit. The wattage rating of the resistor is, of course, calculated by multiplying the resistance in ohms by the current in amps. squared ($I^2 \times R$). The maximum resistance value should be about 5 ohms for 2 volts, and 10 ohms for 6 or 12 volts.

Using the Charger

In use, the battery is connected to the output of the charging circuit, making quite certain that correct polarity is observed, and the mains switched on. The resistor is then adjusted until the correct charging rate is given, and it is here that the ammeter is required. Overcharging is just as bad as undercharging from the point of view of the life of the cell, and the makers' instructions on the label should be followed in this respect. Where no label is fitted, the normal charging rate should be taken as approximately one-tenth of the capacity of the battery. That is, a 40-ampere hour cell should be charged at a rate not exceeding 4 amps. A much lower rate is called for in "trickle charging" under certain conditions as mentioned later, but in all cases the charging should be continued until the separate cells are seen to be gassing freely, and if possible a check with a hydrometer should be made to ascertain that the acid is of the correct S.G. If it is found that the cells have been gassing freely for some time, and the S.G. will not reach the correct figure, it is probable that the cell has been knocked over at some time and some of the electrolyte lost and the loss made good with distilled water. Under normal conditions, that is evaporation due to charging and use, distilled water only should be added, and the S.G. will not be affected as only the water evaporates. But if any electrolyte is lost due to accident, the S.G. of the remainder should be measured and a solution made up of the same strength for addition to the normal level.

Whilst charging, the plugs or stoppers should be removed from the cells, and adequate ventilation should be provided, as the fumes can be harmful.

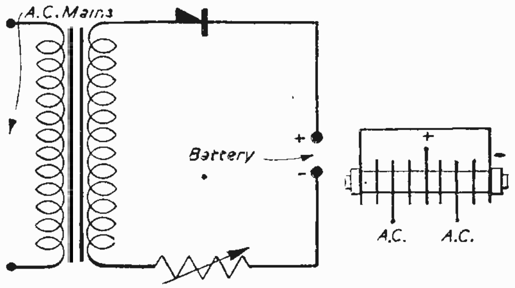


Fig. 1.—Circuit of half-wave charging circuit, and external connections to a bridge rectifier.

Rejuvenation

Where a cell has been persistently under- or over-charged it may be found that it will not hold its charge and in many cases it may be given a new spell of life by the following rejuvenation method: the accumulator should be emptied, refilled with weak electrolyte and given a slow charge in the manner outlined below.

(i) Invert and half empty the accumulator, shake

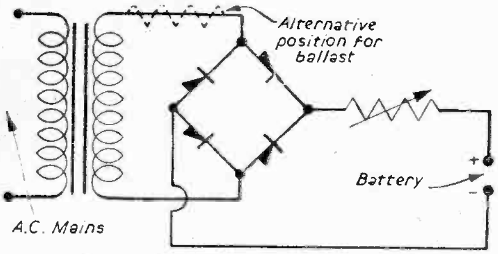


Fig. 2.—A full-wave bridge charging circuit.

thoroughly to remove any loose sludge or sediment, and drain until completely empty.

(ii) Fill with electrolyte of specific gravity not below 1.06 nor above 1.1 to the level specified by the makers.

(iii) The accumulator should then be placed on charge and the charge continued for 100 hours, the rate being taken as one-fortieth of the rated capacity. A 60 A.H. accumulator would therefore be charged at 1.5 amps for 100 hours.

(iv) After charging for the time and at the rate stated, a reading of each individual cell in the accumulator should be taken with a voltmeter. The voltage at the end of the test should be a minimum of 2.3 volts per cell.

(v) If, on testing, it is found that the voltage has not risen, the charging process should be repeated until the voltage is satisfactory. If, after three charging periods of 100 hours each, the voltage has not risen to the value specified, the accumulator should be regarded as of no further use.

(vi) If the voltage has risen to the value specified, the accumulator should be connected to some discharge device which will discharge it at a rate equal to its capacity, e.g., a 20 A.H. accumulator should be discharged at 20 amps. The discharge should be continued until the voltage has fallen to 1.33 volts per cell, *on load.*

(vii) Recharge as before until all cells are gassing freely and the voltage reaches a minimum of 2.3 volts per cell, remains steady, and ceases to rise.

(viii) Charge at the normal charging rate for two hours, after which the S.G. of the electrolyte should be measured and adjusted. This will be correct only at 60 deg. F., and this fact should be carefully borne in mind.

(ix) Make an observed discharge at the 10-hour rate taking voltage and S.G. readings periodically, until any one cell falls below 1.8 volts on load. The actual capacity of the accumulator should be approximately 90 per cent. of the rated capacity, in which case it should be regarded as satisfactory. If on making this test it is found to be less than 90 per cent. efficient, it should be given several cycles of charge and discharge at normal rate until the required efficiency is reached.

A New Mullard Film

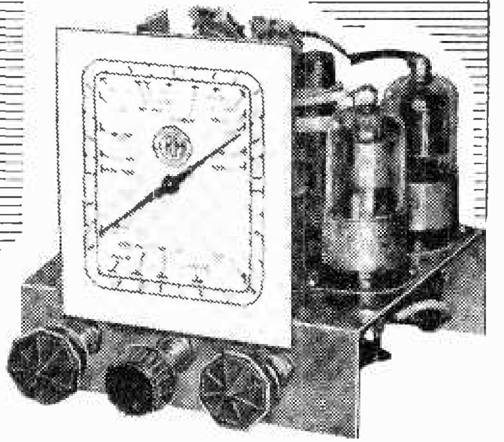
FOR a number of years now, visits to Mullard valve factories by parties of radio retailers and service engineers have formed an important and much appreciated part of the Mullard Information and Educational Services to the trade. These visits have proved of immense value in helping members of the trade to understand more fully some of the complex problems involved in the mass-production of valves and television picture tubes. But such visits can only hope to cater for a small proportion of those interested in valve manufacture. In view of this, the Mullard company have recently made a full-length documentary film that depicts in an impressive manner every important phase in the production of radio valves and television picture tubes, from the actual manufacture of glass, fine wire and components right through to the assembly, sealing, pumping and final testing stages.

This new Mullard film is divided into two sections, the first being mainly devoted to the manufacture of radio valves and the second to the manufacture of television picture tubes. In both sections attention is drawn to the scientific control which is exercised during manufacture. It is also shown that this necessitates an unusual combination of technologies, involving the employment of a wide variety of technical and scientific personnel—glass technologists, metallurgists, chemists, valve engineers, plant designers and electrical and mechanical maintenance engineers.

"It's a Good Sign"

This film, entitled "It's a Good Sign," has been made by National Screen Service, Ltd., working in close collaboration with the Mullard Publicity and Technical Publications Departments. There is no doubt that it will prove a valuable addition to the many technical information services already provided by the Mullard company for the radio trade. The film will form the main feature of a series of meetings that have been arranged throughout the country in conjunction with the Radio and Television Retailers' Association (R.T.R.A.), the Scottish Radio Retailers' Association (S.R.R.A.), the Institute of Practical Radio Engineers (I.P.R.E.) and other trade organisations. The film will also be shown to employees of the Mullard organisation. A special adaptation of the film is already in course of preparation for showing to technical colleges and schools.

THREE BAND ALL-DRY 3



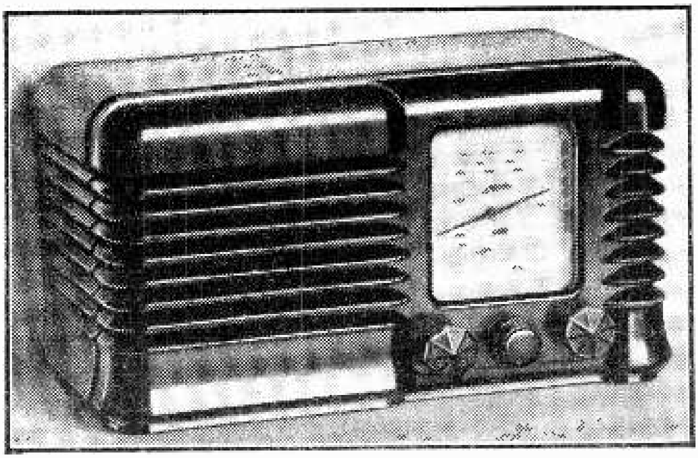
A 3-VALVE DUAL-WAVE BATTERY-OPERATED MIDGET SET

THIS is an efficient and economical receiver for general use, and one which should present no particular difficulty to any constructor. The receiver is compact, but no form of midget construction has been employed, so that wiring and component layout is not cramped. The circuit should particularly recommend itself to those who require a sensitive all-dry receiver, but feel that the usual four-valve superhet is rather complicated and difficult to align. In this receiver there are only two trimmers to adjust, and the settings of these are not very critical, though naturally sensitivity is only at its best when they have been adjusted for maximum volume.

The receiver maintains good volume with even a very short aerial and no earth, and this means that it may readily be used upstairs or in other rooms. It is proposed to conclude with a few details of satisfactory aerials, both indoor and outdoor, for the benefit of those who feel they require some guidance on this point.

Two pentodes and a beam tetrode are used, octal valves having been selected because they are somewhat more robust than the all-glass button-based type. The tapped filament of the 3Q5 output valve is wired for 1.4 v. operation, since this permits a 1.5 v. dry battery to be used and also enables a slightly greater power output to be realised than when the series method is employed. With a power output rating of .27 watt (with a 90 v. H.T. battery) this valve enables ample volume to be obtained, especially as a midget loudspeaker is not necessary.

In order that the total number of controls may be kept down to three, a combined reaction and volume control arrangement is used. With reaction at minimum, volume can still be too great when local stations are tuned in. So the usual reaction condenser has been abandoned, and a potentiometer used. As reaction is reduced the resistance value from aerial input to earth is decreased, and can be brought to zero. For the first part of its rotation the potentiometer functions as a volume control by increasing the resistance in parallel with the aerial winding: after roughly a half-way position the amount of R.F. energy passed through the reaction winding and .001 μF condenser begins to make itself felt, and the detector may be brought up to the oscillating point in the usual way. This ensures maximum sensitivity on weak stations.



The finished receiver in plastic cabinet.

The second knob is a three-pole three-way rotary switch, wired to provide "Off," "Medium Wave" and "Long Wave" positions. The remaining knob is the usual tuning control, and the dial is marked with wavelengths and station names. Two types of dial are available. The first is of printed card, and is placed behind the pointer. The second is of glass, printed with the usual markings, and can be placed in front of the pointer (e.g., fixed in the cabinet front). When the latter dial is used the pointer should be backed up by a piece of white or tinted card. No dial lamp is used in view of dry batteries being employed.

Chassis Details

The chassis is made from a piece of aluminium 5¾in. by 7½in. Two runners are bent to a depth of

1½in. so that the completed chassis is 5¼in. by 4½in. by 1½in. deep. Holes for the valveholders are drilled with their centres ⅜in. from sides and rear. Three ⅜in. diameter holes are drilled for the controls, ¾in. from the lower edge of the front runner, and spaced as indicated in the diagrams. Other holes are

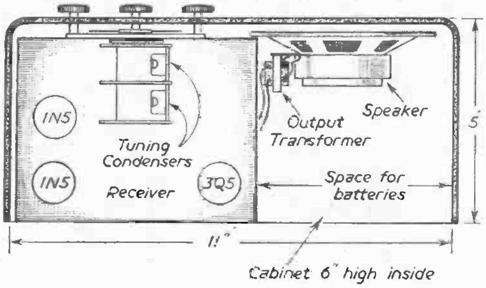


Fig. 4.—Layout of receiver and speaker in cabinet.

drilled for the "aerial" "earth" strip. The earth socket may be in contact with the chassis, but clearance should be allowed around the aerial socket.

Holes about ⅜in. in diameter are drilled for the cord to pass from the tuning dial drum to the spindle below, and a further small hole is required near the aerial coil. After securing the gang condenser in position the drum should be placed loosely on the spindle. The tension spring is hooked to the drum and the cord threaded through the slot in the perimeter, and through the loop at the free end of the spring. One end of the cord is then taken down through the chassis, round the driving spindle, and brought up and knotted, the cord being drawn tight so that the spring is under tension.

The dial plate is bolted to the front of the chassis. If the card dial is used this is glued or taped to the dial plate ; if not, a suitable piece of plain cardboard

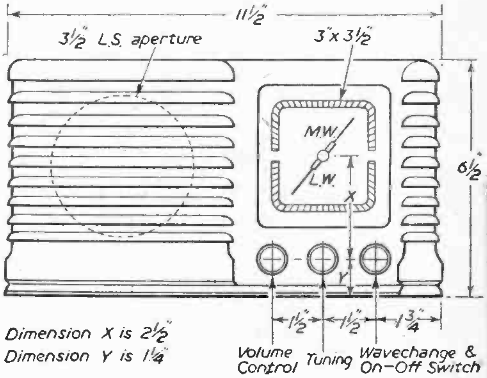
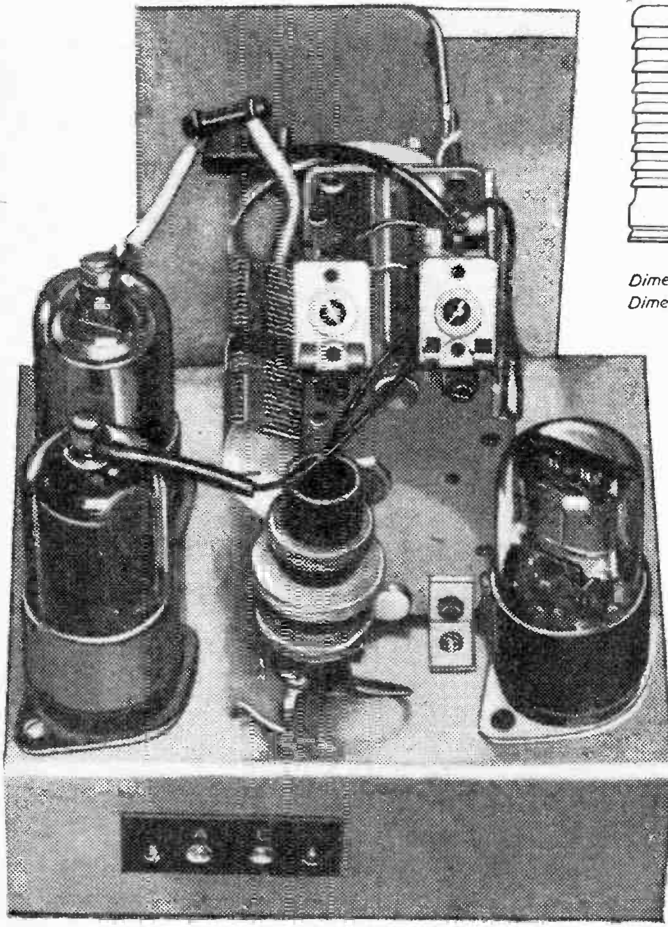


Fig. 5.—Front dimensions of cabinet.



Rear view of the complete receiver.

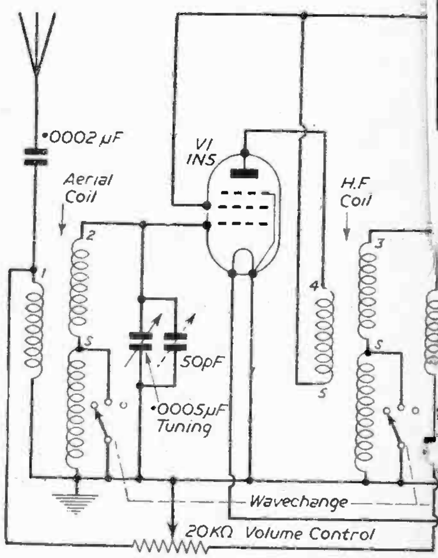


Fig. 1.—Theoretical c

should be fixed in this position. The pointer is then fitted, the end of the condenser spindle being tapped 6 B.A. for this purpose. The two 50 pF trimmers are bolted to the rear of the gang condenser. Long bolts should not be used or these will foul the plates of the condenser.

Sub-chassis Wiring Points

Although all connections are shown in the diagrams a few items require special mention. First, care should be taken that the bias condenser is not shorted to the chassis. The positive tag of this condenser is wired

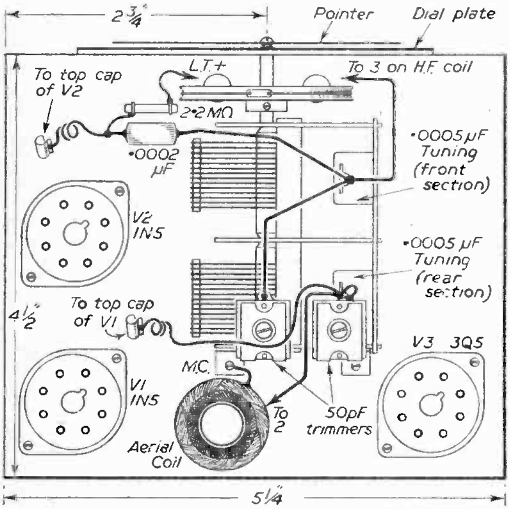
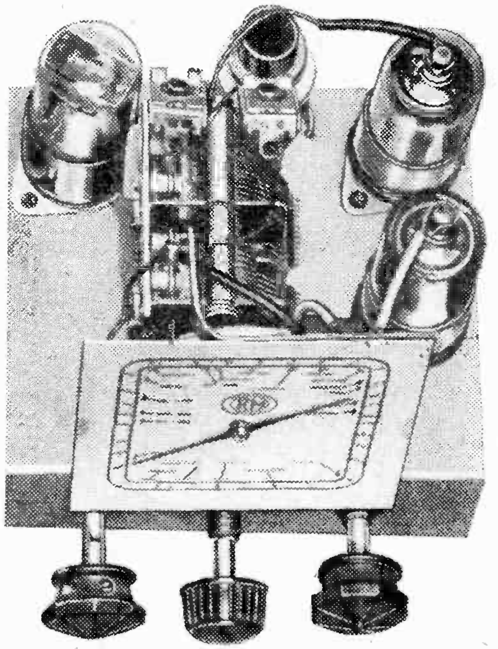


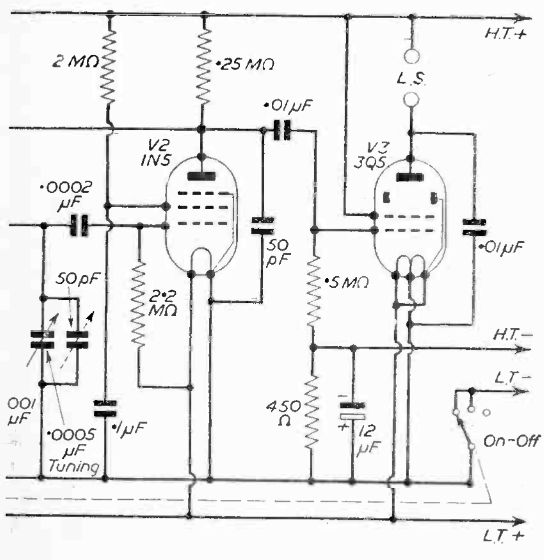
Fig. 2.—Chassis layout of the receiver.



Plan view of the receiver.

to chassis and if a metal-cased component is used the casing will be common to the negative tag. Such a condenser should accordingly be wrapped in tape or other insulating material. If this condenser is shorted volume will be reduced and H.T. consumption increased, due to the failure of the auto-bias circuit.

All other connections should be insulated; 20 S.W.G. tinned copper wire is convenient to use and solder. A short length of twin flex is taken from anode and screen-grid tags of the output valveholder, for subsequent connection to the primary of the



…cuit of the Three-band All-dry 3.

COMPONENT LIST

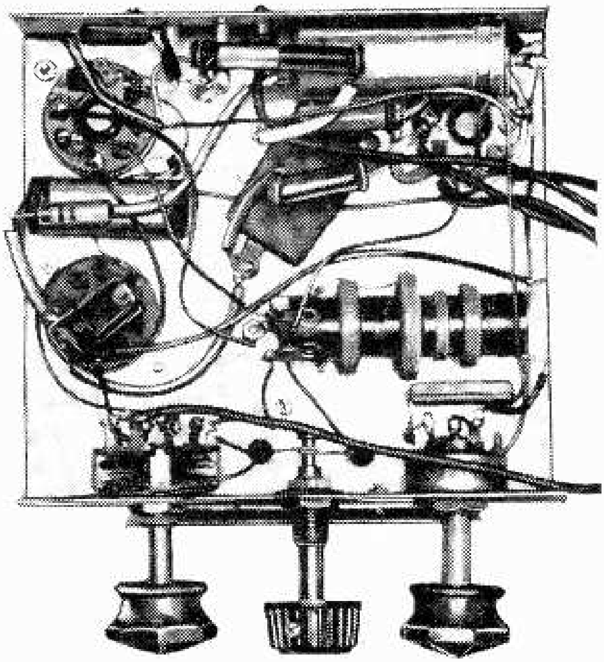
- Dual-wave aerial and H.F. coils with reaction (T. G. Howell).
- 2-gang .0005 µF. tuning condenser with tapped spindle and pointer.
- Two 50 pF. trimmers.
- 450, .25 megohm, .5 megohm, 2 megohm, and 2.2 megohm, ½ watt resistors.
- 50 pF., two .0002 µF, .001 µF, two .01 µF, .1 µF, and 12 µF, 12 v. fixed condensers.
- Three-pole three-way rotary switch (Coventry Radio, etc.).
- Dial and drive assembly, complete, with 2in. drum. (Sussex Electronics.)
- Three 1½in. dia. brown knobs. (Ditto).
- 20,000 ohm potentiometer.
- Three octal valveholders. Two 1N5, and 3Q5 valves.
- Stentorian 3½in. speaker with Miniature Service Output Transformer (60/1 ratio).
- Brown or ivory bakelite cabinet, or wooden ditto (Sussex Electronics.)
- Aerial and earth sockets, nuts and bolts, connecting wire, etc.

speaker matching transformer. The battery leads are of flex cut to a suitable length. H.T. and L.T. leads must on no account be confused.

The coil wiring will become clear from the diagrams. Each coil is already fitted with a stout bare wire: this is bolted to the chassis and supports the coil, also forming one connection. It is recommended that the specified coils be used. Other coils may have the tags in different positions, or have windings of unsuitable type. Though some space remains above the chassis the H.F. coil must not be fitted here, or instability will arise.

The switch wiring is very straightforward. In the "Off" position no circuit is completed. In the "Medium Wave" position both coils are switched to medium waves and the L.T. circuit completed. In the "Long Wave" position the L.T. circuit only is completed.

Wiring should be reasonably short and direct. The lead from the .0002 μF aerial condenser (marked X) should be kept well away from the H.F. coil and detector stage wiring generally. A lead from this point also passes through the chassis to the aerial coil. Other leads can conveniently be taken up through the holes drilled for the driving cord.



Underside of chassis view. Compare with Fig. 3 below.

Operating Instructions

Though little difficulty is likely to arise it is felt that the constructor would like a few details of operation. Wiring should be checked before inserting the valves and connecting the batteries. A H.T. voltage of up to 90 may be used. For L.T., any 1.5 v. dry battery can be used. If this battery has more than one cell, all the cells must be wired in parallel. A combined H.T. and L.T. battery can be used, or separate batteries.

A moving-coil speaker is recommended; this *must* be of the permanent magnet type, and have a matching transformer for battery pentode (8,000 ohms). A transformer matched for a mains-type

(*Continued on page* 213.)

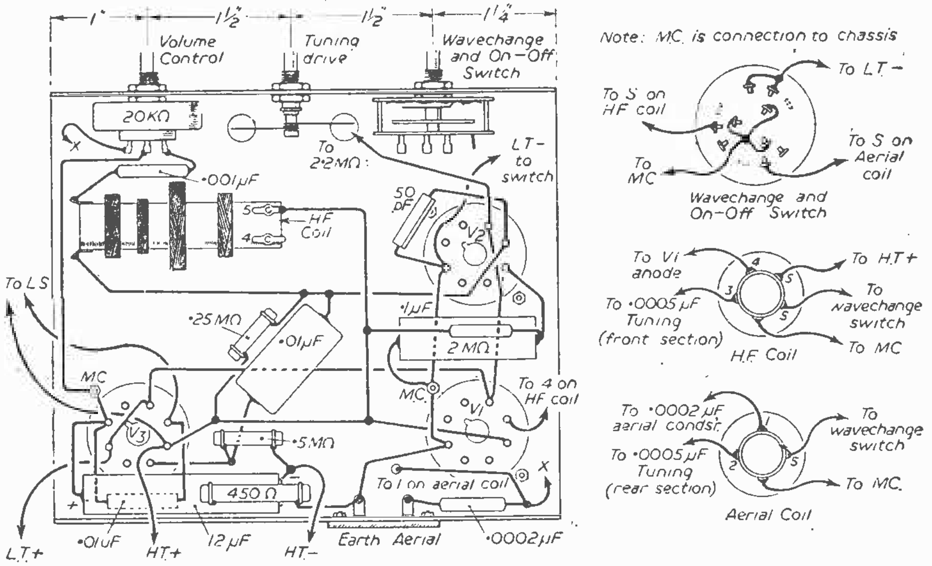


Fig. 3.—Under-chassis layout including switch and coil wiring points.

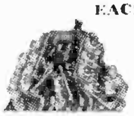
miniature in size...
mighty in performance

Little wonder that OSMOR "Q" RANGE COILS are the "big noise." No imitations regardless of price can compare with them for super selectivity and sensitivity. And you don't just have to take our word for it—the watertight guarantee makes your satisfaction certain! Consider these points of superiority :—

- ★ **Only 1in. high.**
- ★ **Variable iron dust cores.**
- ★ **Low loss Polystyrene formers.**
- ★ **Packed in damp-proof containers.**
- ★ **Fitted tags for easy connection.**

4/- EACH

COILPACKS.—A full range is available for Superhet and T.R.F. Mains or Battery. Size only 1¾in. high x 3¼in. wide x 2¼in. Ideal for the reliable construction of new sets, also for conversion of the 21 RECEIVER, TR1196, TYPE 18, WARTIME UTILITY and others. Aligned and tested, with full circuits, etc. Fully descriptive leaflets available.



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A spotlight on just one of the range of Osmor "Q" coils.

H.F. CHOKE Type Q.C.1.

Frequency coverage 150 kc/s to 20 m/c. Iron-dust core and single-screw fixing Prototype tested and approved by M. G. Scroggie, B.Sc., M.I.E.E. Ideal as anode load in T.R.F. receivers, for decoupling and general purposes. Price 4/-.

FOUR for the Price of TWO!
The NEW OSMOR "FOUR-TWO" CHASSIS CUTTER

of entirely new design. Cuts two sizes of holes with any one reversible punch and die; and can be operated with a spanner or tommy-bar. Blanks easily removed.

Punch and Die Sizes { No. 2 : ¾x1⅛in. No. 3 : ¾x1½in.

Supplied complete with *both* No. 2 and No. 3 punches and dies for 30/- (postage and packing 1/3), or 16/- *one* punch and die only. (Please state which.)

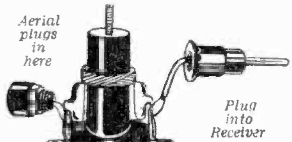
Tommy Bars ... **1/3 each.**

The OSMOR "JIFFY PUNCH" cuts a ⅜in. hole with one blow of a light hammer.

Complete with Punch and Die, 5/9 post free.

Dear Reader,
We can't mention all our products here, but shall be glad to receive your enquiries. If it's top-quality components and a speedy, courteous service you are looking for—try Osmor. We really shall do our best for you.

Clean as a whistle!



Cut out that interfering station "next door" to the one to which you want to listen, by using an

OSMOR "Station Separator"

This is a device on the well-known "wavetrap" principle, which will reject an undesired signal when inserted in the aerial lead.
The Separator may easily be tuned to eliminate any one Station within the ranges stated below and fitting takes only a few seconds. Sharp tuning is effected by adjusting the brass screw provided.

No. 1—141-250 m. No. 4—319-405 m.
2—218-283 ,, 5—395-492 ,,
3—267-341 ,, 6—455-567 ,,
No. 7—1,450-1,550 m.

Complete with plug, socket and full instructions—nothing to add.

7/6 POST FREE *Satisfaction guaranteed.*

We keep stocks of many radio components for use in published circuits, including :
"PRACTICAL WIRELESS"
3-Speed Autogram ; Modern 1-Valver ; A.C. Band-pass 3 ; R1155 Converter.
Midget Mains Receiver (Osmor coils QA11 for M.W. and QA12 for L.W. are suitable. Price 4/- each.)
"WIRELESS WORLD"
No Compromise T.R.F. Tuner (Osmor coils QA11 and QHF11 for M.W. and QA12 and QHF12 for L.W. are suitable, price 4/- each.)

FREE! *Send 5d. (stamps) for* **FREE CIRCUITS** *and full lists of coils, coil-packs and radio components.*

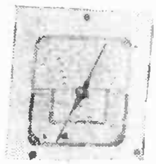
Keep those small components—resistors, condensers, etc., neatly stored yet visible, by using an

OSMOR "JAR-RACK"

(If you're a generous husband you'll buy one or two for your wife's larder, too.) Holds any 1-lb. jam jars which are easily removed but cannot fall out. Just the thing for the tidy "HAM" or Radio Dealer. **Type 1** for wall-fixing, as illustrated, **6/9** each, holds 8 jars. (Jars not supplied but easily obtained.)
Length 24in., enamelled olive green. **Type 2** for screwing under a shelf, **5/9** each, holds 6 jars.
Length 18in., enamelled green. Post and packing 1/- (either type). (*Trade discount allowed to Dealers.*)

I.F.s. 465 kc. Permeability-tuned, with flying leads. Standard size 1⅜in. x 1⅜in. x 3½in. For use with OSMOR coilpacks and others, **14/6** pair. PREALIGNED, **1/6** extra.

DIALS



Metal dials, overall size 5¾in. square, as illustrated. Cream background, 3-colour. **Type M1**, L.M.S. waves. **M2**, L. & M. waves. **M3**, M. & 2 S. waves. Price **3/6** each. Pointer, **1/6** ; Drum, Drive, Spring and Cord, **3/2**.
Type A glass dial assembly, measuring 7in. x 7in. (9¼in. x 9¼in. overall). Mounts in any position. Choice of two 3-colour scales, **24/6**. P. & P. 1/6.

Osmor Radio Products Ltd.

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THREE BAND ALL-DRY 3

(*Continued from page 210*)

pentode is not suitable. If odd speakers and output transformers are to hand, assure that the secondary impedance of the transformer is suitable for the speech-coil impedance of the speaker. If this is not correct, distortion will arise and volume will be reduced. (These items will be correct if the specified speaker and output transformer are obtained, but there is, of course, no reason why speakers of other manufacture should not provide satisfactory results.)

With aerial and earth connected, the local stations should be received immediately, The trimmers may then be adjusted for maximum volume, selecting a weak station of fairly low wavelength in the M.W. band. As the trimmers are adjusted slight re-tuning with the control knob will be required. When no further adjustment of control knob or either trimmer improves volume, then trimming is correct.

With care, a reasonably accurate pointer indication can be obtained throughout the range. The pointer may require turning a little, the screw being loosened. If the dial indication is progressively too low near the lower wavelength end of the scale, then both trimmers should be unscrewed a little. If the pointer indicates wavelengths higher than those actually tuned, at the low-wavelength end of the scale, the trimmers should be screwed down. These adjustments will make little difference at the other end of the scale.

Alignment is not much influenced by the type of aerial, as aerial coupling is by means of a primary winding. However, weak stations will only be received at best volume when the trimming is correct.

Cabinet Details

Best quality and volume will only be obtained when the speaker is enclosed in a cabinet, and a pressed bakelite cabinet in a variety of colours is available, so that the completed receiver can have a finish equal to that of a commercially-manufactured set. Alternatively, a simple type of cabinet could be made, using ½in. wood for top, bottom and sides, with three-ply for the front. As an aid in this direction, cabinet dimensions are given. From reference to these it would be feasible to construct a cabinet, as mentioned.

If the ready-made cabinet is employed, then a small baffle of three-ply about 5in. square should be cut to support the speaker. Sufficient space has been left for batteries of small type ; full-sized batteries cannot be accommodated. If they are to be used, then the battery leads should be extended and the batteries placed outside the cabinet, behind.

Aerial System

An efficient indoor aerial can be made from a length of any thin insulated wire. This may be placed round the picture rail, or suspended along the walls. Thin, plastic-covered wire (consisting of one strand of 22 s.w.g.), or any similar conductor can be used, and a colour to match the walls may be selected. For maximum signal pick-up the wire should be as long as possible, but it should not be continued round more than two walls, or looped back on itself. In many cases a few feet of wire along one wall may be sufficient, but range will then naturally be reduced. With the original receiver, a few feet of wire was found to give ample volume from the local stations. However, reception conditions vary throughout the country.

Best long-distance reception was naturally obtained by using an outdoor aerial. This was 50ft. of 7/22 s.w.g. copper wire, forming aerial proper and lead-in. Such an aerial should be as high as possible, and well clear of walls and earthed objects. With it, the local stations were received at such strength that the output stage was overloaded at maximum volume. (Such over-loading, and consequent distortion, is normally prevented by turning the volume control down, of course). A considerable number of foreign stations were also received.

In each case adding an earth gave a further increase in range. Such an earth is best provided by taking a lead directly to an earthing spike or other metal object buried in damp soil.

E.M.I. Students' Successes

FOLLOWING the many previous successes of students of E.M.I. Institutes—the training organisation associated with Electric and Musical Industries Ltd.—three further important successes have been announced.

These all relate to prizes in public examinations in telecommunications engineering held by the City and Guilds of London Institute, and were awarded as detailed below :

JOHN LOUIS CARROLL has obtained the prize awarded by the Association of Staff and Regional Engineers (General Post Office) in the last Radio III examination. This follows his earlier success in the Radio II examination when he also won a prize awarded by the City and Guilds. Mr. Carroll, who is 22 next May, comes from Cheadle, Cheshire.

Some time ago he was the recipient of a scholarship in electronics offered by E.M.I. Institutes. This was a three-year attendance course in telecommunications engineering. J. L. Carroll is now undergoing a graduate apprenticeship course at E.M.I. Engineering Development Ltd.

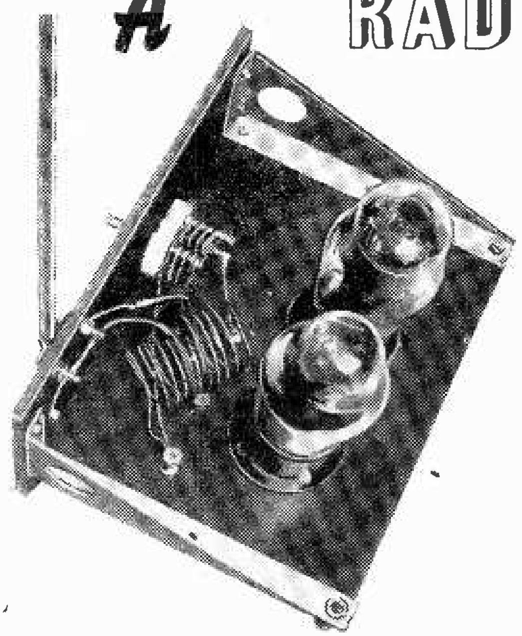
PEDRO MARTINEZ PEREZ has won the 1st Prize Bronze medal in the Telecommunications (Principles) III examination.

He is one of two brothers from Tangier who are now both on the final year of the three-year attendance course in telecommunications engineering at E.M.I. Institutes.

JOHN EDWARD HAROLD THOMPSON, for his success in the Radio II examination, has gained the City and Guilds Bronze medal. Also, he has won the first prize of the Pewterers' Company in this connection.

J. E. H. Thompson, who comes from Worthing, Sussex, is on the second year of his three-year course at E.M.I. Institutes.

A RADIO CONTROL Transmitter



A PUSH-PULL SINGLE-STAGE UNIT FOR 27 MC/S

By F. G. Rayer

NO special licence is required to operate a transmitter used for model-control purposes, and this transmitter is of this type. A great deal of interest and experience can be gained from such equipment, and two bands are available—the 464-465 Mc/s band, and the 26.96-27.28 Mc/s band. The latter band is the most convenient in many respects, and it is upon this band that the two-valve transmitter described here operates. Though only two valves are used, the transmitter will run up to the maximum permitted wattage dissipation, and is, therefore, suitable for controlling planes, boats, and mobile land-vehicles. It is battery-operated, and will operate successfully with a wide range of valves. It is not essential that the valves be a matched pair, and the transmitter will operate with either valve withdrawn, at reduced power.

As the circuit shown in Fig. 1 indicates, a push-pull type of self-excited oscillator is used, with each valve driving its companion. If one valve is withdrawn, the remaining valve operates as a self-excited oscillator, grid impulses of correct phase being received from the centre-tapped coil. Tuning is pre-set, and it is particularly desirable that the transmitter be kept within the permitted band, or harmonics may cause interference to nearby television receivers.

None of the components is critical in value. The coupling condensers may be of 25 to 50 pF capacity, but should have high insulating properties. For tuning, 25 pF is most generally suitable. Excessive capacity should be avoided. here, since the output is noticeably reduced as capacity is increased. The grid resistors are 1 watt types, of 10 to 20 KΩ resistance. A pair of triodes may be used, but it will be less easy to obtain the maximum permitted output (5 watts) with these.

Constructional Details

Both panel and base are of insulated material, ebonite or paxolin being suitable, and the dimensions are shown. The aerial was made from interlocking sections which may readily be purchased. The lower section is secured to the panel by clips, as shown in Fig. 2. The panel also carries an earth terminal. If an earth is not used, this terminal *must* be joined to the H.T. negative line by means of a short lead.

A slot is cut in the end of the tuning condenser spindle. Alternatively, a coupler and insulated spindle at least 6 in. long may be used for tuning. Any attempt to tune by means of a knob fitted directly to the condenser will be unsuccessful.

Wiring under the base is shown in Fig. 3, and construction is very straightforward. All connections should be short, including battery leads.

Three 6 B.A. bolts pass through the base, and serve to hold the self-supporting coil. The latter may readily be removed for modification, if necessary, and consists of 10 turns of 18 s.w.g. tinned-copper wire. It is of 1⅛ in. outside diameter, and 1¼ in. long. To wind, an object about 1 in. in diameter should be taken, and a length of the wire pulled out straight. One end of the wire may be secured to some fixed point, and the coil wound. The object, or former, is then removed, and the turns pulled out slightly. Subsequently, it may be necessary to compress or pull out the coil slightly, to obtain the correct inductance. No adjacent turns should touch,

(*Continued on page* 217)

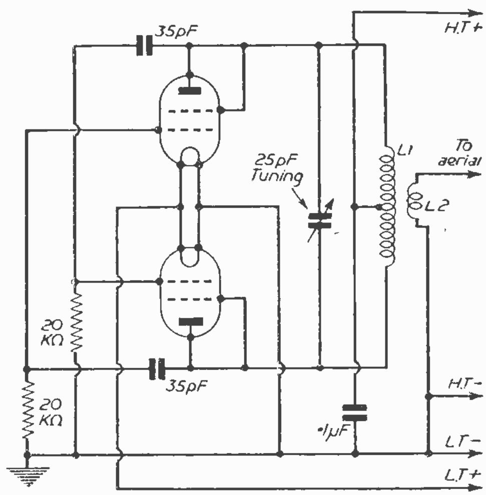


Fig. 1.—Theoretical circuit of the transmitter.

Terms C.W.O. or C.O.D. No C.O.D. under £1. Postage 1/- extra under £1. 1/6 extra under £3.

RADIO SUPPLY CO.

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Open to callers 9 a.m. to 5.30 p.m. Sats. until 1 p.m. FULL PRICE LIST, 5d. TRADE LIST, 5d. Please enclose S.A.E. with all enquiries.

SPECIAL OFFERS. Germanium Crystal Diodes, **2/9.** Midget Mains Transformers (size approx. 2½ x 3 x 2½in.). Drop-through chassis type. Screened Primary 220 240 v 50 c/s. Output : 250-0-250 v 60 mA, 6.3 v 2.5 a. Only **10/9.** Small Filament Transformers. 220/240 v input, 6.3 v 1.5 a output, **5/9.** Auto Transformers (with separate l.t. 6.3 v 1.5 a), 0-110-200-210-230-250 v 50 watts, **4/9** each.

BATTERY SET CONVERTER KIT. All parts for converting any type of Battery receiver to All Mains. A.C. 200-250 v 50 c/s. Kit will supply fully smoothed h.t. of 120 v 90 v or 60 v at up to 40 mA, and fully smoothed l.t. of 2 v at up to 1 a. Price complete with circuit, only **47/9.** Supplied fully assembled, **55/-.**

PERSONAL SET BATTERY SUPERSEDER KIT. A complete set of parts for construction of a Unit (housed in Metal Case) to replace Batteries where A.C. Mains supply is available. Input 200-250 v 50 c/s. Outputs 90 v 10 ma and 1.4 v 250 ma fully smoothed. Price complete with circuit. Only 31/-. Supplied fully assembled at 42/6.

H.T. ELIMINATOR AND TRICKLE CHARGER KIT. Consists of h.t. and l.t. transformer, h.t. and l.t. rectifiers, smoothing electrolytic, and choke, adjustable charger resistor. For Mains input of 200-250 v. Output 120 v 40 mA and 2 v ½ a. Price, with circuit, **29/6.**

BATTERY CHARGER KITS
For Mains 200-250 v 50 c/s.
To charge 6 v acc. at 2 a, **25/6.**
To charge 6 or 12 v acc. at 2 a, **29/6.**
To charge 6 or 12 v acc. at 4½ a, **45/-.**
Above consist of transformer, bridge rectifier, fuse, fuseholder and steel case. The kits can be supplied fully assembled at an extra cost of 7/9 each.

EX-GOVT. VALVES (NEW)

	Each		Each		Each
IT4	8/11	6SN7GT	11/9	1625	5/3
IS5	9/6	6SG7	6/9	25Z4G	10/6
IR5	9/6	6V6G	8/11	35Z4GT	10/6
3S4	9/9	6V6GT	10/6	D1	1/3
5Y3G	9/6	6X5GT	8/9	EF36	6/11
5U4G	10/6	7V7	6/9	EF39	7/6
5Z4G	9/6	7D8	6/9	EL33	10/6
6AL5	9/9	8D2	2/11	EF91	11/9
6F6G	9/6	9D2	2/11	EB91	9/9
6AM6	11/9	954	1/11	KT44	5/3
6J5G	5/9	12H6	2/3	KT61	10/6
6J7G	7/6	12K7GT	10/6	KT66	11/6
6K7G	6/11	12K8GT	10/6	MU14	9/6
6K8G	12/9	12Q7GT	10/6	MS Pen	5/9
6Q7G	9/11	12SK7	6/11	SP4	5/9
6SL7GT	11/9	12SR7	7/9	U50	9/6
		15D2	5/9	VU120	2/11

EX-GOVT. ITEMS. Pye coaxial plugs and sockets, 7/6 doz. prs. Belling-Lee moulded type 5-pin plugs and sockets, 1/11 pr. Int. Octal Valve Screening Cans, 3 piece, 1/3 each, 11/9 doz. Bak. Tubulars, .02 mfd 5,000 v, 1/9, .05 mfd 3,500 v, 2/11.

ELECTROLYTICS (Current production. Not ex-Govt.)

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

Can Types
32-32-8μF 350 v (small) 5/11
16-16μF 450 v plus 20μF 25 v 5/3
32-32μF 350 v plus 25μF 25 v 5/11

A PUSH-PULL 3-4 watt HIGH-GAIN AMPLIFIER FOR £3/12/6. For Mains input 200-250 v 50 c/s. Complete kit of parts including circuit diagram and instructions. (Point-to-point wiring diagrams available for 1/6 extra.) Amplifier can be used with any type of Feeder Unit or Pick-up. Output is for 2-3 ohm speaker. (We can supply a very suitable 10in. unit by Goodmans at 31/-.) The amplifier can be supplied ready for use for **£4/17/6.** Full descriptive leaflet 1/-.

MASTER INTERCOMM. UNIT with provision for up to 4 " Listen Talk Back Units." A high-gain amplifier enables speech and other sounds emanating from the rooms containing remote control units to be heard at the master control. The unit is in kit form and point-to-point wiring diagrams are supplied. A bakelite or wood cabinet is included. Mains input is 200-250 v 50 c/s. Sound amplification 4 watts. Price only **£5/19/6.** " Listen Talk Back Units " can be supplied at **£1** each. Full descriptive leaflet, 1/-.

EX-GOVT. SMOOTHING CHOKES (POTTED)
330 mA 5 H 50 ohms 12/9
220 mA 5 H 50 ohms 10/9
50 mA 50 H 1,250 ohms 8/11

EX-GOVT. BLOCK PAPER MANSBRIDGE TYPE CONDENSERS
4μF 500 v T.C.C. 2/9
4μF 1,000 v T.C.C. 3/3
8μF 500 v T.C.C. 4/9

COAXIAL CABLE, 75 ohms, ¼in., 10d. yard.

DIAL BULBS, M.E.S., 6.5 v 0.15 a, 8 v 0.15 a, **6/9** dozen.

SELENIUM RECTIFIERS. 230 v 50 mA. H.W. (small), **6/9.** 120 v 40 mA. H.W. (small), **4/6.** 12-15 v 2 a F.W. Bridge, **10/9.** 12-15 v 4 a F.W. Bridge, **18/9.**

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

SILVER MICA CONDENSERS. 5μμF, 10μμF, 15μμF, 20μμF, 25μμF, 30μμF, 35μμF, 50μμF, 120μμF, 150μμF, 180μμF, 200μμF, 230μμF, 300μμF, 330μμF, 400μμF, 470μμF, 500μμF, 1,000μμF (.001μF), 2,000μμF (.002μF). All at **5d.** each, **3/9** dozen, one type.

TUBULAR WIRE-ENDED CAPACITORS (New Stock). .001μF 750 v, .01μF 750 v, .02μF 750 v, .05μF 350 v, .1μF 350 v, .25μF 350 v, .5μF 400 v. All at **4d.** each, **3/3** dozen, one type, **27/6** gross.

BAKELITE (Brown or White) and **WOOD** (Walnut veneered) **CABINETS.** Size approx. 12 x 6¼ x 5in. Very attractive appearance. For illustration see our List. Supplied complete with fully punched T.R.F. 3-valve Chassis, back, 2 or 3 wave. Glass scale with coloured station names. Dial Backplate. 25/-, plus Carr. 2/6. All parts available for construction of T.R.F. or Superhet Receiver in above cabinets.

VOLUME CONTROLS with long spindles, all values less switch, **2/9,** with S.P. switch, **3/11.**

WIRE WOUND POTS. : 20 ohms, 5K, 20K, 25K, 50K (medium length spindles) **2/9.**

P.M. SPEAKERS. All 2-3 ohms, 5in. Plessey **13/9,** 5in. Goodmans **14/9,** 6½in. Elac **14/11,** 6½in. Goodmans **16/9,** 8in. Plessey **15/9,** 10in. Goodmans **31/-,** 10in. Plessey **18/6.**

M.E. SPEAKERS. All 2-3 ohms, 6½in. Rola field 700 ohms, **11/9.** 8in. R.A. field 600 ohms, **12/9.** 10in. R.A. field 600 ohms, **23/9.**

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

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

TOP SHROUDED. DROP THROUGH
260-0-260 v 70 mA, 6.3 v 3 a, 5 v 2 a ... 14/11
260-0-260 v 80 mA, 6.3 v 2 a, 5 v 2 a ... 15/9
350-0-350 v 80 mA, 6.3 v 2 a, 5 v 2 a ... 17/9
250-0-250 v 100 mA, 6.3 v 4 a, 5 v 3 a... 23/9
300-0-300 v 100 mA, 6.3 v-4 v, 4 a, c.t. 0-4-5 v 3 a 23/9
350-0-350 v 100 mA, 6.3 v-4 v 4 a, c.t. 0-4-5 v 3 a 23/9
350-0-350 v 150 mA, 6.3 v 4 a, 5 v 3 a... 29/11
350-0-350 v 150 mA, 6.3 v 2 a, 6.3 v 2 a, 5 v 3 a 29/11

FULLY SHROUDED UPRIGHT
250-0-250 v 60 mA, 6.3 v 2 a, 5 v 2 a, Midget type 2½-3-3in. 17/6
350-0-350 v 70 mA, 6.3 v 2 a, 5 v 2 a ... 18/9
250-0-250 v 100 mA, 0-4-6.3 v 4 a, 0-4-5 v 3 a 25/9
250-0-250 v 100 mA, 6.3 v 6 a, 5 v 3 a, for R1355 conversion 29/9
300-0-300 v 100 mA, 0-4-6.3 v 4 a, 0-4-5 v 3 a 25/9
350-0-350 v 100 mA, 0-4-6.3 v 4 a, 0-4-5 v 3 a 25/9
350-0-350 v 150 mA, 6.3 v 4 a, 5 v 3 a... 33/9
350-0-350 v 150 mA, 6.3 v 2 a, 6.3 v 2 a, 5 v 3 a 33/9
350-0-350 v 160 mA, 6.3 v 6 a, 6.3 v 3 a, 5 v 3 a 45/9
350-0-350 v 260 mA, 6.3 v 6 a, 4 v 8 a, 0-2-6 v 2 a, 4 v 3 a for Electronic Eng. Televisor 67/6
425-0-425 v 200 mA, 6.3 v-4 v 4 a c.t., 6.3 v 4 a, c.t. 0-4-5 v 3 a, suitable Williamson Amplifier 51/-
425-0-425 v 250 mA, 6.3 v 6 a, 6.3 v 6 a, 5 v 3 a 65/6
325-0-325 v 20 mA, 6.3 v 0.5 a, 6.3 1.5 a for Williamson Preamplifier ... 17/6

ELIMINATOR TRANSFORMERS
Primaries 200-250 v 50 c/s. 120 v 40 mA 7/11
120 v 50 mA, 6 v 1.5 a 14/9

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

CHARGER TRANSFORMERS
All with 200-230-250 v 50 c/s. Primaries : 0-9-15 v 1.5 a, **14/9** ; 0-9-15 v 3 a, **16/9** ; 0-9-15 v 6 a, **22/9** ; 0-4-9-15-24 v 3 a, **22/9** ; 0-9-15-30 v 3 a, **23/9.**

SMOOTHING CHOKES
250 mA, 8-10 H, weight 12 lb. 16/9
100 mA 5 H 100 ohms 5/9
80 mA, 10 H 350 ohms 5/6
60 mA, 10 H, 400 ohms 4/11
1 A, .25 H, t. type 4/9

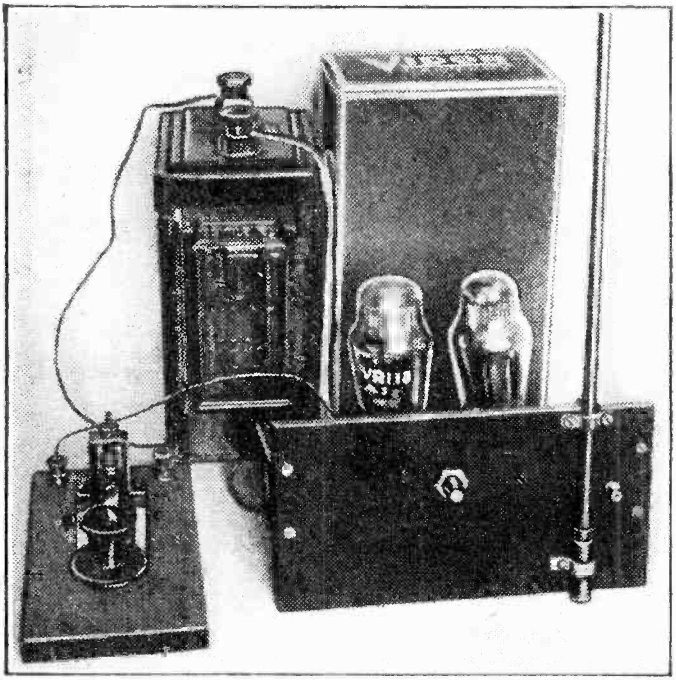
E.H.T. TRANSFORMERS
4,000 v (5,000 v smoothed) 5 mA, 2 v 2 a 39/6
2,500 v 5 mA, 2-0-2 v 1.1 a, 2-0-2 v 1.1 a, for VCR97, etc.... ... ... 37/6

OUTPUT TRANSFORMERS
Midget Battery Pentode 66 : 1 for 3S4, etc. 3/9
Small Pentode, 5,000Ω to 3Ω ... 3/9
Small Pentode, 8,000Ω to 3Ω ... 3/9
Standard Pentode, 5,000Ω to 3Ω ... 4/9
Standard Pentode, 8,000Ω to 3Ω ... 4/9
Multi-ratio 40 mA, 30 : 1, 45 : 1, 60 : 1, 90 : 1, Class B Push-Pull ... 5/6
Push-Pull 10-12 Watts 6V6 to 3Ω or 15Ω 16/9
Push-Pull 10-12 Watts to match 6V6 to 3-5-8 or 15Ω 16/9
Push-Pull 15-18 Watts to match 6L6, etc., to 3Ω or 15Ω Speaker ... 22/9
Push-Pull 20 Watts, high-quality sectionally wound, 6L6, KT66, etc., to 3, 7.5 or 15Ω (secondary in 4 sections of 3.7Ω each) 51/9

(*Continued from page* 214.)

and a length of wire is soldered on at the centre of the coil, to form the H.T. tapping. The wires should then be cut and bent suitably, and secured under the terminals mentioned.

The aerial-coupling coil L2 consists of two turns of insulated wire. In Fig. 3 it is shown at one end of L1. This is to avoid confusion between the windings,



General view of the apparatus ready for use.

and results will be slightly better if the coil is placed centrally over L1. To aid this, the coupling winding can be about 1¼ in. in diameter. L1 should not be near the panel bracket, or R.F. energy will be absorbed by the latter.

Valves and Batteries.

Any type of pentode or triode will function, but output will be greatest with " Power " and equivalent-type valves. If a field-strength meter is used, the output obtained with various valves will be immediately apparent.

For maximum output, a pair of pentodes such as the 220HPT will be suitable. For short-range work, or experimental purposes, one valve may be removed, or L.F. type triodes can be used. Short-range control is possible with detector-type valves.

The H.T. voltage can be varied between wide limits, a voltage of from 60 to 150 being suitable. For regulation purposes, the wattage figure is that of the valve or valves powering the aerial—in this case the total current consumption of the transmitter multiplied by the H.T. voltage used. The current consumption may be found by including a meter in the H.T. positive lead. For example, assume that a reading of 20 mA. is obtained, and that a 120 v. battery is used. Since 20 mA. equals .02 amp., the wattage dissipated equals 2.4, which is well within the permitted maximum. The wattage may be increased by increasing the H.T. voltage, or by using valves of a type passing heavier anode current. If small power or L.F. type valves are used, with moderate H.T. voltages, there is no danger of exceeding the permitted maximum rating. But with power pentodes and high H.T. voltages a check should be made to see that the maximum permitted rating is not being exceeded. Measurements of anode current (or combined anode and screen grid current, in the case of tetrodes and pentodes) should be taken with the full aerial connected.

Re-tuning is necessary if the valves are changed, or one valve removed. Such re-adjustment is also required if the length of the aerial is changed, or the position of the coupling winding modified.

Initial tests should take place with a very short aerial (1ft. is sufficient) and reduced H.T. voltage. The output may afterwards be increased when it is found that the transmitter is not outside the permitted frequency band. An initial test for R.F. oscillation may be made by soldering a loop of wire to a low-consumption torch bulb and bringing this near L1, when the bulb will light. (This test cannot be applied with detector valves, or similar types giving exceedingly small outputs.)

Aerial Details

The type of aerial rods referred to have the advantage of being self-supporting, but a wire aerial may be used. An aerial 8ft. long is sufficient ; where less range is required, much shorter aerials may be used.

The simplest aerial is a single element, placed vertically, with a counterpoise earth, such as that afforded by the H.T. negative line, or a true earth, obtained by pressing a spike into the ground. If a wire is used for the aerial, it may be supported by a bamboo or other convenient mast. If the transmitter

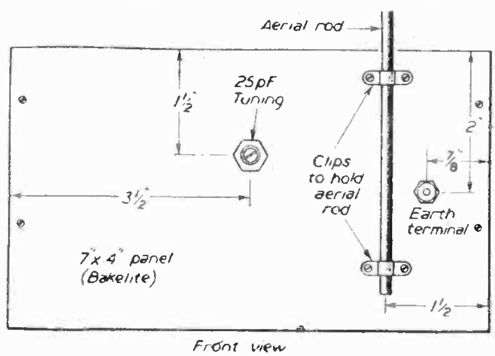


Fig. 2.—Panel data.

is placed on the ground itself, then additional earthing is not necessary.

If a di-pole aerial is to be used, the aerial rod shown should be removed. A twin feeder is then taken from the terminals to which L2 is secured. The feeder terminates at the inner ends of the di-pole elements, in the usual way. With this type of aerial the terminal marked "Earth" is not earthed; nor is it connected to the H.T. negative line.

The actual strength of the signal radiated with various aerials may be found without difficulty if a signal-strength meter is used. Such a meter is recommended, and is very helpful when setting up the transmitter. The strength of the radiated signal increases sharply as the length of the aerial is increased, until a length of 7ft. to 9ft. is reached, when further increase in length only brings about a comparatively small increase in radiation.

Frequency Checking

When only one set of equipment is in use it is usual to select a frequency in the middle of the permitted band, and this may be done by using a wavemeter. A frequency of 27 Mc/s. is suitable, and this is approximately 11.11 metres.

If it is found that the tuning condenser requires to be quite, or almost, closed, then the inductance of the coil should be slightly increased by compressing it. If, however, the condenser is fully open, then the coil should be drawn out slightly. The aim should be to peak the condenser for maximum output on 27 Mc/s. with the condenser almost at minimum capacity. The exact setting will be influenced to quite a large extent by the self-capacity of the valves used. If the valves are changed, re-tuning is essential.

It is wise to check the transmitter for correct frequency before use. The receiver should also be tested for maximum response before endeavouring to control the model at range. The maximum range at which the equipment will function naturally depends upon the type of aerial, and the sensitivity of the receiver. With a single-valve receiver of the gas-filled super-regenerative triode type, a range of half a mile is obtainable without much difficulty, under average conditions.

The transmitter is controlled by wiring a morse key in the H.T. negative line. Short wires are essential; if the leads need to be at all long, a short-wave H.F. choke should be included in each, at the transmitter end. When the key is depressed the transmitter radiates, thereby actuating the relay and controlling mechanisms in the model.

As with all such equipment, correct setting-up is absolutely essential. If receiver and transmitter are not correctly tuned to the same frequency, the range will be much reduced. The relay in the receiver should also be adjusted to operate with the smallest possible change in current. Initially, receiver and transmitter may be tried at no great distance (say 20 yds.). The distance may then be increased, and more exacting adjustments made to the receiver. Final adjustments should take place at the maximum range required. A completely insulated tool, such as a length of ebonite rod, should be used to adjust the transmitter tuning condenser.

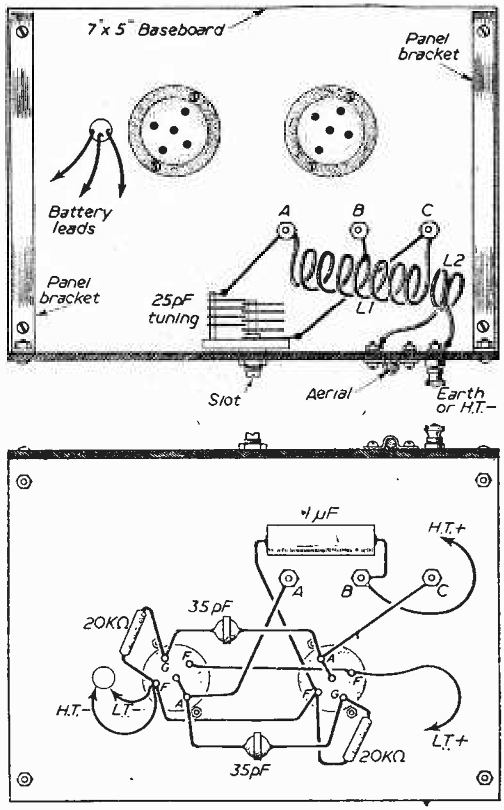


Fig. 3.—Top and underchassis layout and wiring details.

The Coronation

IN view of the public interest and local arrangements now in the course of preparation, the BBC would like it to be known that its present plans envisage Coronation broadcasts on June 2nd between the hours of 10.15 a.m. and 5 p.m.

The times, which cover both sound and television broadcasts, are based on those of the 1937 Coronation, and at the time of going to Press must be regarded as provisional.

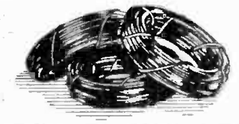
Her Majesty's Broadcast

On the evening of June 2nd, as has already been announced, Her Majesty the Queen will broadcast to the Commonwealth at 9 p.m. (B.S.T.). This will be carried by all the domestic services, including television in sound only in addition to the external services.

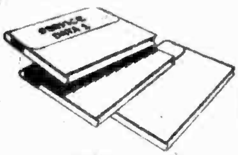
Rediffusion

No objection will be taken by the Corporation to the rediffusion in public of the sound and television broadcasts of the Coronation ceremony and processions. The Corporation is also authorised to make the same statement on behalf of the Performing Rights Society.

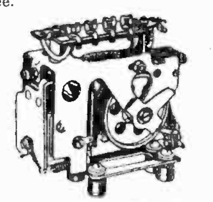
The rediffusion of television programmes to paying audiences is not covered by the G.P.O. £2 receiving licence, but the Postmaster-General has announced that he proposes to issue a collective licence, free of charge, to cover the rediffusion of the Corporation broadcasts to paying audiences.



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



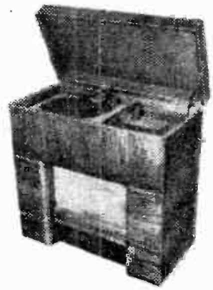
SERVICE DATA
100 service sheets, covering British receivers which have been sold in big quantities, and which every service engineer is ultimately bound to meet. The following makers are included: Aerodyne, Alba, Bush, Cossor, Ekco, Ever-Ready, Ferguson, Ferranti, G.E.C., H.M.V., Kolster Brandes, Lissen, McMichael, Marconi, Mullard, Murphy, Philco, Philips, Pye, Ultra. Undoubtedly a mine of information invaluable to all who earn their living from radio servicing. Price £1 for the complete folder.
Our folder No. 2 consists of 100 data sheets covering most of the popular American T.R.F. and superhet receivers "all dry," etc., which have been imported into this country. Names include Sparton, Emmerson, Admiral, Crossley, R.C.A. Victor, etc. Each sheet gives circuit diagrams and component values, alignment procedure, etc. etc. Price for the folder of 100 sheets is £1. Post free.



REMOTE CONTROL
With only one pair of wires and a simple push button you can select any one of four stations without leaving your armchair. This is just one of the many applications of our impulse relay. There are many other purposes to which it can be put. Note they are somewhat soiled due to storage, but mechanically O.K. Price 2/6.

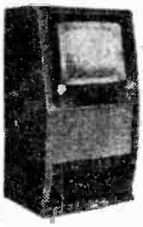
POWER UNIT FOR MODELS
Power unit designed for trains, etc. Gives 6 to 12v. D.C. continuously variable. Fitted reversing and mains on/off switch. Complete kit including case 35/-, or made-up ready to work 39/6.

RADIOGRAM UNITS

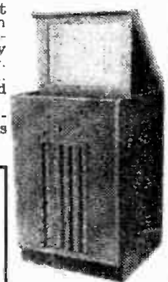


Console type Cabinet. With full grained walnut finish, will take standard type auto change gram. unit Price £11 10/-. H.P. Terms, £3/17/- deposit and 12 monthly payments of 16/9, plus 15/- carriage.
Radio Chassis to suit. £8 19/6. H.P. Terms, £3 deposit and 10 monthly payments of 13/-, plus 7/6 carriage.
Auto Change Units, Collaro. For long playing and standard records, with turnover pick-up head, £11/11/-, plus 3/6 carr. & insurance.
SPECIAL OFFER.—Cabinet, Radio chassis and Auto Changer, 29 gns. H.P. Terms, £10/14/- deposit and 12 monthly payments of £2/3/-. Non-callers add £1 carr. and ins.

CABINETS—LESS THAN COST!

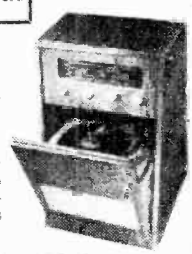


A 12in. Console T.V. fitted with castors and front flap for controls. Size 19in. x 35in. x 15½in. deep. Price £7/10/-, plus 10/- carriage or £2/10/- deposit.
A 12in. Table Model complete with armour plate glass and surround, £3 17 6, plus 7/6 carr. and insurance.



An impressive cabinet designed for projection T.V. but also very suitable for a good quality radiogram or amplifier. Size 23in. wide x 22in. deep. 37½in. high with lid closed.
Price £9/15/- plus 15/- carriage. Or H.P. Terms £3/5/- deposit.

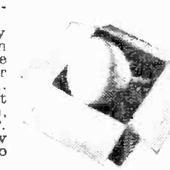
Mechanical details for the Console or Table Model available as a parcel. Punched and prepared metal chassis, punched outrigger, valve plate with spacers, 12in. Tube clamping ring, tube rear support, brackets, etc. Price 25/-, plus 2/6. Post included free with this parcel, circuit diagram and details of 5 Channel 12in. T.V. which uses these cabinets, chassis, etc.



Drop front radiogram—will take the Collaro 3 speed changer RC511, etc. Size 13in. x 30in. x 11in. to 16in. deep. Price £7/10/-, plus 10/- carriage. Or £2/10/- deposit.

SPECIAL OFFER. This grand cabinet and Collaro 3-speed auto-changer complete with turnover pick-up. Price £17/16/8 plus 12/6 carriage and insurance. Cash with order or H.P. terms £6/7/- deposit.

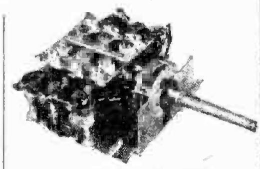
13 colour scale, scale pan, chassis, pulley, driving head, springs, etc., to suit the radiogram are available as a parcel at 15/-, plus 1/6 post.



STILL AVAILABLE 15in. MAGNETIC TELEVISION TUBE.
By famous maker, as used in many popular Television receivers (list on request). Specification Blue White screen 9 Kv. ion trap triode, heater 6.3 v. at .55 amp., 50 deg. deflection. New, with written guarantee offered at approximately half price, £12/10/- each, plus 10/- carriage and insurance. H.P. terms £4/4/- deposit and 12 monthly payments of 18/3. Limited quantity so order immediately.

MAINS TRANSFORMER SNIP
Heavy duty transformer, with 5 secondaries, suitable for big Amplifier, T.V., etc. Primary: 200, 220, 240v. Secondary 1: 350-0-350v. at 200-250 m.A. S2: 6.3v. at 5 amp. S3: 4v. at 3 amp. S4: 4v. at 3 amp. S5: 5v. at 3 amp. Half shrouded drop through chassis mounting. Price 29/6 plus 1/6 postage.

ELECTRONIC PRECISION EQUIPMENT DEPT. 7
42-46 WINDMILL HILL, RUISLIP, MIDDLESEX • 152-3 FLEET ST. LONDON E.C.4.



COIL PACK SNIP
Manufactured by quite a famous company, this 3 wave Coil Pack incorporates a gram position and Long, Medium and Short wave band, designed for 465 kc/s IF. Brand new and fully guaranteed, complete with circuit only 19/6, limited quantity so act quickly.

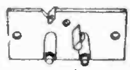
CARBON RESISTORS
¼ watt, 4d. each.
½ watt, 5d. each.
1 watt, 6d. each.

SMALL CONDENSERS
Moulded mica, silver mica, ceramic, paper tubular, all values up to .01 mfd. normal 350 v. working, 6d. each, 5/6 doz.
.01 mfd., 6d. each.
.1 mfd., 9d. each.
.5 mfd., 1/- each.
1 mfd., 1/3 each.

SOMWEAVE

This really lovely loudspeaker fabric we offer at approximately a third of today's cost. It is 42in. wide and our price is 12/- per yard or panels 12in. x 12in., 1/9 each. This is also very suitable for covering plain wooden cases, for portable radio amplifiers, etc.

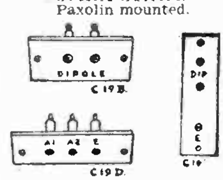
SPECIAL SWITCHED PANEL (C16A)



C16A.

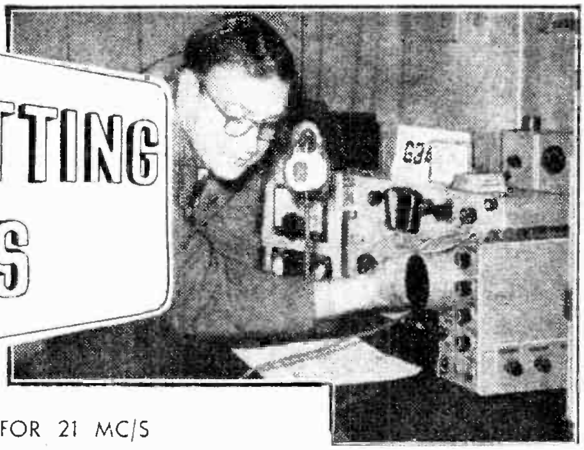
This is a 2-socket panel with optional switching for internal and external L.S. Just inserting two pin plug, C20B gives both speakers, pushing it right home cuts out internal speaker. Price 9d. each.

SOCKET STRIPS
Paxolin mounted.



Two socket engraved L.S. 6d. each. Bin. C16B.
Two socket engraved A.E. 6d. each. Bin. C18A.
Two socket engraved P.U. 6d. each. Bin. C19B.
Two socket engraved Dipole 6d. each. Bin. C19B.
Two socket plain. 5d. each. Bin. C18B.
Three socket engraved DIP and E. 9d. each. Bin. C16D.
Three socket engraved A1, A2 and E. 9d. each. Bin. C19D.
Four socket engraved A.E. Pick-up. 9d. each. Bin. C19E.
Four socket engraved P.U. Ext. L.S. 9d. each. Bin. C16E.
Five socket plain. 9d. each. Bin. C16C.

TRANSMITTING TOPICS



AERIAL IDEAS FOR 21 MC/S

By B. H. Jay

IN the previous treatment of unusual ideas for aerials, the data for operation on 21 Mc/s. was included. In view of the opening of this new band, some ideas on adapting or using existing aerials for 21 Mc/s. can be considered. It is clear that a number of amateurs have been undecided as to the best method of utilising existing installations. This indecision stems from the fact that the 21 Mc/s. band is in a 3/2 frequency relationship to the 14 Mc/s. band. The normal short-wave amateur bands have formerly been in a simple two to one relationship. However, it is not necessary to erect a special separate aerial for 21 Mc/s. operation, as in the majority of cases highly efficient operation of an existing aerial designed for another band can be obtained in 21 Mc/s. service. However, it is important to determine whether a series or a parallel aerial tuning circuit is required, as otherwise difficulty will be found in loading up to the transmitter tank. With the correct choice of feeder length and tuning circuit, efficient 21 Mc/s. results can be easily obtained. In fact, many existing transmitting aerials can be used without alteration for 21 Mc/s. with a radiation efficiency rather better than a half-wave cut specially for 21 Mc/s. As it is pointless to go to the trouble of erecting a fresh aerial when the present one will do, the use of the following "standard" types of aerial for 21 Mc/s. use may be found helpful.

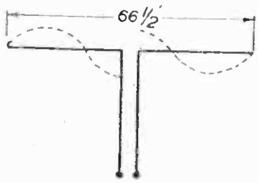


Fig. 1.—Forty-metre dipole operated on 21 Mc/s. as a "three half-wave centre fed" aerial. Current distribution shown dotted.

Feeder lengths (feet)	Tuning circuit required
22, 44, 66, etc.	Series
11, 33, 55, etc.	Parallel

The most popular array in common use is undoubtedly the "40-metre dipole centre fed with quarter-wave feeders," that is, a 66 ft. top with 33 ft. feeders. As a half-wave at 21 Mc/s. may be taken as 22 ft., the top thus becomes for 21 Mc/s. operation, a "three half-waves centre fed" aerial. The three half-waves type of aerial is a novelty in amateur practice, but is a well-known and highly efficient type. Its radiation pattern approximates to an all round pattern, while its radiation resistance is high. It is, in fact, a rather better radiator than a plain half-wave at 21 Mc/s. This arrangement is shown in Fig. 1, together with the tuning required for various feeder lengths. For the 33 ft. feeders usually used with a 66 ft. top for 40-metre operation, parallel tuning is required.

"Extended Element"

As a 20-metre dipole would become a "three-quarter wave top" at 21 Mc/s., some amateurs appear to believe that it is hopeless to try to tune such an arrangement for 21 Mc/s. operation. However, such an aerial belongs to the class of "extended element" radiators. These are of superior performance to a plain half-wave, and there is no difficulty whatsoever in tuning up such a system on 21 Mc/s. It cannot be too strongly stressed that both a 40-metre doublet and a 20-metre doublet provide efficient radiating systems when used on 21 Mc/s. This is important, especially to those living in cities where

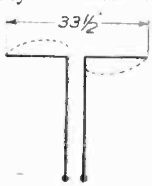


Fig. 2.—Twenty-metre dipole energised at 21 Mc/s.

Feeder lengths (feet)	Tuning circuit required
22, 44, etc.	Series
11, 33, etc.	Parallel

restricted space makes it difficult to erect more than one or two aerials. As existing aerials already provide for efficient operation on 21 Mc/s., there is little point in providing a separate 21 Mc/s. dipole, unless coverage is required in some direction not covered by the existing aerials. As beam arrays are a rather different proposition, those who are in a position to set up rotary beams will be able to design element lengths by scaling down by two-thirds the lengths quoted for 20-metre arrays. Fig. 2 quotes the case for operation of a 20-metre dipole on 21 Mc/s.

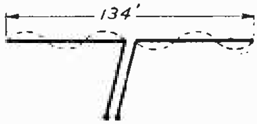


Fig. 3.—An 80-metre dipole energised at 21 Mc/s.

Feeder lengths (feet)	Tuning circuit required.
11, 33, 55, etc.	Series
22, 44, 66, 88, etc.	Parallel

with the appropriate tuning circuits required. For interest, Fig. 3 shows also the current distribution on an " 80-metre dipole centre-fed " when operating on 21 Mc/s.

Folded Dipole

The use of simple dipoles designed for lower frequency bands on 21 Mc/s. is straightforward. However, the case of *folded* dipole multiband operation is a little different. A folded 20-metre dipole is unsatisfactory for 21 Mc/s. use. However, a folded dipole can be designed for efficient third harmonic radiation. This enables a folded dipole to be used for fundamental operation on 40 metres, and also for third harmonic use on 21 Mc/s. Owing to the effects of end correction factors, it is necessary to make the top length appreciably longer than the value usually quoted for 40-metre operation. Using the value shown in Fig. 4, the standing wave ratio on the 300 ohm feeders will be satisfactory for both 7 Mc/s. and 21 Mc/s. operation. If an existing 7 Mc/s. folded dipole is used, it will be found to give a poor match with high standing-wave ratios when fed at 21 Mc/s. and it is advised that the top length be slightly lengthened to conform with the dimensions of Fig. 4, for satisfactory operation on 7 Mc/s. and 21 Mc/s. The matching circuit at the transmitter end will be the usual parallel tuned circuit with

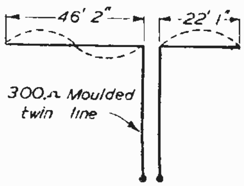


Fig. 5.—Using the " Allband Matched Impedance Antenna " on 21 Mc/s. as a tuned system.

Feeder lengths (feet)	Tuning circuit required
10, 30, 50, etc.	Series
20, 40, 60	Parallel

the feeders tapped down the coil. A very popular scheme is the celebrated WØWO aerial, which has been previously described. In view of its popularity, it will be welcome news that it can readily be adapted in its 40-metre form for efficient all-band operation *including* 21 Mc/s. The 20-metre version is not suitable for 21 Mc/s. operation.

As readers of this journal who have read the original articles on the WØWO aerial are aware, it is a unique matched-impedance device which operates on several bands. This is valuable, as any

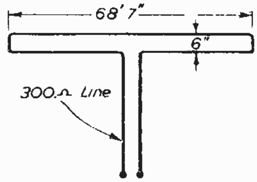


Fig. 4.—Optimum dimensions for folded dipole for operation on both 7 Mc/s. and 21 Mc/s. This is slightly longer than the usual length of a 7 Mc/s. folded dipole.

convenient length of 300 Ω line may be used to feed the system. However, by cutting the feeder to a length, making the system resonant on 21 Mc/s., it can be used as a *tuned* system on 21 Mc/s. while retaining the matched-impedance feature for all the other bands (7 Mc/s., 14 Mc/s. and 28 Mc/s.) originally covered by this popular aerial. As this merely entails (with standard 300 Ω line) making the feeders any convenient multiple of 10ft. long, it is purely a question, at the most, of adjusting by 5ft. one way or the other the length of feeder already in use, to enable 21 Mc/s. to be covered by this versatile aerial. It is, indeed, a strange coincidence that the tap point for this aerial should so conveniently provide a truly " ALL-BAND " operation that now includes 21 Mc/s.! As will be seen from Fig. 5, the lengths quoted for the 40-metre fundamental top provide for harmonic operation on 21 Mc/s. The feeder length for series and parallel tuning at the feeders are also given. It will be noted that these feeder lengths are in multiples of TEN feet, as allowance has been made for the propagation factor of moulded twin 300 Ω line. It is also advised that the Telcon circular section 300 Ω moulded line be used, as this prevents any of the trouble experienced in wet weather with flat moulded line. In case any doubts are felt about using moulded line for use as tuned feeders, it can be stated that such line will operate satisfactorily with powers well in excess of the legal maximum input of 150 watts, and that losses are low. It is suggested, therefore, that those already using the 40-metre fundamental WØWO aerial, carefully measure their feeder length and adjust it to the nearest multiple of 10ft. that is convenient. To tune up on 21 Mc/s. is then a question of selecting the correct type of tuned circuit, and of tapping the feeders on for optimum loading. Incidentally, do not be unduly worried if the aerial ammeter shows an unusually high or an unusually low figure on 21 Mc/s. If the P.A. loading is normal it can be taken that the aerial is being efficiently fed. Under series tuning conditions, the aerial current with, say, 25 watts P.A. input, may run up to around an ampere, while if the feeder length requires parallel tuning, the corresponding feeder current may only be one-tenth of an amp.

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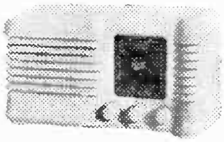

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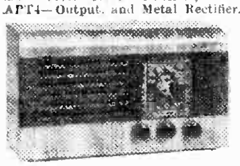

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3 A	... 1½	2¼ round	R.F. Thermo	7/6
3.5 A	... 1½	2¼ x 2¼ ...	R.F. Thermo	7/6
4 A	... 1½	2¼ x 2¼ ...	R.F. Thermo	7/6
8 A	... 1½	2¼ x 2¼ ...	M/C ...	12/6
20 A	... 1½	2¼ round...	M/C ...	8/6
30 A	... 1½	2¼ x 2¼ ...	M/C ...	8/6
40 A	... 1½	2¼ round...	M/C ...	8/6
1.5 mA.	... 1½	2¼ round....................		12/6
5 mA.	... 1½	2¼ x 2¼ ...	M/C ...	8/6
6 mA	... 2	3¼ round....................		16/9
50 mA	... 1½	2¼ x 2¼ ...	M/C ...	8/6
100 mA	... 1½	2¼ x 2¼ ...	M/C ...	8/6
500 Micro/a	... 1½	2½ round...	M/C ...	15/-
20 V	... 2	3¼ round...	M/C ...	8/6
40 V	... 1½	2¼ x 2¼ ...	M/C ...	8/6
1 mA...	... 2	3¼ round	M/C ...	25/-

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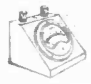

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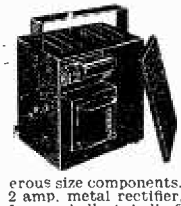

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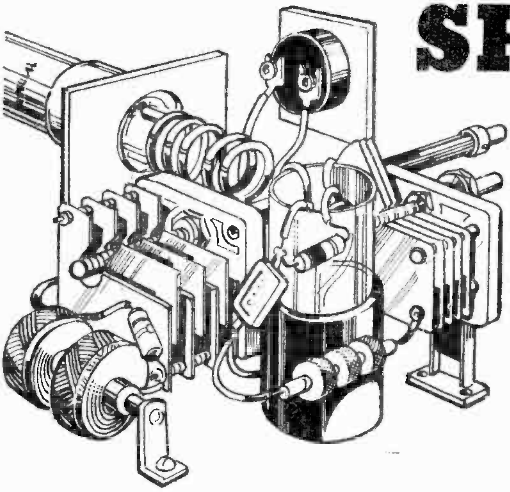


SHORT-WAVE SECTION

Modern American Amateur Communication Receivers

3.—THE NATIONAL NC-183D

By A. W. Mann

In keeping with the general trend of modern amateur communication receiver design and development, the new miniature type valves are used in the NC-183D.

IN addition to the H.R.O. "Sixty," the National Company have designed and produced a number of others, one of them being the NC-183D amateur communications receiver, an illustration of which accompanies this article.

This also is a double conversion superheterodyne. Dual conversion is carried out on the three highest ranges, which include the 6-, 10-, 15-, 20- and 40-metre amateur bands.

There are three I.F. stages which include in all 16 permeability tuned circuits on the three high bands, and 12 on the remainder. Steep-sided skirt selectivity with entire freedom from whistles is thus obtainable. A new departure in crystal filter design is another feature of this design.

This model also incorporates two R.F. stages and a push-pull output stage.

Frequency Drift

With some short-wave superhets frequency drift during, and in some instances after, warming up is experienced. This trouble, however, is not common to all superhets.

In the case of the NC-183D freedom from drift is assured by the inclusion of a new bi-metallic temperature compensated tuning condenser.

General Coverage and Bandspread

In the author's opinion one of the many highlights of this receiver centres around the general coverage and bandspread arrangements. Note the following :

Band	*General Coverage*	*Bandspread*
A	——	47-55 Mc/s
B	12-31 Mc/s	26.5-30 Mc/s
	——	20.0-21.5 Mc/s
C	44-12 Mc/s	14.0-14.4 Mc/s
D	1.55-4.4 Mc/s	6.9-7.3 Mc/s
E	0.54-1.55Mc/s	3.5-7.3 Mc/s

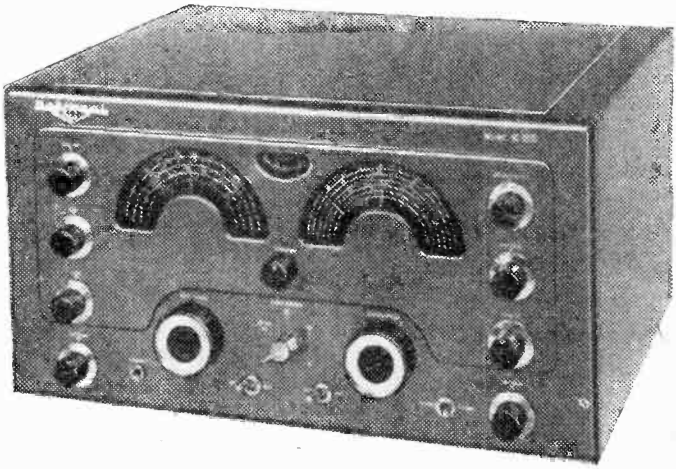
Full advantage is taken of the two stages of R.F. which are effectively used on all bands.

Valve Complement

First and second R.F.s 6BA6 ; first and second converters 6BE6 ; first and second I.F.s 6BA6 ; second detector and A.V.C. 6AL5 ; A.V.C. amplifier 6AH6 ; B.F.O. 6SJ7 ; noise limiter 6AL5 ; first audio 6SJ7 ; phase inverter 6J5 ; audio output (2) 6V6GT/G ; voltage regulator OB2 ; rectifier 5U4G.

Panel Controls

The panel controls as shown in the accompanying illustration are as follows. Taking those at the extreme left, from top to bottom : C.W. operation switch. Next down, B.F.O. control graduated 1 to 5 each side of central zero. Tone control graduated 1 to 10. A.F. gain control marked "on/off." Extreme right (top), graduated selectivity control. Next down, graduated phasing control 0-5-0. Noise limiter and R.F. gain control both graduated 0-10. Bottom of panel (from left), phone jack, standby-receive switch, A.V.C. MVC, radio-gram switch. The left tuning dial control knob is for main tuning, while the bandspread tuning control is to the right. Between-band switch.



The National NC-183D. Photo by courtesy of the National Co. Inc.

Above (in centre), trimmer. Note: An S meter is included, and the calibrated Lucite tuning scales are indirectly illuminated.

The Cystal Filter

The new crystal filter incorporated in this receiver is one of wide range, Pass-band selection being carried out by switching. In six progressive steps, the pass bands can be narrowed. Thus the operator has at his finger-tips the means whereby he may counteract the effects of Q.R.M., to a considerable degree even under conditions of abnormal severity.

The difference in operating and in the results achieved when using a bandspread receiver and a similar one in which bandspread facilities are not available, are most marked. It is interesting to me to note that the parallel method of bandspreading is incorporated in the model under discussion. Not only does this method allow the bandspreading of the amateur frequencies, but in addition, any frequency to which the receiver can be tuned can also be bandspread.

Next come considerations relative to selectivity, sensitivity, and signal-to-noise ratio. The performance figures which follow, speak for themselves.

Sensitivity—better than 1.5 microvolts at 6db. signal-to-noise ratio throughout the entire frequency range. Measured with a standard 300 ohm dummy aerial.

Selectivity

Bandwith	6db down	60db down
Selectivity switch off ...	3.4Kc/s.	12.5Kc/s.
Selectivity switch "5"	80 cycles	7Kc/s.

Image rejection :—

Signal/image better than 55db at 30Mc/s.

Audio System

Undistorted output 8 watts. Frequency response with tone control at 10 = 60 to 12,000 c.p.s. Tone control at 0 = 60 to 1,000 c.p.s.

Output impedence. Speaker socket 8 or 500 ohms. Phone jack—not critical.

This receiver, which is finished in smooth grey, is available in table model and rack form.

Dimensions—10¼in. x 19¾in. x 16¾in. Shipping weight—65lb. Speaker—12lb. The power consumption of the NC-183D is 120 watts.

Like the H.R.O. "Sixty" the NC-183D upholds the National Company traditions as manufacturers of precision radio apparatus.

Due to currency and import restrictions communication receivers of modern American design and manufacture are not available in this country. PRACTICAL WIRELESS, however, circulates the world over, and there are no doubt readers outside the United States who may at some time find the information given in this series of articles of use.

The same applies to readers at home. Proof of this is to be found in the correspondence the author received following a previous article on pre-war communication receivers. In conclusion the writer cannot supply theoretical diagrams of any of the receivers discussed in this series of articles.

News from the Clubs

DERBY AND DISTRICT AMATEUR RADIO SOCIETY

Hon Sec.: F. C. Ward (G2CVV), 5, Uplands Avenue, Littleover, Derby.

AT the society's Annual General Meeting, on February 4th, the following were elected as officers for the ensuing year: chairman, C. M. Swift (G3IUK); hon. sec., F. C. Ward (G2CVV); hon. contests sec., K. J. Pegg (G3FSH); hon treasurer, W. R. Chaffe (G2DLJ); committee, Messrs. F. Clay (G3IBL), T. Darn (G3FGY), C. Rodgers (G3IIJ), G. Mather, B. J. C. Brown (G1889); magazine editor, T. Darn (G3FGY); auditors, C. Drinkwater (G3FNK), W. M. Sudbury (BRS 13922). The society's president, A. G. G. Melville, Esq., F.R.C.S., presided.

The society meets weekly at the Derby College of Art, Green Lane. Interested enthusiasts in the Derby and District area can obtain a copy of the society's programme upon application.

Q.R.P. RESEARCH SOCIETY

Hon. Sec.: J. Whitehead, 92, Rydens Avenue, Walton-on-Thames, Surrey.

THIS society, catering for all radio enthusiasts interested in low-powered receiving or transmitting gear, invites new members.

Q.R.P. "Skeds" are being arranged between members, and the co-operation of S.W.L.'s is invited in reporting on them.

It is proposed to hold a regular society "net" on the first Sunday of each month between 3,500 and 3,545 kc/s C.W. only. Work is in progress with the development of a Q.R.P. communications receiver. There is also a V.H.F. section within the society, ably managed by GC2CNC.

LIVERPOOL AND DISTRICT SHORT WAVE CLUB

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

AMONG the recent lectures given at the club, two outstanding ones were those given by Messrs. Goodmans representative on Hi-Fi reproduction (this was voted to be one of the best and the demonstration given was first class), and a lecture given by Mr. Hancock of H.M.F. on Computing. In a recent contest, held by the Association of North Western Radio Societies, G3BWR was first with a frequency measurement of 1,892.462 kc/s out of 1,892.424 kc/s. Future activities will include a D.F. Contest, the prize being "The Malcolm Cohen Cup." Many other things have been planned to interest both the S.W.L. and "Ham." Meetings held every Tuesday evening, Room 5, St. Barnabas Hall, Penny Lane, Liverpool, 15.

EDINBURGH AMATEUR RADIO CLUB

Hon. Sec.: D. Black, 16, Edina Place. 'Phone: ABB 1363.

THE club has moved into its own premises, meetings being held every Wednesday at 7.30 p.m. in the club rooms, at 16, Bothwell St. (downstairs), off Easter Road.

BIRMINGHAM AND DISTRICT SHORT WAVE SOCIETY

Hon. Sec.: A. O. Frearson, 66, Wheelwright Road, Erdington, Birmingham, 24.

THE following officers and committee were elected for 1953, at the Annual General Meeting in December:

Chairman, T. Burton (G2BON); vice chairman and minute secretary, F. C. Cooke; hon. secretary, A. O. Frearson; treasurer, R. Collett (G3EGS); committee, R. Yates, T. E. P. Ellis, W. Muller (G2CJY).

To meet rising costs it was agreed to raise the annual subscription to 12/- a year, 6/- for members under 18.

All visitors will be welcome at the Colmore Inn, Church Street, Birmingham on any meeting night, the second Monday in the month.

A technical discussion night is held every fourth Monday, when any snags and difficulties are discussed and ironed out.

COVENTRY AMATEUR RADIO SOCIETY

Hon. Sec.: K. Lines, 142, Shorncliff Road, Coventry.

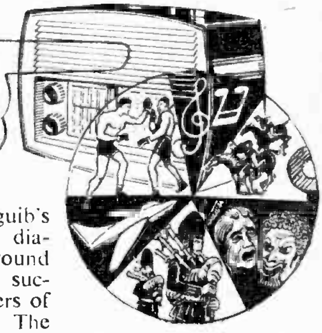
THE society enter the New Year with a full programme of lectures, discussions, field days and outings, to suit every taste. Entries for all competitions are now being scrutinised, and results will be announced next month.

Congratulations are due to the president, "Freddie" Miles (G5ML), for his win in the Low Power Field Day, to secure the coveted trophy awarded by the Radio Society of Great Britain.

Future programme at the Y.W.C.A., Queen's Road, 7.30 p.m. is as follows:

March 16th, Lecture by J. Hanson (G6YU); March 30th, "Mathematics—Which?" a lecture by T. R. Theakston, B.Sc.; April 13th, Readers Digest; April 27th, "A Multipurpose Power Supply," lecture and demonstration by Ray Bastin.

Programme Pointers



By MAURICE REEVE

Scrapbook

THE "Scrapbook" series has long been a radio feature of considerable excellence, and one held in great esteem. Those whose memories take them back to the days of Merrie England of before the first World War, love to be reminded of Our Miss Gibbs, Ranji, Edward the Seventh, in all of whom is sublimated their own primes and glories. Whilst the events of those days, apart from their glamorous personalities, are none the less historical and exciting for having been witnessed and perhaps taken part in. Consequently, every scrapbook dealing with the first two decades or so of the century, has been first-class radio experience.

But when we come to those dealing with the thirties, we have an entirely different kettle of fish. Something has gone wrong. Sand has blown into the works. They are made more topical and less historical. I suppose the events being so recent, we ourselves have become more scrutinising and more factual. Our memories are keener. They are also events which actually happened in the radio age.

The recent example, "Scrapbook for 1935," was, I thought, one of the poorest of the now long series. The background to the story was the unfolding of Hitler's and Mussolini's rise to power, and their passage from the stage when their criminal bluff could have been called without the shedding of a drop of blood, but wasn't, to the second, when they had to be destroyed only at the cost of world carnage and ruin.

In all the scrapbooks of this period, two fatal errors of production are made. First, this grim and tragic story—a date with destiny if ever there was one—is unfolded by a typical member of the British proletariat, helped by his wife and family, who are made to express views of an ignorance which frequently reaches the imbecilic, a brutal indifference and an abysmal nadir of fatuity which, if one didn't know it actually existed, would be considered entirely and utterly impossible.

The second great error is that these events, and opinions and comments, are always given as background to the current popular music-hall and dance-hall successes. The result is, of course, that the dreadful events, whose comings cast their shadows before and throughout the scrapbook, are made to seem as the inescapable decrees of a monstrous fate. Not the ghost of a shadow appears on the stage in the least capable of shaping events differently. Who cares anyway? says the proletariat in effect; "Glamorous Nights" is at Drury Lane. Hammond is at Lords. Hurray for the Silver Jubilee: The 1935 version all over again of "we have the ships, we have the men . . ." We'll leave the quotation incomplete.

I suppose the "Scrapbook for 1953," to be shown in Columbia's British Network in 1975, will quote all Stalin's, Tito's, Neguib's and Mossadecq's diatribes to a background of current musical successes and the cheers of the Coronation. The destination of the Ashes is undecided at the time of writing.

Tuesday Programmes

Why are Tuesday evening programmes duller and less interesting than any others? Much improvement could be made here if the overlappings of good items on other days were spotted and some of these given on Tuesdays.

Plays

The most powerful play of the month was, I think "The Waltz of the Toreadors," by the brilliant Frenchman, Jean Anouilh, one at least of whose works is always a success in the West End these days. Best described as a dissertation on the impermanence of love, it sets its theme out in brilliant dialogue and creates effective scenes and climaxes for its characters. Norman Shelley was in grand form as were Austen Trevor, Ralph Truman, Rachel Gurney and others. It was on the Third.

Somerset Maugham's "The Constant Wife" was given a lightning-like performance in "The Stars in Their Choices" series; Margaret Lockwood making the choice. It was played throughout at a tongue-twisting pace; too quickly, I thought. It was timed to take a quarter of an hour less than these plays usually take.

Flora Robson chose "Journey to Earth" for her appearance, a play by Bridget Roland. Next to the Anouilh piece, I thought this the most interesting play of the month, and Miss Robson's, easily the best performance. What a beautiful voice and accomplished technique she has. The play dealt with a nun who gets released from her vows to return to the world and do what she considers is a more important job. It was full of good cerebral meat.

Discussion

"Did We Forfeit the Fruits of Victory?" was an absorbingly interesting discussion between Chester Wilmot, defending his book, "The Struggle for Europe" (recently serialised in four feature programmes) against some criticisms from the American Professor Commager. An effective postscript.

Guest "Night"

References, in the course of one of Henry Hall's "Guest Nights" to the morning—"it's nice to see you this morning, Henry," or some words similar and to the same meaning—didn't help to maintain the illusion that we were supposed to be listening to a "guest night" with everybody, presumably, in stiff shirts or bare backs.

TONE FILTERS

AN ARTICLE DEALING IN THE MAIN WITH THE MORE ADVANCED TYPES OF FILTER, OF THE BAND STOP, HIGH PASS AND LOW PASS TYPES

By James S. Kendall

THE correction of tone in an amplifier is a very important factor. It is, in many cases, not a matter of getting the reproduction of the amplifier perfect, but getting the tone to suit the person that is using it. The normal types of control are shown in Figs. 1a and 1b. Both of these controls are of the "cut" type, that is 1a causes a cut in the bass response (the smaller the condenser the larger the cut), and in 1b the top is cut by allowing the higher frequencies to be shunted away through the condenser. The variable resister governs the amount of cut, whilst the capacity of the condenser controls the frequency.

With these two common methods the amount of cut usually amounts to a maximum of about 6 db. per octave. This sounds good, but when one considers that at very low and very high frequencies only a very small portion of the output is required to make itself felt, it will be seen that a sharper cut is sometimes desirable. For instance, the actual power of noise from a record is very low, but as its frequency is very high it is heard very easily. It is, therefore, good if a very sharp cut can be made just below this frequency, or, better still, cut it out, leaving the higher frequencies for reproduction. These two types of filter will be considered here.

Types

The main types of filter are:

(a) Band pass. This only passes a small band of frequencies and is of no use for audio work.

(b) Band stop. This cuts out only a very small band of frequencies.

(c) High pass. This passes the high frequencies, but stops the lower.

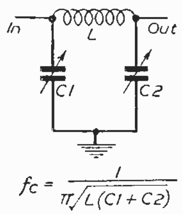
(d) Low pass. This passes the low and stops the higher.

Band Stop

The band stop filters are used for the removal of heterodynes and also removal of scratch noise from records. A typical circuit is shown in Fig. 2. It is a very efficient type and gives an extraordinarily high attenuation to only a very narrow frequency band. The operation is on the Wien Bridge principle and is such that the output arriving via Rv is 180 deg. out of phase with that arriving via C2. This condition only exists when Rv equals $4\sqrt{R_L^2+\omega^2L^2}$. The cut-off band can be calculated from the formula

$$Fc \text{ equals } \frac{1}{2\pi\sqrt{L(C_1+C_2)}}$$

Also C1 must be equal to C2. If the cut-out band is required to be at the top end of the audio band, L can be a normal H.F. choke. As the inductance of the chokes varies as much as 20 per cent. either way, it is as well if C1 and C2 can be varied, so the use of a two-gang condenser here is invaluable. It can be either used to shunt two fixed condensers or used on



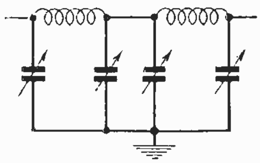


Fig. 4.—A low-pass filter. *Fig. 5.—Two low-pass filters in series.*

its own. The frequency band having been set, the resistor Rv is then manipulated until the maximum attenuation of the unwanted frequency is obtained. One word of warning; if a two-gang condenser is used the frame must be insulated from the chassis.

High Pass

The high pass type of filter is another that is simple to construct. The circuit is shown in Fig. 3. Again the inductance can be an H.F. choke or other inductance of known value. The formula is Fc equals $\frac{1}{\pi\sqrt{L(C_1+C_2)}}$. Note here Pi ($\pi$) and not two

(*Concluded on page 234*)

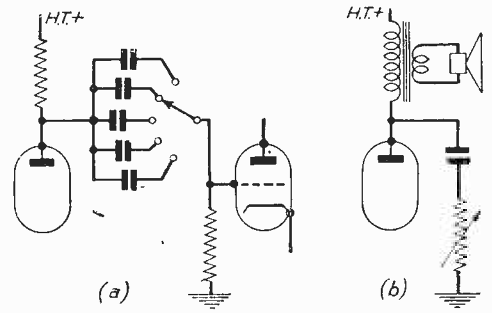
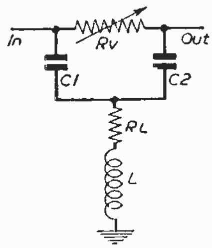


Fig. 1.—Normal types of tone control as found in average receivers.



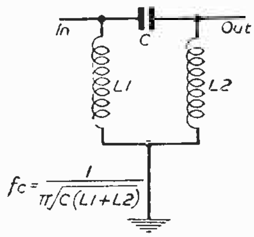


Fig. 2.—Band-stop filter. *Fig. 3.—A high-pass filter.*

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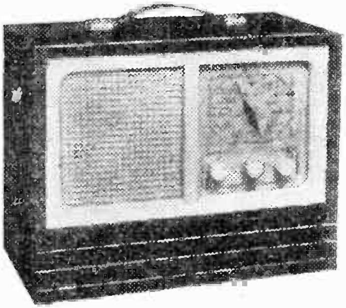

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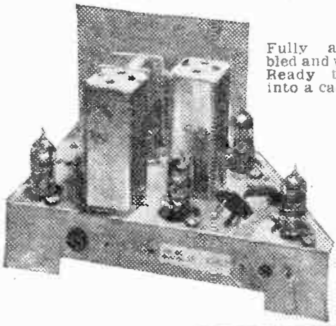
Carriage 5/- extra.

ALL DRY PORTABLE CHASSIS

Superhet. Medium and short wave bands. 200-500 M. and 19-50 M. Uses 1 each 1R5, 1T4, 1S5 and 3S4 valves. 465 Kc/s I.F. Circuit available.



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VALVES. 10,000 IN STOCK AT THE LOWEST POSSIBLE PRICES. Write for complete list. SPECIAL OFFER. 4 Valves: 1 each 1R5, 1T4, 1S5 and 3S4. LASKY'S PRICE 32/6. POST FREE.

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All less o.trans. new and unused. First quality.

3in. Elac	12/11
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EX-A.M. RECEIVER TYPE R1155. Brand new and unused. Aerial tested before despatch. Supplied complete with 10 valves. Circuit: B.F.O., A.V.C., R.F. Amp., two I.F. Stages, Magic Eye, etc., etc.

5 Frequency ranges: 18.5-7.5 Mc/s; 7.5-3.0 Mc/s; 1,500-600 Kc/s; 500-200 Kc/s; 200-75 Kc/s.

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FULLY ASSEMBLED POWER PACK AND OUTPUT STAGE FOR R1155 RECEIVERS. For use on 200-250 volt A.C. mains. Wired and complete with valves. LASKY'S PRICE, 79/6 Carriage 5/- extra.

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SUPERHET COILS

Aerial and oscillator. For 465 Kc/s I.F. Supplied with circuit. Size, each coil: 1⅞in. high, ⅞in. diam.
No. 1. Long and medium wave. 2/11 per pair.
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3 Wavebands: 12-35 metres; 35-100 metres; 200-550 metres. Size: 4 x 4 x 3in. Price 16/-.

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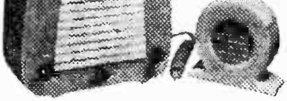
465 Kc/s iron dust cores, in cans, midget type. Size: ⅞in. x 1in. x 2½in. Price 12/6 per pair.

Wearite Type 550. Permeability tuned. 445-520 Kc/s. In cans, size: 3in. high, 1⅜in. square. Price 12/6 per pair. Wearite Type 500. Range 450-470 Kc/s. air cored, compression trimmer tuned. In can, size: 3⅛in. high 1⅜in. square. 12/6 per pair.

INTER-COM. SETS



4-station operation. For use on A.C./D.C. mains 200-250 volts. Supplied complete, with 3 new valves, ready for immediate installation. Fitted in attractive plastic cabinet.

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MASTER UNIT, £7 15/0. Carr. 5/- extra.

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No. 1. Miniature. With Perspex dust cover and trimmers. Size: 1½in. x 2in. x 1⅞in. ¼in. spindle. LASKY'S PRICE, 8/6.

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MAINS TRANSFORMERS

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AT/3. Auto transformer. 0-10-120, 200-230-240 volts, 100 watt. Price 17/6.

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OPEN TO DISCUSSION

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

Hi-Fi Amplifier

SIR,—I feel that I must say a few words in connection with the Single-ended Hi-Fi Amplifier, published in the February issue. First, I should like to comment on the statement "For some time there has been a demand for an amplifier that has an output sufficient for a small hall, and is low in both overall distortion and cost." Surely, this has always been the desire of everyone interested in quality reproduction, and as things are at present, this state of affairs is very difficult to achieve, and a compromise has to be made.

In the case of the "Single-ended Hi-Fi Ampifier," I think that the compromise has been made at the expense of good quality. Two per cent. harmonic distortion at 10 watts is just a bit too old-fashioned to be called Hi-Fi these days. I have heard amplifiers of this type (single-ended pentode with N.F.B.) and amplifiers like the Williamson and Leak in conjunction with good associated equipment, and I think it is needless to say which type is the better.

Where quality is required, expense must be made a secondary consideration, as everyone knows, that real Hi-Fi can cost quite a lot of money.—J. VOSPER (Apprentice T.R.E. Malvern).

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

Personal Communication Receiver

SIR,—My "Personal Communication Receiver," published in PRACTICAL WIRELESS February, 1952, was subjected at the time to much adverse criticism on various grounds, the critics arguing purely from a theoretical standpoint as not one of them had built and tested the receiver.

Partly as a result of this criticism, but chiefly because the receiver appealed to them, I have had a large volume of correspondence from readers in regard to it, and as a result I have been able to arrive at a number of conclusions, the most important of which is that a diagram of the physical layout of the chassis is an essential. In this respect I have been able to help a number of readers who have built, or are building, the receiver, and I am now beginning to get performance reports from a number of them.

While all of them speak enthusiastically of it, one reader in South Africa states that after following my advice in regard to layout, he now gets short-wave stations in China, Brazil and Canada, among other countries, on a four-foot length of wire.

This, I think, is sufficient vindication of the publication of the design and of the efficiency of the circuit.—T. W. DRESSER (Tangier, Morocco).

TV Harmonic

SIR,—I was interested to read in your February issue that your correspondent J. Law, of Gillingham, had received a TV transmission on 18.65 Mc/s, as I have recently experienced a parallel phenomenon.

Tuning through 43 Mc/s, I was surprised to hear "Mrs. Dale's Diary." After some thought I came to the conclusion that the signal must be the 93.8 Mc/s transmission from Wrotham, beating with the second harmonic of the oscillator to produce the required I.F. As a check I injected a large signal at 93.8 Mc/s from a signal generator and, sure enough, I found that the receiver gave a response at 43 Mc/s.

In your correspondent's case I conjecture that the I.F. of his receiver is 4.2 Mc/s. Thus, when the dial is set to 18.65 Mc/s, the oscillator frequency is 18.65 +4.2 Mc/s, i.e., 22.65 Mc/s. The second harmonic is, then, 45.3 Mc/s, which corresponds to a signal frequency of 45.3—4.2 Mc/s, i.e., 41.5 Mc/s—the frequency of the Alexandra Palace sound transmission. —A. S. BOUND (Ilford).

SIR,—I have read Mr. Law's letter with interest as, for over a year, I have been receiving TV on the same waveband, but in two spots. They are not very far apart. I am using a commercial receiver!

I wrote to BBC, Engineering Division, and this is what they said:

"... presuming that your receiver is of the superhet variety ... the local oscillator in the set is generating a train of harmonics, one of which is mixing with the incoming Holme Moss frequency and producing the I.F. of your set. ..." They also went on to explain how to get rid of it, if it proved troublesome, reduction of anode voltage on L. oscillator, screening, etc.

I wish I could improve my reception of it! I do not really want to hack the set about, but a wave trap helps a lot. Sorry I can't tell you any more just at present—I do not really understand what is going on.—MICK TAYLOR (Cheshire).

Radio Control

SIR,—With reference to the article by Mr. Rayer, in the February issue of PRACTICAL WIRELESS, on the construction of a radio control receiver, I feel that insufficient emphasis has been given to the band within which the apparatus may operate. As is known, the G.P.O. has allocated licence free the 27 Mc/s waveband for radio control, the band limits being 26.96 Mc/s to 27.28 Mc/s.

The G.P.O., however, has stated that if any interference whatsoever is experienced from radio control, then radio control will cease. In the modelling world this tuning of transmitters to the centre of the band is regarded as being of paramount importance if radio control is to continue.

Thus, in fairness to modellers who use radio control, I feel that all potential radio control enthusiasts should ensure that their transmitters are tuned *exactly* to the centre of the band. Wavemeters are sold especially for this band.—A. BAILEY (Swansea).

Electronic Music

SIR,—The article in the February issue on polyphonic organs requires some qualification. It is by no means so simple to produce a multiple tone generator as is suggested. Problems of the utmost importance which have not been mentioned include intermodulation distortion; degradation of individual voices due to combining filter circuits; proper control of the rate of attack and decay of the sound; mixing into a common outlet from several manual generator units; allocation of bass and treble power ratios; "pulling" of common oscillators; stabilisation of same; production of independent pitch ranges; and a number of others.

It might also be pointed out that the Baldwin pulse divider unit mentioned is not large, the actual size being 7in. × 1½in. × 1in. (over coils). I have spent a considerable time at the Baldwin plant in Cincinnati and am in possession of all the drawings of the organ circuits. Should any interested reader care to communicate with me in this matter I will be glad to assist.—ALAN DOUGLAS (BCM/ECRH, London, W.C.1).

SIR,—I have been interested in the various articles which you have published on this absorbing topic, and I have been for a long time interested in this sphere of work. I have heard two or three amateur attempts at building the "tone wheel" type of instrument, and only one using valves. The latter, to my mind, was infinitely superior to the home-made wheel arrangement, which each had a peculiar wow effect due, I think, to inaccurate cutting of the wheels. But neither of these types approached the tone of the real organ, and it is this which I am endeavouring to obtain. My reason for writing this letter is to ask whether any reader has experimented with variable-capacity tone generators similar to that used in a British invention, and whether the waveform of this does, in fact, approach the true pipe organ.—G. WATTS (Hendon).

Home-constructor Results

SIR,—One seldom sees in your columns thanks from a constructor for a design. I should like to remedy this by giving you my results with the Three-speed Autogram. I was in need of a radiogram, and although I had only built two or three small receivers in the past, decided when the design was published to have a go at making what I thought appeared to be a good design. After two or three small troubles which I managed to overcome without assistance, I finally got the set working, and in my opinion it is better than any radiogram I have heard. No doubt I have a certain prejudice as I made it myself, but allowing for this even, I feel that the tone is really great and all my friends have commented on the performance. The station-getting properties, too, are good, and although I am not interested in foreigners I find a good selection in the evenings when the BBC are not putting out anything in my line, and altogether I feel that the set has been a really worthwhile investment.—P. KELLY (Wembley).

Audio Problems

SIR,—We feel that we cannot let E. D. Brock's letter on "Audio Problems" go without comment. From our experience the cause of distortion that he refers is not the speaker but the amplifier itself, and is usually due to a form of instability. The Williamson amplifier is a particularly stable amplifier and this is due to a very large extent to the high level of negative feed-back. The oscillation is usually more pronounced at the lower frequencies, as the voltage swing at the grid of the offending valve is greatest at these frequencies. The use of grid stoppers gives some measure of relief, but usually re-designing the layout of the amplifier is of better value. The best way of checking for this type of trouble is with the aid of a 'scope.

Another point of interest is Mr. J. Law's letter on TV harmonics, the trouble is no doubt due to the radiation from a superhet type of TV receiver. In this district these I.F. radiations can be picked up very easily on several different frequencies.—KENDALL & MOUSLEY (Tipton).

Tone Filters

(*Continued from page 230*).

Pi (2π or ω) is used in the equation, as Fc is the frequency at which attenuation starts. All components have to be calculated, and the only variable control that can be used is a variable condenser. If the frequency is very low, say, 500 cycles, this is not practical and a bank of switched condensers has to be substituted.

Low Pass

The other type of interest is the low pass. This can be used to stop any frequency above any predetermined point. This type of unit can be used in almost any branch of radio and electronics. It can be used in audio work to cut off the reproduction sharply at a given frequency; attenuations as high as 30 db. per octave can be obtained. The circuit of a typical example is shown in Fig. 4. The cut-off frequency is given by the formula Fc equals $\frac{1}{\pi\sqrt{L(C_1+C_2)}}$

Here again it will be seen that π and not 2π has been used. Looking again at the diagram, it will be seen that it is the same as the circuit used for smoothing in a normal power unit of a radio receiver or amplifier. In the amplifier the two condensers can be a two-gang variable, and the inductance a choke. The action is simple. As the frequency rises, the impedance of the condensers falls, whilst that of the inductance rises. If two filters are to be used in series to get a still larger cut, then a four-gang condenser has to be used as is shown in Fig. 5.

Whilst worked examples for specific purposes are not given in this article, it should give a little food for thought.

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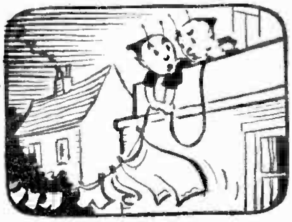

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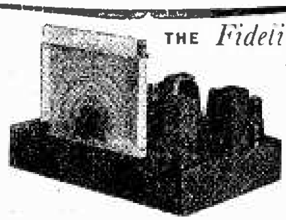

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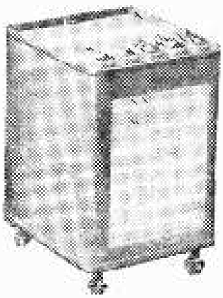

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