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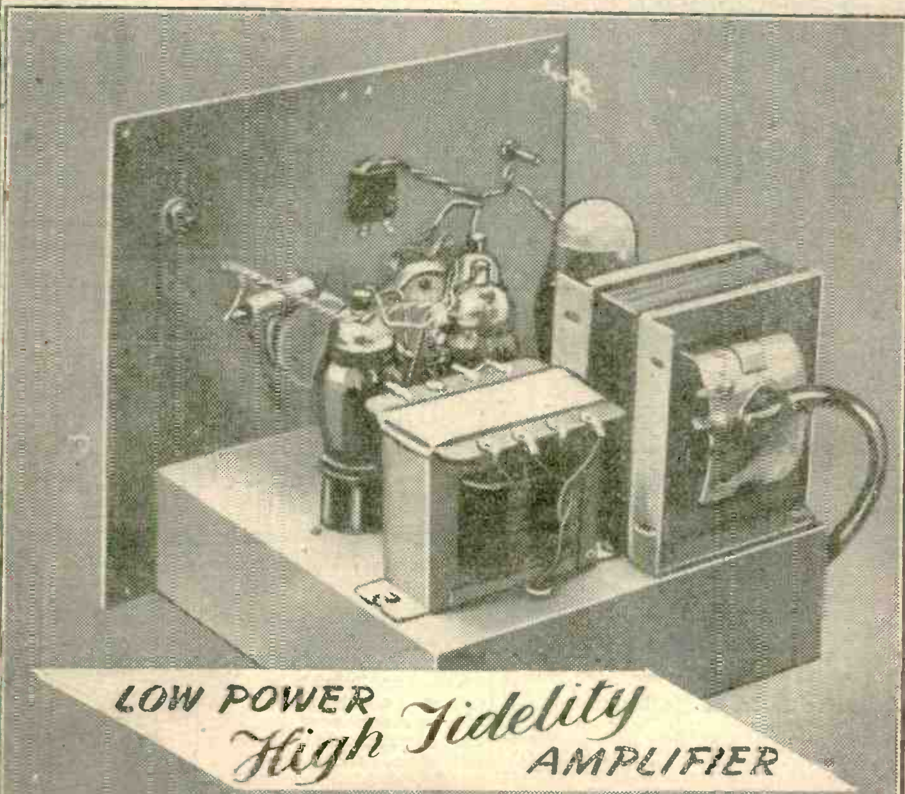
PRACTICAL WIRELESS

EDITOR:
F.J.CAMM



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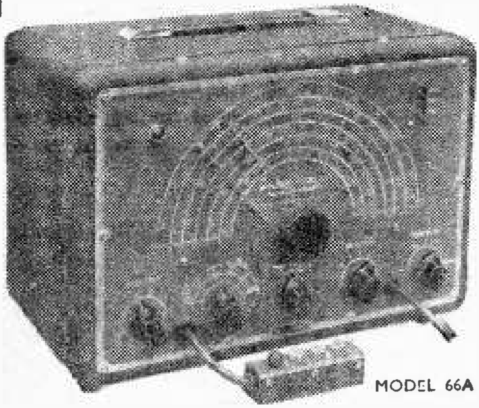
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Practical Wireless

EVERY MONTH
VOL. XXVIII. No. 544 FEBRUARY, 1952

Editor F. J. CAMM

20th YEAR OF ISSUE

COMMENTS OF THE MONTH

By THE EDITOR

FREE 1/- BLUEPRINT NEXT MONTH–

of the Mini-four Battery Portable

A MIDGET PERSONAL BATTERY PORTABLE

EVERY issue of this journal next month will contain a free gift, 1s. full-size blueprint of the Mini-four battery personal portable.

There has been an insistent demand, ever since power cuts were introduced, for a design for a battery receiver of this type, but unfortunately the shortage of paper and other production difficulties prevented us from issuing a blueprint, although we have published many designs for such receivers in this journal.

This is the first time since 1939 that a blueprint has been presented with any journal, and we have selected this occasion to present to every reader this design for a highly efficient portable receiver, a product of the PRACTICAL WIRELESS Laboratory.

It is a four-valve, all-dry battery portable, employing a superhet circuit incorporating a new type of rotary coil turret with four-station pre-set tuning—three medium stations and one long wave. The quality of reproduction is excellent, especially when we consider the midget size of the components which include a 3½in. speaker. The receiver is, of course, entirely self-contained, with special Batterymax battery.

Those who require a battery receiver for general domestic use may use a larger panel and, of course, larger capacity batteries.

The overall size of the receiver in neat case is 6½in. × 5in. × 3½in. There is bound to be a large demand for next month's issue, and those who have not a standing order with newsagents should order next month's issue at once.

NEW WAVELENGTH PLAN

REPRESENTATIVES from 65 nations in conference, at Geneva, on December 3rd, reached agreement on a world-wide plan to reallocate wavelengths. As was to be expected the Soviet Union, which put the NO in UNO, and eight East Communist States refused to sign!

It has long been realised that the enormous growth in aviation broadcasting has rendered necessary an early change in wavelength allocation. In previous discussions of this sort aviation has been permitted a very small amount of space in the frequencies. Other broadcasting services have considerably increased since the last agreement on wavelengths was reached.

The present discussion has extended over three and a half months, with consistent opposition throughout from the Russian zones. No notice has been taken of their opposition, which amounted in effect to political filli-bustering. The failure of Russia to co-operate may create certain technical difficulties for a short time because Russia will be compelled to use the frequencies allocated to it in the Aviation and Maritime Services. They will soon realise what they apparently do not yet comprehend that they will lose more than they gain by persisting in their favour of the Berne frequency list of 1932.

This new agreement prescribes the procedure to be followed in the changeover of world-wide radio frequencies in the short-wave band between 4,000 and 27,500 kilocycles. This changeover will align them with the frequency tables agreed to at the Atlantic City Radio Conference in 1947. The changes in some of the radio services and particularly Aviation and Maritime Safety Services commenced on January 1st of this year.

The changeover to the high-frequency broadcasting and fixed services will be reviewed at the 1955 International Conference.

R.S.G.B. EXHIBITION

THE fifth Amateur Radio Exhibition which was opened by Mr. C. I. Ore-Ewing, towards the end of last year was organised by the R.S.G.B., and we are glad to note that in his opening speech Mr. Ore-Ewing paid tribute to the importance of the amateur movement. He spoke of the work which amateurs have undertaken voluntarily in exploring bands of ever-increasing frequency which were subsequently used for commercial or service purposes. The R.S.G.B. represents 95 per cent. of the licensed amateurs in this country, with its total membership of 12,000.—F. J. C.

ROUND the WORLD of WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate numbers of licences issued during the year ended October 31st, 1951.

Region	*Number*
London Postal ..	2,346,000
Home Counties ..	1,653,000
Midland	1,748,000
North Eastern ..	1,938,000
North Western ..	1,634,000
South Western ..	1,073,000
Welsh and Border Counties ..	733,000
Total England and Wales	11,125,000
Scotland	1,113,000
Northern Ireland ..	211,000
Grand Total ..	12,449,000

The above total includes 1,031,950 television licences, which is an increase of 73,450 during the month—the largest monthly increase so far recorded.

Co-operation Between Columbia and Philips

IT was recently announced by Philips Electrical, Ltd., that Philips Phonographic Industries, Baarn, Holland, has reached agreement with Columbia Records Incorporated, U.S.A., to co-operate on a world-wide basis for the exploitation of their record libraries, with effect from January 1st, 1953.

Lucas "Picture Quiz" Winner

IN the first competition solely for members of the staff of the Lucas organisation in Birmingham, the first prize—a portable radio set—has been won by Mr. A. R. Pugh, of the Tool Ratefixing Department in the Great King Street factory.

Mr. Pugh correctly identified, from "odd angle" photographs, a number of everyday articles of office equipment, ranging from wire staples to date stamp adjusting wheels.

Ekco "Festival Year" Display Competition Results—Art School Students Win Prizes

THE Ekco National Window Display Competition which, last year, ran during the whole Festival period from May to September, attracted the largest number of entries received since this annual event was introduced.

Once again co-operation between art school students and Ekco dealers was a feature and "student-dressed" windows won 1st and 3rd prizes in the main competition. There were also special prizes for students only.

The following are the 1st and 2nd prizewinners:

Dealers' Section

1st prize—Geo. Watson, Ltd., 811, Green Lanes, London, N.21. £100.

2nd prize—J. W. Gray, Ltd., 82, Westborough, Scarborough. £50 (plus £5 to assistant responsible).

Students' Section

1st prize — *Dealer:* Geo. Watson, Ltd., N.21. *Student:* Miss Daphne S. Dall, Hornsey School of Arts and Crafts. £20.

2nd prize—*Dealer:* Gentry & Bayley, Ltd., 30, High Street, Gillingham, Kent. *Students:* Mr. M. Solley & D. Newton, Medway College of Art, Rochester, Kent. £10.

Rees Mace Marine, Ltd.

THE demonstration launch, *Radio Dolphin*, which was visited by thousands of people at the Radio Show at Earls Court, is now in service on the Thames with moorings at Putney. She recently made a test run from Gravesend to Barnes Bridge, including Bow Creek and Barking Creek in under four hours during which time she was in continuous touch with a shore office by V.H.F. radio telephone.

B.I.R.E.

THE following meetings will be held in January, 1952:

London Section.—Wednesday, January 9th, at 6.30 p.m. London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, London, W.C.1. "Crystal Triodes," by E. G. James, Ph.D., and G. M. Wells, B.A. (Research Laboratories, G.E.C.).

Scottish Section. — Thursday, January 17th, at 7 p.m. Natural Philosophy Department, The University, Drummond Street, Edinburgh. "Television Aerials," by G. L. Stephens (Belling & Lee).

North - eastern Section.—Wednesday, January 9th, at 6 p.m. Neville Hall, Westgate Road, Newcastle - upon - Tyne. "Test Gear Design," by A. W. Wray, M.A.

South Midlands Section.—Tuesday, January 15th, at 7.15 p.m., Exhibition Gallery, Public Library, Rugby. "Propagation and Reception of Television Signals," by G. L. Stephens (Belling & Lee).

Reception in Wales

BETTER reception for more than 300,000 rediffusion listeners in Wales is promised as the result of a recent ministerial decision. The Minister of Housing and Local Government has decided to allow Rediffusion (Wales), Ltd., to build a station to receive foreign broadcast programmes near Sully, Glamorgan, to be used for a period of five years.

The firm had appealed against the decision of Cardiff Rural District Council, acting on behalf of the Glamorgan County Council, refusing permission for the station.

Aircraft Detector

A NEW plan for the detection of enemy 'planes or guided flying machines has been announced by the Radio Corporation of America.

The method is comprised of television, airborne radar and microwave radio relay beams which, it is claimed, would enable diverting signals to be transmitted to ward off any aircraft or object from its target.

Radio Show for Glasgow?

THERE is a possibility of a radio show being held in Glasgow this year with the backing of the Radio Industry Council.

The Kelvin Hall would probably

be booked to house the show, provided that it is available.

BBC Appointments

ON January 1st, 1952, Mr. H. P. Wheldon will succeed Mr. E. C. Thomson as Television Publicity Officer. Working to Mr. John Hytch, Assistant Head of Publicity, Home, Mr. Wheldon will take charge of the Television Publicity unit which is staffed by Mrs. Nest G. Bradney, who writes the weekly release "Television News," and Mrs. N. Louise Duffell, who handles Press inquiries.

Huw Pyrs Wheldon was born at Prestatyn, Wales, in 1916. Educated at University College, Bangor, he graduated at the London School of Economics.

He worked for the Kent Education Committee in 1938 and on the outbreak of war joined the Army, serving with the 6th Airborne Division in Europe and the Middle East, being awarded the Military Cross. In 1946 he joined the Arts Council, becoming its Director for Wales.

Use for Co-axial Cable

MESSRS. AERIALITE have received a very interesting letter from the Medical Research Council of New Zealand reading as follows :—

"You may be interested to know that I have found your Aerialite 100 ohm co-axial cable, semi-airspaced, exceedingly satisfactory for the coupling of Geiger counting tubes to scaling equipment in the measurement of radio-active isotopes. The high degree of flexibility is a great advantage in the use of such counters in clinical work, while the low capacity enables the use of long cables without excessive shunting of the signal. This advantageous combination is not to my knowledge to be found in any other make of co-axial cable, while the moderate cost of Aerialite is a further recommendation. In my opinion the advantages of this cable for this particular work deserve to be more widely known."

Test Frequencies

A REVISED schedule is now in operation from the Rugby station under the auspices of the National Physical Laboratory. The following are the appropriate details: 05.44-06.15 on 5 Mc/s, 06.29-07.00 on 10 Mc/s, and 10.29-11.30 and 14.29-15.30 on 60 kc/s. For the benefit of new readers it may be repeated that the first minute of each transmission period is devoted to the call sign in slow morse (MSF) and then a speech announcement. Further details may be obtained from the N.P.L., Teddington, Middlesex.

Transparent Adhesive Tape

A NEW ZEALAND contemporary points out in a recent issue that a well-known amateur enthusiast has experienced trouble when using transparent adhesive tape.

He has found the tape to contain a material that corrodes enamel wires, having discovered green specks on the windings of a home-wound output transformer which had failed.

Scottish Reception

WHEN the Scottish Advisory Council of the BBC met recently, under the chairmanship of Sir John Falconer, the subject of poor reception of sound broadcasting in some areas of Scotland was discussed. The installation of low-power transmitters for the districts of Brechin, Montrose and Dumfries was urged.

The Council also heard reports on Scottish contributions to the BBC's Overseas Services and were pleased to hear that the number of these contributions had increased during the past year.

More Blind People in Industry

TWO HUNDRED and ninety-six blind people entered industry and business during the past year, 54 more than the previous year.

Blind workers are now finding that they can master the operation of almost all precision tools.

This is revealed by the National Institute for the Blind, 224-228, Great Portland Street, London, W.1, in its annual report.

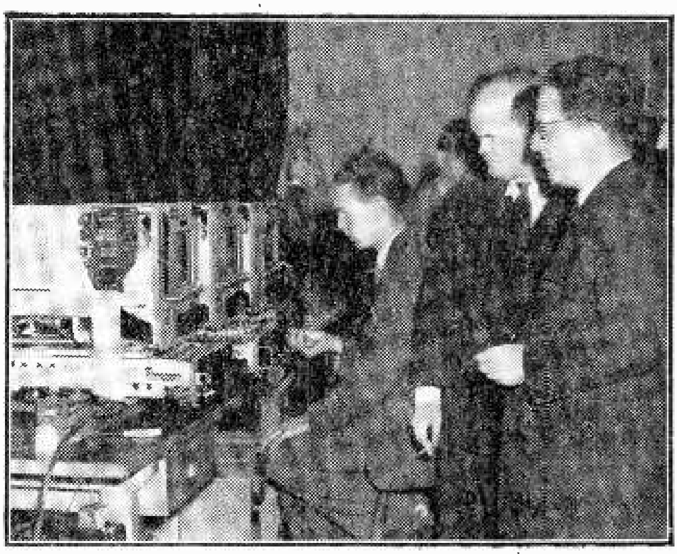
Radio-Taxis

FIVE hundred taxi-cab owners at a recent meeting in London approved an extension of the use of radio control for over 2,500 vehicles. It would almost be safe to say that now the majority of London's cabs are using radio to avoid wasteful plying for hire.

B.S.R.A. Booklet

A 20-PAGE extract from the B.S.R.A. Diary giving data and formulæ on recording on disc, film and magnetic tape is now available in a booklet entitled "Facts and Figures."

It costs 1s. 3d. and is obtainable from the Hon. Librarian, British Sound Recording Association, 8, Stanton Road, London, S.W.20.



Four senior officials of the French Broadcasting Authority recently paid a visit to the Chelmsford Works and Laboratories of Marconi's Wireless Telegraph Co., Ltd. The visitors are seen above inspecting television camera monitors at the works.

A "Personal" Communication Receiver

A SET PROVIDING HIGH SENSITIVITY AND SELECTIVITY TOGETHER WITH FREEDOM FROM SECOND CHANNEL INTERFERENCE

By T. W. Dresser

THE term "communication receiver" has been subjected to much abuse since it was first coined to define the specialised receiver built solely for the use of amateur transmitters and designed essentially for the reliable reception of long-distance signals without regard for tonal quality. T.R.F.s, simple and otherwise, have had the title thrust upon them solely because their coverage was similar to that of a genuine communication receiver, while superhets of the domestic variety have seized upon the name purely because someone had added an R.F. gain control to the original circuit and had extended the short-wave bands down below 20 metres! To some extent that sort of wrong definition could be excused in the days when transmitting amateurs were not as numerous as to-day, but even before the war the bands were becoming so congested that receivers of this type were almost useless for serious DX work. Now, of course, the bands are far more cluttered up than ever before, and the outstanding requirement of any receiver aspiring to be a "communication" job is superlative selectivity, and that rules out the T.R.F.! Sensitivity is almost as important, while noise level must be down to the lowest limit. But of equal importance, though not always recognised as such, is the question of image suppression. The lower the drop in wavelength the more troublesome second channel images become, particularly in the standard type of communication receiver with 450 to 470 kc/s I.F. stages, and on the 20 and 10 metre bands they are exceptionally annoying. An R.F. stage ahead of the main receiver is some help in reducing them but also brings up the noise level and is therefore a poor remedy.

At some time or other most amateurs find that commercial communication receivers, while performing excellently on the higher wavelengths, fall down pretty badly on the 20 and 10 metre bands. There are a variety of reasons for this falling off, the principal one being that it is difficult to design a receiver capable of covering with equal efficiency all the amateur bands. Components which function effectively on the higher wavelengths lose a large part of their efficiency down on 20 and 10 metres. The inductance-capacity ratio becomes increasingly critical as far as ease of tuning goes the higher one goes in frequency, and it is a difficult task so to design the L/C ratio of the

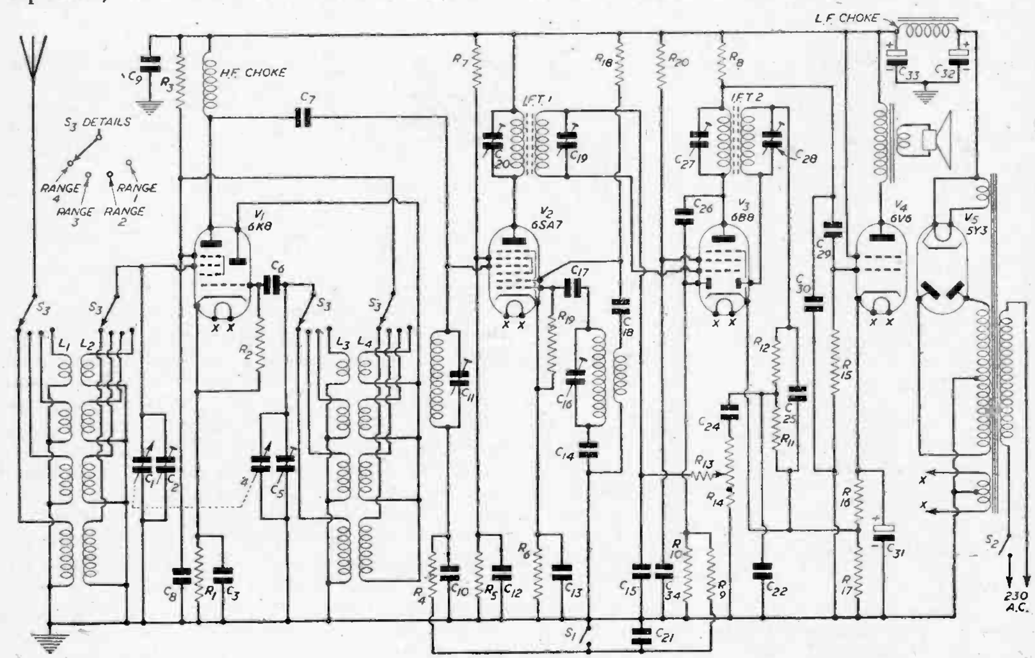


Fig. 1.—Details of the circuit.

tuning circuits as to perform equally well on 160 and on 10 metres.

The losses due to valveholders, coil formers and variable condensers can be largely offset by the suitable choice of modern high-efficiency components, while a careful selection of valves will also have an immense effect upon performance. But in the final assessment the receiver stands or falls by its design as a whole.

The requirements of an efficient communication receiver can be enumerated as follows: (1) outstanding selectivity and sensitivity; (2) high signal-to-noise ratio; (3) freedom from second channel interference, particularly on 10 metres; and (4) ease of handling and reasonable cost.

The first, second and final requirements are relatively easy to obtain and even a high signal/noise ratio is not too difficult of achievement. Second channel images, however, are another matter. Pre-selectors will reduce them, but will also bring up the noise level; loosely-coupled coils will have a much similar effect.

There is, in fact, only one real answer to this question and that is to use I.F. stages high enough in frequency to prevent their appearance. But while that solves one problem it also brings in its train another, for the selectivity of high I.F. stages is very much inferior to that of the more normal 110 to 473 kc/s, and while fairly broad selectivity can be an advantage on the high-frequency bands it is a necessity to have really sharp tuning on the lower frequencies. It would appear, then, that the only solution to both image suppression and selectivity is to use both high I.F.s (1,600 kc/s to 10 Mc/s) and low to medium I.F.s (110 kc/s to 473 kc/s) and that, of necessity, implies a double superhet, and also accounts for the increasing popularity of this type of receiver.

The Circuit

The circuit (Fig. 1) gives the basis of such a receiver which was built by the writer some time ago in an endeavour to fulfil the above requirements at a cost that would be within reach of any short-wave enthusiast. It amply fulfils both purposes. Its sensitivity and selectivity compare very favourably with that of the majority of commercial receivers the writer has handled, while its freedom from second channel images makes it a pleasure to use on "ten."

Orthodox Circuit

In many respects the circuit is quite orthodox. The signal is fed into the grid of the first frequency changer through a loosely coupled aerial coil and converted to 1,600 kc/s. The choice of this frequency was made deliberately; quite apart from the fact that 3 Mc/s and 10 Mc/s. I.F. transformers are neither easy to obtain nor cheap to purchase, 1,600 kc/s lies at the bottom of the medium-wave band and therefore ordinary medium-wave coils, which are easy to procure and reasonable in price, may be used for the second frequency changer grid and oscillator coils.

The 1,600 kc/s signal from the 6K8 is then injected into the grid of the second frequency changer, a 6SA7, and converted to 465 kc/s, which is then passed on to a 6B8, functioning in a reflex circuit, which acts as I.F. amplifier, second detector, A.V.C. rectifier and first audio amplifier. From there the L.F. is passed to a 6V6 through a normal R.C. coupling circuit.

Including the rectifier, a 5Y3, there are only five valves in the circuit, but each and every one works at maximum efficiency. In consequence the performance equals that of a standard six or seven valve receiver. All the valves used are readily obtainable on the surplus market at moderate prices, as are most of the other components, and the total cost of building the double superhet should not exceed £4 10s. Housed in a surplus TU7B case it will bear comparison with commercial receivers in either appearance or performance.

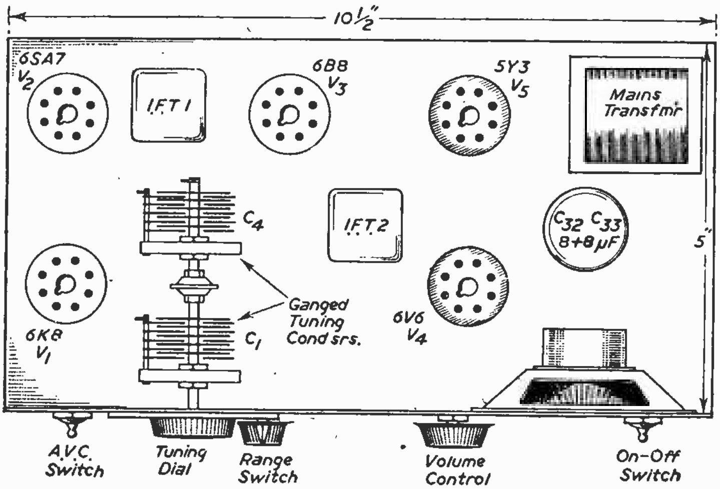


Fig. 2.—Layout and dimensions of the chassis.

Layout

In Fig. 2 is given the layout and dimensions of the chassis, which is bent from 18 s.w.g. aluminium, bolted with 4BA bolts at the corners. The coil data and method of winding is given in Fig. 3 and components list on page 56. The diagrams should make clear the disposition of the under-chassis wiring and components. A.V.C. is applied only to the second frequency changer but has proved quite satisfactory in use, and there have been no signs of grid blocking, distortion or overloading. Provision has been made for switching out the A.V.C. if required. The only other controls are the on/off switch, audio gain control, wavechange switch and tuning. The layout of the controls is symmetrical and pleasing without detracting from the efficiency of the circuit. Break-in can be arranged quite simply by opening the centre tap of the transformer H.T. winding and inserting a switch between there and earth as in Fig. 4.

Coil Data

Coils for 1.7/3.5 M/cs and 3.5/6.5 Mc/s are close-wound with 22 s.w.g. enamel wire. Coils for ranges 3 and 4 should be spaced to cover the tuning range and to ensure correct tracking. This can be done *in situ*, and is approximately wire diameter spacing. Spacing between L1 and L2 and between L3 and L4 should be ⅛in. except for ranges 3 and 4, on which L4 is interwound with the earthed end of L3.

LIST OF COMPONENTS

C11, C16—3 30 pF. trimmers (preferably air spaced).
C1, C4—50 pF. variables, ceramic insulated.
C2—25 pF. trimmer (preferably air spaced).
C3, C9, C10, C12, C13, C14, C15, C34—0.1 μF.
C6, C7, C17=.0001 μF.
C18—.002 μF. mica.
C22—.001 μF. mica.
C24—.01 μF.
C25—100 pF. mica.
C29—.005 μF.
C30—.001 μF.
C31—50 μF. electrolytic 25 v. wkg.
C32, C33—8 μF. electrolytics 350 v. wkg.
R1—300 ohms.
R2, R18, R19—50 KΩ.
R3—22 KΩ.
R4, R9, R10—1 MΩ.
R5, R7—100 KΩ.
R6—400 Ω.
R8, R20—10 KΩ.
R11, R13—470 KΩ.
R12—47 KΩ.
R14—½ MΩ vol. control.
R15—220 KΩ.
R16, R17—150 Ω.
3 ceramic international octal valveholders. 2 bakelite ditto.
2 465 kc/s iron cored I.F.T.s.
1 medium-wave aerial coil (Wearite P or similar).
1 medium-wave oscillator coil (Wearite P or similar).
1 H.F. choke.
2 miniature toggle switches (Bulgin or surplus).
1 mains transformer for 250 v. 80 mA., 5 v. 2 A., 6.3 v. 2 A.
1 smoothing choke, 10 Henry, 300 ohms, 80 mA.
1 5in. P.M. speaker with pentode transformer.
1 2-pole 4-way 2-wafer switch.
1 Muirhead tuning dial (surplus).
Aluminium chassis, 10½in. x 5½in. x 2½in. deep.
Aluminium panel, 10½in. x 5½in.

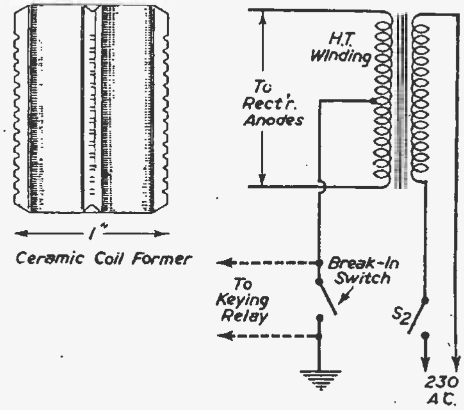
Alignment

Aligning the receiver is a simple matter with or without a signal generator, although it is preferable to use one. A 465 kc/s signal should first be injected into the 6B8 grid and the last I.F.T. lined up. The input from the signal generator can then be transferred to the 6SA7 grid and the first 465 I.F. transformer aligned. With the signal generator tuned to 1,600 kc/s next inject a signal into the 6K8 grid and line the latter's oscillator coil and the 6SA7 grid coil, and the job is done.

In conclusion, the dimensions of the completed receiver will give you the clue to the use of the term "personal."

COIL DATA

Coil	1.7-3.5 Mc/s	3.5-6.5 Mc/s	6.5-14.5 Mc/s	14.5-30 Mc/s
L1	22	7	5	2
L2	70	25	12	5
L3	55	22	9	3
L4	18	6	3	2



Figs. 3 and 4.—(Left) The coil former. (Right) Details of switch in the H.T. winding.

Advanced Navigational Technique

SINCE its inception, V.H.F. direction-finding equipment (Marconi type AD.200), which, as described last month, presents *bearings* of a calling aircraft instantaneously on 8in. meters, has achieved great popularity, particularly in the field of high-speed jet flying. An attachment has now been designed by Marconi's Wireless Telegraph Co., Ltd., which enables the *position* of aircraft to be located automatically and instantaneously.

This installation with its new attachment is unique in providing bearing information over long distances by means of telephone lines or by radio link.

The bearings obtained are projected on to a translucent map by an ingenious adaptation of the episcope principle; 5in. bearing indicators with black dials and white pointers are used in conjunction with wide-angle short focus F1.9 anastigmatic lenses. These lenses are 4in. in focal length and are screw-focused. Illumination is by means of mercury vapour lamps.

At a recent demonstration given by the Marconi Co. to delegates to the Commonwealth Conference on the operation of jet turbine aircraft at the Marconi Research Laboratories, Great Baddow, two twin-channel AD.200 equipments were used. One was sited at Bedells End, Essex, and the other at the de Havilland airfield, Hatfield, Hertfordshire. This latter installation was 35 miles from Baddow and worked, through normal telephone exchanges, with the aid of only one repeater unit. The total line length was 54 miles.

Two narrow beams of light on the translucent map indicated the two bearings taken on the aircraft and presented continuous instantaneous fixes.

FREQUENCY MODULATION

5.—THE A.F. AMPLIFIER AND THE DOUBLE HETERODYNE CIRCUIT

By J. F. Golding

(Continued from page 14 January 1952 issue.)

SINCE the voltage across the tuned transformer primary is 90 deg. out of phase with that across the secondary when the circuits are at resonance and, as points (a) and (b) are virtually connected together by capacitance C4, and R.F. voltage equal to the full primary plus half the secondary, voltage appears between points (a) and (d) and an equal voltage between (a) and (e) ; C3 appears as a short-circuit to radio frequencies. The currents due to the rectifying action of diodes D1 and D2 flow through resistors R4 and R5 in opposite directions resulting in a zero voltage at the centre point.

When the frequency deviates in either direction, the voltage across the secondary circuit of T1 becomes either more or less than 90 deg. out of phase with the primary voltage, so that the voltages between points (a) and (d) and between points (a) and (e) are no longer equal, causing a voltage difference across resistors R4 and R5 proportional to the deviation.

The A.F. voltage, therefore, appears across either of the resistors and, as one end of R5 is conveniently connected to chassis, the output from the centre tap is taken to the grid of the first A.F. amplifier. The diagram shows the inclusion of a de-accentuation network, which reverses the action of the pre-accentuation of the high audio frequencies at the transmitter to improve the signal-to-noise ratio.

The A.F. Amplifier

As the R.F. bandwidth of a medium-wave A.M. receiver rarely exceeds 10 kc/s., very little importance need normally be attached to the high-frequency response of the audio amplifier, unless, of course, it is also used for gramophone reproduction.

The F.M. receiver, on the other hand, is capable of covering the complete audio band, so in order to take full advantage of the improved quality of F.M. reception it is necessary to use a high fidelity A.F. amplifier with a frequency characteristic which is reasonably flat up to 15 kc/s.

Fortunately, the output from the demodulator is fairly high at medium volume levels, so that a very high A.F. gain is not needed. An additional advantage may also be taken of the pre-accentuated high audio frequencies in the transmitted signal. By arranging that the de-accentuation network has a shorter time constant than the pre-accentuation network at the transmitter, some compensation can be made for a falling characteristic on the part of the amplifier.

The symmetrical output from the discriminator could conveniently be fed to a push-pull amplifier, which is balanced throughout, but, as this means that the de-accentuation network, the volume control and any tone-control filter circuits must be duplicated for each side of the circuit, it may be difficult to maintain an accurate balance throughout, and any advantage would be lost. In the opinion of the author, therefore, it is better to take an unbalanced output from the discriminator and apply it to a triode amplifier. This may be followed by a phase-inverter valve feeding two output valves in push-pull. The volume and tone controls should form part of the coupling circuit to the grid of the phase-inverter, and negative feedback should operate over the entire A.F. train.

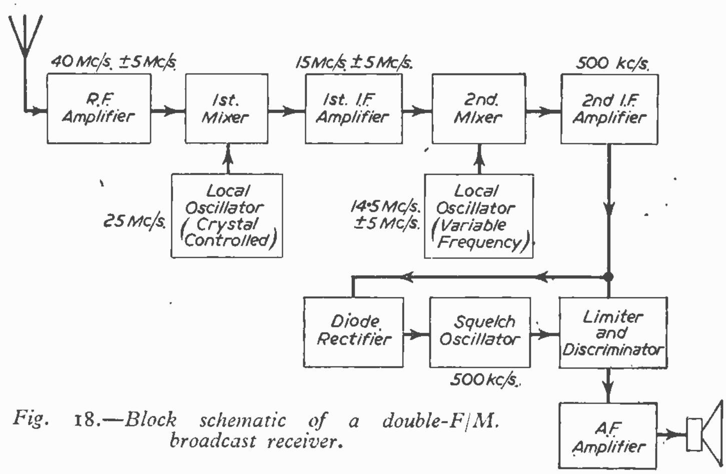


Fig. 18.—Block schematic of a double-F/M. broadcast receiver.

Double Heterodyne Circuit

It is of interest here to consider briefly the operation of the double heterodyne receiver.

Although this circuit can be adapted for broadcast reception it is mainly used for communication work, such as police car radio, where a small deviation is quite satisfactory since a high degree of level contrast is not required.

The block diagram in Fig. 18 shows the general arrangement of such a receiver, intended for use at a fixed tuning in the 40 Mc/s. band with a maximum deviation of 25 kc/s.

The R.F. input is amplified and applied to the first frequency changer to produce a beat frequency of approximately 15 Mc/s. This is amplified again and applied to a second frequency changer to give a final I.F. at 500 kc/s. It is at this frequency that most of the gain is obtained, a two- or three-stage amplifier being employed. This amplifier is followed by a limiter and phase discriminator stage which feeds the audio amplifier.

As the most prevalent cause of frequency instability is drift in the first local oscillator, this is crystal controlled, some degree of variable tuning of the receiver being obtained by adjusting the frequency of the first I.F. and the second local oscillator.

An additional refinement to the communication receiver is the anti-squelch circuit. This is necessary for this type of work because, unlike broadcast transmission, the transmitter output is cut off altogether when no message is being sent. With no input to the receiver, the internal noise is detected by the diodes of the discriminator to give a loud and unpleasant hiss in the headphones.

This noise can be obviated by the use of a local oscillator working at the final intermediate frequency, the output being applied to the demodulator. When an F.M. signal, sufficiently strong to produce complete limiting, is received, a portion of it is rectified and used to bias the squelch oscillator to cut off.

The double heterodyne has the advantage that a very high standard of long-term frequency stability can be obtained, together with a high gain and low second-channel interference. It has the disadvantage, from the broadcasting point of view however, that it is difficult to tune. Since the R.F. and first I.F. stages must be ganged to the second oscillator for continuously variable tuning, the tracking would become too difficult, switch tuning being the only satisfactory method.

In addition to this difficulty, the fact that the 75 kc/s. deviation requires a second I.F. of about 2 Mc/s. reduces to some extent the inherent advantages of the system. For broadcast F.M. reception, therefore, this type of receiver seems unnecessarily complicated.

The Outline Design of an F.M. Receiver

The outline design now to be described can be taken as a basis from which the final and complete circuit of a F.M. broadcast receiver may be developed. During this development it is inevitable that some modification to the circuitry will be found advantageous. Nevertheless, the methods given are the accepted and proven ones, and it is hoped that the information contained will prove useful to those readers intending to construct a F.M. broadcast receiver.

Before attempting to draw up a circuit we must first decide what are the minimum requirements of such a receiver.

It appears, from various statements published in the technical press, that a total tuning range of 85 Mc/s to 97.5 Mc/s should be adequate to cover the F.M. broadcast band. The aerial at Wrotham has a bandwidth sufficient to enable it to handle two transmissions in the frequency range 87.5 to 95 Mc/s. The figures quoted for a suitable receiver allow a margin of 2.5 Mc/s above and below this range.

It has been generally accepted that a 75 kc/s deviation is to be adopted, so that an overall radio-frequency response of about 200 kc/s bandwidth must be regarded as a minimum.

The sensitivity for complete limiting at fringe areas should not be less than 100 micro-volts.

The A.F. amplifier must have a flat frequency response up to 15 kc/s and, for good listening, should provide a maximum output of about 4 watts for 75 kc/s deviation. The de-accentuation network time-constant should be 100 micro-seconds to line up with the 100 micro-second pre-accentuation at the transmitter.

The block circuit diagram given on page 57 may be accepted as a suitable electrical layout for a receiver conforming to the above requirements. The method of operation of each part of the circuit has already been discussed in previous articles. This description is, therefore, confined to the engineering problems of a particular receiver.

The Aerial

Using a sensitive receiver, quite satisfactory results can be obtained from a simple dipole aerial. As is well known, this comprises two elements mounted on insulators with a centre spacing of 2.5in.

The elements are 30in. long, so that the total length of the aerial is 62.5in. or 1.59 metres. This is 5 per cent. less than 1.67 metres which is equal to a half wavelength at 90 Mc/s. The terminals at the aerial centre are connected to the lines of a twin feeder having a characteristic impedance of 75 ohms.

If it is thought necessary to use a reflector, this should be in the form of a single rod 66in. long, spaced 15.6in. away from the aerial in the direction opposite to the transmitter.

(To be continued.)

On Your Wavelength

By Thermion

The Dance Band Cut

MY mental tranquillity has not been disturbed by the decision of the BBC to cut down the number of dance band broadcasts. Finding itself with £2,000,000 less to spend, it was the obvious thing to do to eliminate redundancy. In all businesses when revenue declines, a wise management looks round and dispenses with the least useful of their servants. I therefore congratulate the BBC on its decision.

Naturally this is a blow to "... and their Bands," for broadcasting is a useful shop window for them. They do not receive very high fees, but once a comparatively obscure band has made its name over the air it is not uncommon for them to desert their radio audiences for the allurement of lucrative stage engagements.

Readers know my views on dance music and crooning, and bebop, and all of the other aboriginal antics which go with dance band music. I have expressed my views on many occasions concerning it, and have criticised the large amount of programme time which is devoted to this hoyden thing, which has been spawned on the ether too much for too long. Unfortunately, half the number of bands are capable of making twice as much noise, so we must, or at least those who think with me on this matter, wait to see whether a smaller number of bands will have greater programme time. I hope not.

The Effect of Rearmament

MR. G. DARNLEY SMITH, the vice-chairman of the Radio Industries Council, when responding to the toast of the Radio Industry at the first annual dinner of the council, referred to criticisms of the industry which suggested that it was unwilling to accept rearmament contracts because the manufacture of sets was more profitable. He gave an emphatic denial to these rumours, but pointed out that it was necessary to keep up the manufacture of domestic sets until defence contracts are placed. The factories must remain fully manned. He pressed the Government not to demand a suicidal cut in normal production.

Of course, this is sound common sense. All governments are merciless with various industries once their plans have been carried out. Ministers will pay lip service to the wonderful work a particular industry is doing, both in the House of Commons and in post-prandial orations. When the work is done, the contracts completed, it is a different story. Industries do not trust governments. Indeed, they do not know what government will be in power when their contracts are at an end. A new government may have totally different ideas about rearmament, and for an industry to base itself on such sandy prospects would be to court disaster. People do not live on armaments, necessary though they may be. It takes years to get together an efficient personnel. Once they are dispersed it takes years to get them together again, as firms found when the war ended and war contracts ceased.

Alternative Broadcasting Agencies

I WAS very interested in the debate which followed the Government announcement that they proposed to renew the BBC Charter for six months, to give the Government time to consider the terms of the new Charter and the recommendations of the Beveridge Report.

It may be that Beveridge, like alcohol (no pun intended), should be taken in small quantities. My interest, however, was aroused by a statement by Mr. J. D. Profumo, M.P., that "there is a considerable body of opinion not only in this House but also in the country generally that a new Charter should embrace provision for the licensing of alternative broadcasting agencies particularly in television, so that, despite cuts in revenue, there should be a wider and better programme without any further cost to the nation."

There are, of course, differences of opinion on that matter.

Service Engineers

THERE is one vital difference between a radio service engineer and a TV service engineer. The latter started off with a considerable knowledge of radio, the former started off with practically no knowledge of radio and had to find out as he went along. Moreover, the frequent changes in technique as radio developed from the crystal stage to complicated circuitry made his task even more difficult.

There were no examinations for service engineers in those days. TV, therefore, starts off in a far better position, and one can enlist the services of a TV dealer with confidence that the job will be competently carried out.

I note that of the 53 candidates who sat in the 1951 Television Servicing Certificate Examination, 19 satisfied the examiners in all papers, 16 were "referred" in the practical examination, and 6 qualified for the Certificate, having been "referred" in the 1950 practical examination.

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Preparing for the Season

HINTS FOR THE HOME CONSTRUCTOR

By R. Hindle

AT this time of the year the workshop has to be prepared for the season's work. It is a good plan, and the writer always follows it, to spend the first period of the season straightening up the workshop, reorganising, sorting out, throwing away all the rubbish that has accumulated and for which a use cannot be foreseen. A littered workspace and disorderly storage is conducive to considerable wastage of valuable time and should be eliminated at the outset. There is a strong temptation to store everything in case it should be needed sometime. That is all very well if adequate space is available but rarely will the amateur, or the professional either for that matter, be in the fortunate situation of being able to use space lavishly. Much useless junk accumulates, for instance, from the ex-Service units that have been broken up for parts and all items should be critically examined and only if future use is really likely can they be given valuable storage space. Here again the writer has formulated a plan scrupulously adhered to so as to curb his natural miserly instincts. A box in the corner is for apparently useless junk kept "just in case." Such junk is not allowed to overflow. When full, the contents are sorted and a proportion thrown away to make room for further additions.

Resistors

Unfortunately, too, useless items are often found in the drawers of "good" components. These drawers have been neatly divided into sections to hold different types of components and the contents of each drawer appear on a label in the front. Neatness in storage means speed in finding what is wanted, but so often leads to false confidence in the items so neatly stacked. It is part of the "seasonal clean" to consider the trustworthiness of the contents of these drawers. Resistors do not generally deteriorate in store though they may be faulty or of wrong value when added to stock. The practice adopted is to put all purchases of new components into stock without test. Then, as they are brought into use, they are given a quick test unless they are to go into a position where a fault will be easily identifiable. Much depends on the kind of work for which they are to be used. If a complete new receiver or complicated panel is to be constructed, particularly if the design is of experimental nature, all the required resistors are assembled in advance and all given a routine check for value. This can save endless time in fault-finding when it is not known if some undesirable phenomenon is the result of faulty design or faulty component, and it is very comforting, under such circumstances, to know that all resistors have actually the resistance intended.

Used resistors or resistors removed from ex-Service equipment, even if purchased in new condition, are generally suspect. These have been exposed to the heat of a soldering iron and may well have changed their value. This particularly applies to attempts to remove the components from a chassis. Generally, heat has to be applied longer when unsoldering the wires of a component that was originally soldered in to stay for all time than was necessary for the original soldering. If sufficient wire is left it is far better to clip the resistors off with wire-cutters than to attempt to unsolder. Generally, however, this course results in wire leads too short for convenient re-use and unsoldering is necessary. It is very important in these circumstances to protect the resistor from the heat of the iron. The best way is to provide thermal "decoupling" by means of a suitable "capacity."

A block of copper as large as will conveniently go into position has a crocodile clip sweated on to it and this is clipped between the point of contact of the soldering iron and the body of the component throughout the operation. If the thermal shunt is too effective, of course, there will be difficulty in raising the temperature of the joint sufficiently. The size will depend to some extent on the kind of soldering iron used, but perhaps in the first place a piece of solid rod, say, 2in. by ½in. diameter could be tried. This could be made up something like the sketch in Fig. 1. Very likely the bit of an old soldering iron could be given a new purpose in life if it is cleaned up, removed from the shank of the old iron and sweated on to a crocodile clip as shown.

Transformers

Transformers also give little trouble if stored in dry conditions and, if terminal boards are fitted, these are well cleaned before the component is put into use. If the transformer has been removed

Fig. 1.—A thermal shunt.

from other equipment it may be that, where a common soldering tag is used for lead out and for external connection, the application of the soldering iron to remove the external lead may disconnect the lead-out wire, but a careful inspection will generally indicate this. A resistance test of each winding will show any open circuit and, by comparison with the resistance of similar windings of other transformers of the same type, will indicate serious internal shorts. An attempt to test for leakage between windings is not likely to be satisfactory unless a voltage at least equal to, and preferably higher than, that to which the windings are to be exposed under operating conditions is used.

Condensers

Condensers are more of a problem. Used electrolytics are notoriously unreliable. Their new "shelf-life" is limited to about two years and this is counted from time of forming during manufacture so that quite a large proportion of that life may be expended before the component finds its way into the stock drawer. Often the date of manufacture appears on the case and this should always be looked for when purchasing, particularly when surplus lines are under consideration. After this period of two years the condenser may still be of some use but it is better not to rely on it in any important equipment.

There is not the same limit in life in the case of an electrolytic actually in use in a receiver or other item of equipment because this is being repeatedly exposed to a voltage and the leakage current through it maintains the forming process. Here, obviously, is the answer to the storage problem. All electrolytics purchased should be under 12 months old and should be reformed before being placed into stock. This is done by applying a D.C. of correct polarity to the component. A variable power supply should be used. Starting at, say, a tenth of the working voltage, the voltage applied should be gradually increased over an hour to the prescribed working voltage. The leakage current then passing through the condenser should be measured. The permissible leakage depends on the capacity and the working voltage. An 8 μF. 350 volt or 450 volt condenser should have no more than ½ mA leakage; a 16 μF. component no more than .8 to 1 mA. For wet electrolytics rather more leakage is to be expected; about twice the above figure is permissible. A 50 μF. 50 volt condenser can show a leakage of about a third of 1 mA; a 50 μF. 12 volt condenser should give no more than 100 microamp.

The date of purchase of these components should be marked on them after the forming process has been carried out and subsequently, at least every 12 months if they are being kept in store so long, the forming process should be applied. Equipment

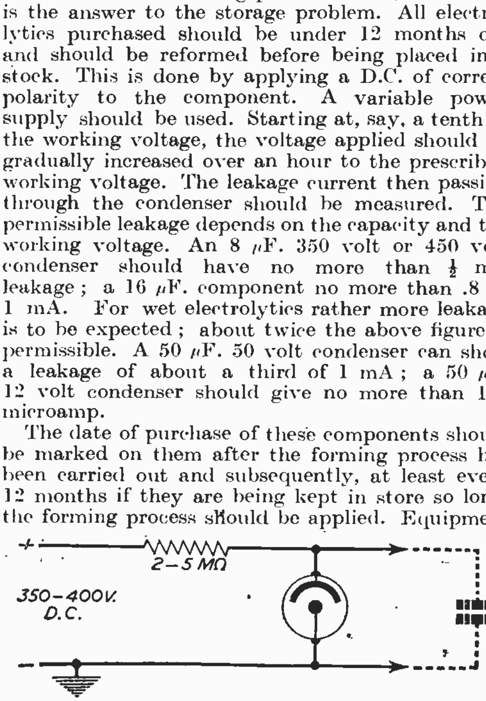


Fig. 2.—A D.C. supply for experimental use.

in which electrolytics have been wired cannot generally be operated to give the gradual build up of voltage here suggested. It is better to see, therefore, that each such item of equipment is operated under normal conditions at least for an hour every three months.

Testing Paper Condensers

Paper dielectric condensers all too frequently die a premature death. It is the writer's practice to suspect all, new and old. They are tested on purchase, before putting them into stock, and again, usually, before being incorporated into equipment. A very simple and quick method of test is needed for this purpose, and fortunately it can easily be arranged. The workbench has, of course, a standard power supply. Leads from the 400 volt D.C. supply provided by this power pack are brought to a convenient point on the bench backboard. In series with one of these leads is a resistance. Actually this is placed in the positive lead because the negative of the power pack is earthed and with the resistance in this position it acts as a current limiter in event of an accidental short of the positive lead to an earthed object. A neon lamp is wired in parallel with the flying leads, terminated by crocodile clips. The circuit is as in Fig. 2. When the power pack is switched on the neon strikes and draws power through the resistor, which limits the current drawn. Now, when the leads are clipped across the condenser under test, shown dotted in Fig. 2, the circuit becomes a neon oscillator. The condenser, in the first instance, is uncharged and therefore the voltage across the neon is zero and the lamp extinguishes. There is now a simple integrating circuit; an uncharged condenser in series with a resistance across a source of steady voltage. The condenser charges exponentially and the voltage across it builds up in an attempt to reach the supply voltage, but when it reaches the striking voltage of the neon this lights. The neon finds it easier to draw current from the condenser, the current from the power source being limited by the series resistance, so the voltage across the condenser is run down to below the extinguishing voltage of the lamp, which goes out and starts the procedure from the beginning again. But if the leakage of the condenser is such that, by comparison with the series resistance, only a proportion of the source voltage can appear across the condenser, then the lamp may not be able to strike. An ex-Service indicating neon is ideal for this purpose, and a series resistance of 2 to 5 megohms is suggested with a power supply of 350 to 400 volts derived from any normal power pack.

The procedure is, then, to switch on the power pack and wait until the neon lights. In actual practice this is permanently switched on and at the ready. Then the leads are clipped across the condenser. Incidently, if the condenser to be tested is wired into a chassis it will be necessary to disconnect one end or the resistance of the associated components may give a false indication. If the neon fails to light the condenser is leaky. It may still be of use in a position where leakage current is of no account, such as the cathode by-pass condenser, but it will completely upset operations, say, as an anode coupling condenser. Preferably the condenser should be discarded as faulty.

The interval of time between flashes of the neon depends upon the size of the condenser and the resistance used. It is, in fact, an easy matter to estimate the capacity of larger condensers, and the writer has adjusted the size of the resistance used by trial and error, until a 1 μF. condenser gives a one-second flash interval. Condensers down to .05 μF. can then be checked for capacity with reasonable accuracy. Below that capacity an estimate of capacity can still be made by listening to the frequency of the oscillation, but it is not easy to arrange a circuit for this purpose, avoiding either damping of the condenser circuit, which would prevent striking, or the introduction of stray capacity which, if variable, would falsify the estimate. The experimenter might like to try it out, but the device loses the advantage of simplicity if this is done and, as it stands, it fulfils the original intention of providing a simple, immediately available leakage detector.

In passing it might be worth while to point out that the neon circuit described is, in fact, a simple saw-tooth timebase circuit for cathode-ray-tube work. It is not truly linear, of course, but it is more linear the higher the source voltage. The amplitude of oscillation is equal to the difference between the striking voltage and the extinguishing voltage of the neon, of the order of 15 volts.

It will be realised that this method of testing is unsuitable for electrolytic condensers, which by their nature have to pass a leakage current, but it will indicate leakage in either paper or small mica and ceramic condensers.

Tools

Having cleaned up the bench and sorted and tested the stock of components the tools come in for consideration. Screwdrivers with nicely ground

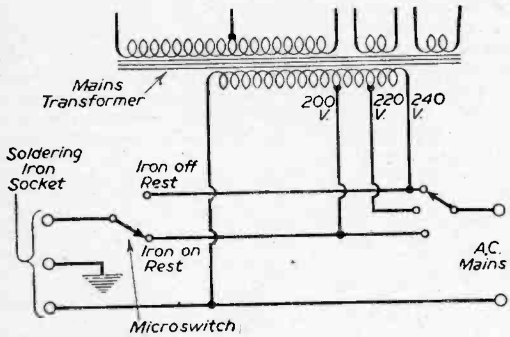


Fig. 3.—A soldering iron hint.

blades that fit snugly into the screwheads are a joy to use, but it is a joy that many do not permit themselves. It is a good thing to look at them and give them necessary attention forthwith. Wire-cutters that will cut are equally desirable. They are cheap, and maybe a new pair would not be amiss. Files, too, and saws, or at least sawblades, need attention or renewal. Much time is wasted looking for the right tool for the job, and the opportunity has been taken to mount a row of Terry clips along the front of the bench to hold those most frequently used right at hand. The habit of returning each tool to its place immediately after use is then easily formed. The bench top overlaps sufficiently to prevent the tools and clips getting in the way when working.

A few more power sockets have been added to the collection already mounted along the front of the bench in easy reach. It is a good idea to have one each of all the most common types, wired and earthed ready for use, so that plugs have not to be changed whenever a piece of equipment from elsewhere has to be tested. Points for the bench test gear are standardised, of course. Two-amp., 3-pin sockets are provided on the two shelves fitted at the back of the bench to carry test equipment of different kinds. Great care should always be taken in wiring mains around the test bench. An intermittent contact, besides causing trouble in the gear connected to the offending point, can cause interference conveyed via the mains to receivers connected to other points, and much time might be wasted searching in such a receiver for trouble that does not exist in it.

The Soldering Iron

The tool most frequently in use in the workshop is the soldering iron, naturally enough, and a power point in front of the bench is specially earmarked for this purpose. Nothing else is allowed to use or share this socket. As a matter of fact, it is very different from other sockets. The problem of power supply to a soldering iron is complicated by two factors these days. First there is the difficulty caused by variable supply voltage as a result of load shedding, and secondly there is the need for continually having the iron ready heated even though long intervals of time may elapse between one soldered joint and the next when experimental or development work is in progress.

The old faithful, the iron with a standard chisel type bit, has at last been relegated. It has given long and satisfactory service, but it is a little too clumsy for the modern, compact type of work often using miniaturised components. It is not pensioned off completely. There is still the occasional job requiring heat to be applied over a comparatively large area for which it is more suitable, so it is still kept clean and nicely tinned and is still given its place, and its power point, on the bench. The new unit taking its place, however, is one of those pistol-grip models with a small diameter bit, and it is a revelation in easy handling and rapid soldering.

If left continuously switched on, any soldering iron tends to burn its bit, and this spoils it for soldering work. These modern irons with small bits are worse than the larger ones from this point of view. Some irons are made with an arrangement incorporated, operated by means of a sleeve on the shank of the iron, for increasing the consumption whilst the iron is actually in use. It is thought that anything that makes the iron more cumbersome is to its detriment, but no doubt the balance of the tool has been carefully considered. The method adopted in the present case is thought to be rather better, however.

An old mains transformer is used to feed the iron and is connected as an auto transformer. Normally, when the power is switched on and the iron is on the rest, its heater is connected between the common and the 200 volt tappings of the primary of the transformer. The iron is rated for 230 volts, so it is under-run, but it is maintained at very near working temperature, though it cannot overheat. A change-over micro-switch is incorporated in the iron-stand, connected so that, when the iron is lifted from the stand, the connection of the element is between the common and the 250 volt tappings, the change being made without any action by the user for that purpose. The iron is now quickly at working temperature. In fact, there is no need to wait, and the extra heating capacity is simply used to supply the heat required to do the job. It is just like the variable charging arrangements on a car, where the output of the dynamo is automatically adjusted to suit the load applied.

To tackle the other problem of variable supply voltage the transformer primary tappings are brought out to a switch, chosen with contacts and insulation suitable for the purpose. It should not be the type that short-circuits adjacent contacts as it is turned; i.e., not the make-before-break type. The mains is connected to the transformer via this switch as shown in the diagram in Fig. 3. It will be noticed that both mains and heater element of the iron are connected to the primary windings and the secondary windings are not used. When the mains voltage is found to be low the

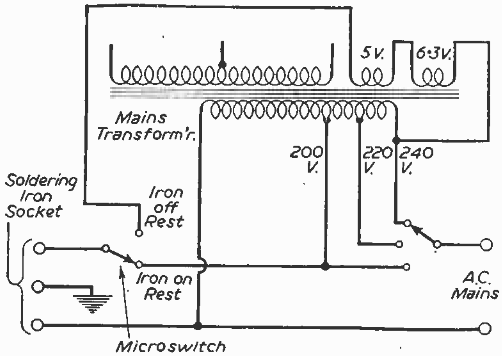


Fig. 4.—An alternative to the idea shown in Fig. 3.

switch can be turned to a lower tapping (giving a greater step-up ratio) without affecting the change-over arrangement by the micro-switch.

If this idea is adopted it is worth while remembering that a still greater voltage can be applied to the iron, if found necessary, as may be the case if the mains are at times much lower than the iron rating, by connecting the heater secondary windings in series with the primary winding. The connection must be such that the two windings give additive voltage. If they are connected the wrong way round the resultant voltage will be decreased. An A.C. voltmeter reading will soon show which is the correct way. Fig. 4 gives the resulting circuit.

There is a second soldering iron stand provided, this time without micro-switch, so that when top-speed soldering is being done the iron can be rested momentarily without reducing the voltage supplied, but care is taken never to use this unless the rest is to be only a matter of seconds. To help to ensure this the rest with switch is placed rather nearer and more conveniently.

Work of preparation in the workshop, as suggested, will be amply repaid when a job of construction is eventually undertaken, by cutting down the time for construction and for testing. Even if a separate room is not available as a work-shop, the suggestions made will be found well worth consideration.

News from the Clubs

EDINBURGH AMATEUR RADIO CLUB

Hon. Sec.: C. L. Patrick, 19, Montgomery Street, Edinburgh.

THE club meets weekly on Wednesdays at 7.30 p.m. in Unity House, Hillside Crescent, Edinburgh.

On January 9th the opening meeting for the year will be held and tea will be served. On the 23rd, a lecture on communications Receivers will be given by I. Alexander, and on alternate nights the club Tx, which is now operating on 'phone, will be on the air.

A dance will be held on Friday, February 1st, and any friends who are interested will be able to obtain tickets from members.

THE EXETER RADIO AND TELEVISION CLUB

Hon. Sec.: L. R. Jenkin, 16, South Avenue, Exeter.

AT the annual general meeting the name of the club was changed from "The Exeter & District Radio Society" to the above title, since the interests of members cover nearly all branches of radio, television and electronics.

The programme for the month of January is as follows:—

January 10th.—The detector—talk and demonstration.
January 17th.—Competition of home-built equipment.
January 24th.—New developments in radio.
January 31st.—The use of vectors and the operator j in practical radio.

All club meetings are held in the Exeter Hobbies Association Hut at the top of Haldon Road, Exeter, on Thursday evenings, at 7.30 p.m. Constructional facilities are available to members.

WORTHING AND DISTRICT AMATEUR RADIO CLUB

Hon. Sec.: F. H. Betteley 42, Anweir Avenue, Lancing, Sussex.

THE winter session is now in full swing, and meetings are held on the second Monday of each month at the Adult Education Centre, Union Place, Worthing. At recent meetings attendances have been good and enthusiasm of a high order shown. It is proposed to show the "Mullard" film strip on valves for the January meeting. Any interested reader should contact the club secretary.

(EDINBURGH) LOTHIANS RADIO SOCIETY

Hon. Sec.: I. Mackenzie, 41, Easter Drylaw Drive, Edinburgh, 4.

MEETINGS are held at fortnightly intervals on Thursday evenings, 7.30 p.m., at 25, Charlotte Square, Edinburgh.

The 1951-52 syllabus includes lectures and demonstrations of transmitting and receiving equipment, amplifiers, tape recorders, oscilloscopes, V.H.F. equipment, etc. A series of lectures dealing with the conversion of ex-radar units for T.V. has also been arranged.

Instructional classes for the Radio Amateurs Exmination are available to members at every meeting. A cordial invitation is extended to prospective members to attend these meetings. Dates for January are January 17th and 31st.

Further details and a copy of 1951-52 syllabus may be obtained from the hon. sec.

COVENTRY AMATEUR RADIO SOCIETY

Hon. Sec.: Ken Lines (G3FOH), 142, Shorncliffe Road, Coventry.

ARRANGEMENTS have been finalised for the annual dinner at the "Opera House" on February 29th, 1952, and tickets are available from the hon. sec.

COVENTRY AMATEUR RADIO SOCIETY

A NEW departure is the inclusion of a ten-minute Morse Training Period each club night, to help beginners and the not-so-fast.

Competitions for all Club Trophies are to be held before February, and these include the "Best DX Report" and the "Best Home Constructed Equipment," as well as Transmitting and Receiving Contests.

Prospective new members are always welcome on Club Nights, which continue to be held at the Y.W.C.A., Queen's Road, at 7.30 p.m.

Forthcoming programme is as follows:—

7th January.—Members Lecturettes (please come prepared!).
21st January.—Mullard Film Strip.
4th February.—Debate.
18th February.—"Mathematics Made Easy"—a lecture by T. R. Theakston, Esq., B.Sc. (tickets obtainable from Hon. Sec. and open to the public).
29th February.—Annual Dinner at the Opera House.
3rd March.—"Frequency Modulation"—a lecture by W. Grimbaldeston (G6WH).
17th March.—"25 Years of Amateur Radio"—reminiscences by the Chairman (G5GR).

SOCIETY FOR LEIGH, LANCS.

AN attempt is being made to form a Radio Club in the above area. All interested should contact Mr. W. Pollard, at 24, Winmarleigh Gardens, Leigh.

Surplus V.H.F. and U.H.F. Valves

DETAILS OF TRANSMITTING VALVES AVAILABLE ON THE SURPLUS MARKET

By E. G. Bulley

THE following details relate to valves other than Magnetrons, Klystrons and disc-sealed valves that are available on the surplus market and are most suitable for the transmitting amateur.

A large number of these valves employ a type of construction differing from the conventional valve, that is, they employ what is known as a pressed glass base in place of the usual stem on to which the electrodes are assembled. In valves designed for the higher frequency bands, it is usual to find the anode and sometimes the grid connection brought out of the top of the glass envelope.

Upon examination of any such valve employing a pressed glass base, it will be noted that fairly heavy leads are hermetically sealed into it, the lengths of these being kept to a minimum. The reason for this is that such leads must have the minimum of inductance, and this can only be accomplished by having leads with a fairly large cross-sectional area and of the shortest possible length.

Some valves that fall into this category have two or more leads taken to the anode and grid electrodes, the purpose of these being to increase the cross-sectional area, reduce the power losses and thus enable the R.F. current to be carried with safety. It is as well to mention, however, that in indirectly heated valves the cathode lead is given special attention because the inductance of it is common to both the anode and grid circuits.

Valve types such as the 829B and 832A are two of the types that are available on the surplus market and both are very popular with the transmitting amateur.

An important factor in the actual design of such valves is that of the electron transit time. This characteristic is kept to an absolute minimum and is the time taken for the electrons to travel from the cathode to the grid, and from the grid to the anode. These electrons must, therefore, be in phase, otherwise cathodic bombardment will result and cause the destruction of the emitting surface.

The valve designer always aims at obtaining the shortest possible transit time for valves that are to be used at high frequencies, and to do this, the spacing of the various electrodes is reduced to an absolute minimum. It must not be forgotten, however, that the designer must also produce a valve with a high-slope characteristic and that it must also have low inter-electrode capacities.

When valves of this nature are being developed, special attention is given to the electrode design, due to the possibility of stray electrons which must be avoided at all costs. Their presence would not only upset the transit time but there would be a possibility of their striking the bulb and creating what is known as electrolysis followed by the puncturing of the glass envelope. It is usual to find internal screens in such valves so that the emitter is completely shielded.

Valves that are to be used successfully in the U.H.F. band must be kept physically small and at the same time satisfy the electrical requirements. These valves usually employ either a thoriated tungsten or an oxide-coated cathode to supply the required emission. Such emitters are able to supply the emission at much lower anode voltages than if pure tungsten filaments were used. This enables the valve to be physically smaller.

The reader must always remember that any valve with a thoriated tungsten filament must always be operated at the correct filament voltage within plus or minus 5 per cent. of the actual rating. Failure to do so will result in the filament being reduced to pure tungsten and the loss of emission.

Another point of interest is that all metallic supports, baffles or screens are connected internally

TABLE 1.

British Surplus No.	British Comm. No.	U.S.A. Surplus No.	U.S.A. Comm. No.	Ef	If	Max. Ea	Max. W	Max. F	μ	Slope	Type
—	—	VT228	8012A	6.3	2.0	1,000	40	500 Mc/s	18	—	Triode
—	—	—	8025A	6.3	1.92	1,000	30	500 Mc/s	18	—	Triode
CV668	—	—	35T	5	4	2,000	50	100 Mc/s	39	2.8	Triode
CV2663	QV04-20	VT287	815	6.3	.8	400	20	150 Mc/s	6.5	4	D. B. Pentode
”	”	”	”	12.6	1.6	400	20	150 Mc/s	6.5	4	
CV630	—	—	826	7.5	4	1,000	60	250 Mc/s	31	—	—
CV2666	QV07-40	VT259	829B	6.3	2.25	750	40	200 Mc/s	7	8.5	D. B. Pentode
”	”	”	”	12.6	1.125	”	”	”	”	”	
CV788	—	VT286	832 A	6.3	1.6	750	15	200 Mc/s	7	3.5	D. B. Pentode
VT88	—	”	”	12.6	.8	750	15	200 Mc/s	7	3.5	
VT88	—	VT118	832	(Data	as for	832A)					
CV683	4316A	VT191	316A	2	3.65	450	30	300 Mc/s	6.5	2.4	Triode
CV710	—	—	368AS	1.15	4.5	300	20	1,000 Mc/s	10	2.4	Triode
VT62 NT58 CV1062	DET 12	*	UH50 8019 834	7.5	3.25	1,250	50	100 Mc/s	10.6	2.0	Triode

* 834. Same electrical characteristics but fitted with Ux base instead of BVA 4-pin.

to one of the electrodes. This obviates the possibility of any metallic component absorbing some R.F. energy and so upsetting the correct operation of the valve.

When installing valves in which leads are brought through the bulb or a pressed glass base, one should never solder direct to these leads, but connections should be made by brass or copper slugs that are held on to the leads by means of small grub screws. Care must also be taken when fixing the slugs to the leads, otherwise strains may be set up in the glasswork. An advantage in using slugs is that they assist in keeping the seal cool, an important point in U.H.F. operation.

Other valves that can be used in the U.H.F. range are those like the 35T or DET12. Both these valves are of the conventional type of construction, with the exception that the anode of the former is brought out of the top of the bulb, and with the latter both the anode and grid are brought out of the top. Nevertheless, copper or brass slugs or radiators must be attached to such leads to provide adequate cooling and electrical contact. The bases of such valves are normally of the low-loss type such as those made from ceramic.

Table 1 shows valves that are still available on the surplus market, with their commercial equivalents together with brief electrical data that may prove of interest to the reader.

Another points concerns the 829B valve. This valve consists of two beam pentodes in one envelope, both dependent on a common filament, centre tapped so that the valves can be operated in parallel or series.

This valve, however, is most suitable for push-pull operation and is to be found in many transmitters operated by the more experienced amateur.

A Metal-folding Machine

A HAND-OPERATED ACCESSORY FOR CHASSIS WORK

By R. G. Ilston

THE machine described here is easily and cheaply constructed, and is a useful addition to the equipment of any small radio workshop. It is hand-operated, and will bend mild steel of up to 16G x 16in. in width, producing a satisfactory corner along the whole length.

The first items made are the frames of 1¼in. x 1¼in. x ¼in. mild steel angle, which are cleated or welded together at the corners, both being covered with ⅛in. M.S. plate fixed by ½in. x $\frac{3}{16}$in. B.S.W. countersunk screws tapped into the angles at suitable intervals. The bedplate frame has four 13/32in. dia. holes in it for fixing bolts, and in the 18½in. x 14½in. plate which covers it two studs 2in. long by ⅜in. diameter are welded in holes provided. These studs are for the clamping bar and are threaded ⅜in. B.S.W. for a distance of 1in. from the top.

A plate 18½in. x 12in. covers the lifting frame, and plate and angle are filed to an ⅛in. radius along the edge marked, while a handle formed from ⅜in. dia. B.M.S. is fixed to the front of the frame by rivets or screws.

Four hinge plates and two packings of ¼in. M.S. flat are cut and drilled, then two of the plates have ⅜in. B.S.W. studs 1in. long welded in the holes drilled to give 1 L.H plate and 1 R.H. Any excess weld must be cleaned off to leave a flat surface at the back, and this pair of hinge plates is fixed to the bedplate frame by ½in. x $\frac{5}{16}$in. B.S.F. setbolts tapped into the angle. They are fixed in such a position that the centres of the studs coincide exactly with the top point of the covering plate.

The other two hinge plates are fixed, with a

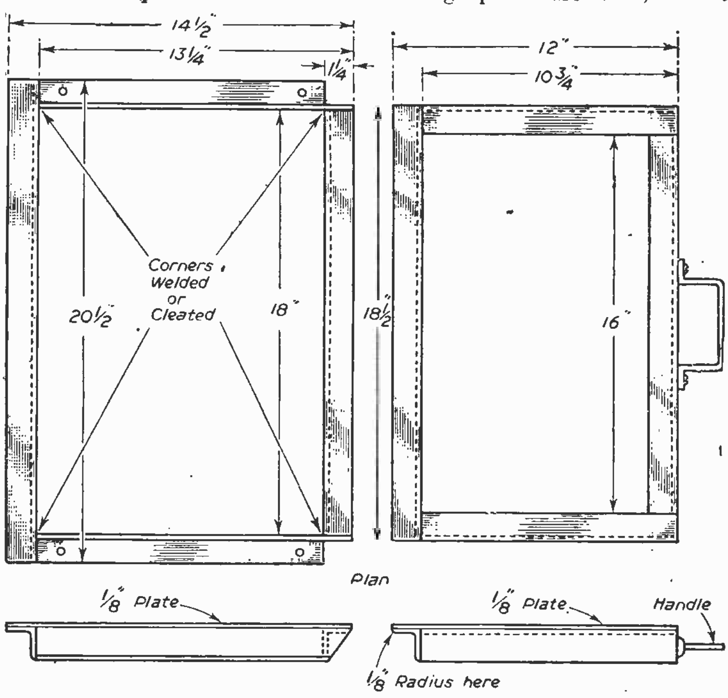


Fig. 1.—General layout details.

packing behind each, temporarily to the lifting frame by $\frac{3}{8}$in. x $\frac{5}{16}$in. B.S.F. setscrews, as shown, so that the pin-hole centre is level with the top of the $\frac{1}{8}$in. plate, but is set $\frac{1}{16}$in. from the edge of it. After a trial fixing these hinge plates are removed, the frame is lined up in the correct position to the bedplate and the plates are refixed to engage the studs on the other plates, and a $\frac{3}{8}$in. B.S.W. nut on each stud holds the assembly together. If desired, after tightening the nuts to allow easy,

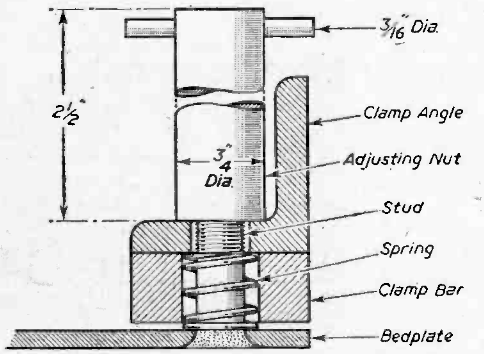


Fig. 2.—The spring-loaded clamp.

but not slack, movement of the lifting frame, a small hole for a locking wire may be drilled through nuts and studs. For the clamping arrangement a clamp bar and angle are cut and drilled as shown, the bar being fixed to the angle by $\frac{1}{4}$in. x $\frac{1}{2}$in. B.S.W. countersunk screws. Two springs, $\frac{3}{8}$in. I/D x $\frac{3}{4}$in. free length and consisting of five turns of 14G wire, are obtained and fitted over the studs, after

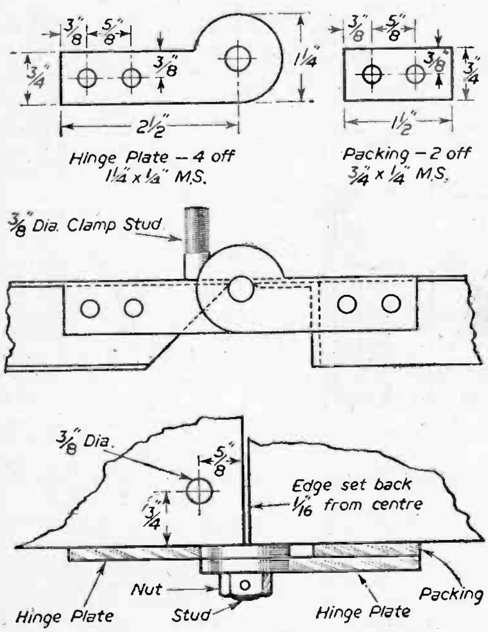


Fig. 4.—Details of the hinge.

which the clamp bar fitting is also fitted over the studs, the springs seating in the $\frac{9}{16}$in. holes in the bar and the studs projecting through bar and angle.

Two tension-adjusting nuts are turned from $\frac{3}{4}$in. dia. B.M.S. 2$\frac{1}{4}$in. long and are drilled and tapped centrally $\frac{3}{8}$in. B.S.W. 2in. deep, with fixed tommy-bars 2$\frac{1}{2}$in. long x $\frac{3}{16}$in. dia. at the top.

These, when screwed on to the protruding studs, provide the means for adjusting gap and pressure

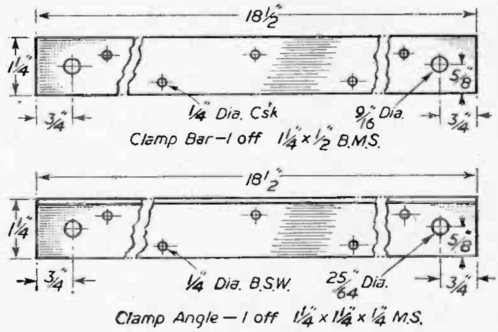


Fig. 3.—Clamp bar and angle.

between clamp bar and bed for different thicknesses of materials.

Finishing

When the machine is finished, any burrs are removed by a file from the plate surfaces, which are then rubbed over with smooth emery cloth until a good finish is obtained, and the same operation is carried out to the underside of the clamp bar. The remaining steelwork is then given a coat or two of black, matt finish paint. Instructions for the use of the machine need no description here, it being only necessary to mention that a little oil occasionally on the clamp studs and hinges will keep the machine working at its easiest.

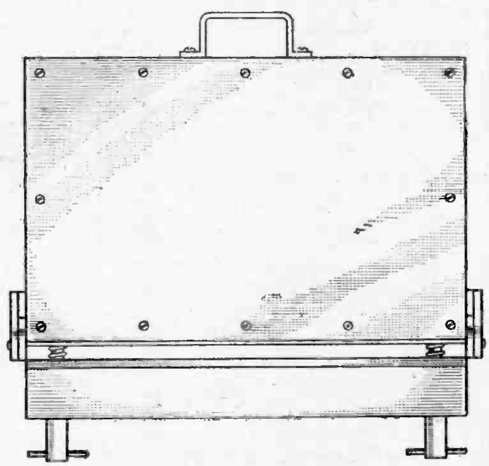


Fig. 5.—Plan of the completed machine.

A Two-stage R.F. Pre-amplifier

A USEFUL ADDITION TO OLDER SUPERHET RECEIVERS FOR MODERN CONDITIONS

By T. Hatton

THE performance of many superhet broadcast receivers produced prior to 1945 is deficient as regards sensitivity and, on the medium waveband, all the more distant stations seem to be surrounded by an irritating band of background noise. Static and noises due to electrical storms are beyond the listeners' control, but the majority of noise is not due to this, but is added by the first stage of the receiver. This may be further subdivided into the noise due to the random movement of electrons in the tuned circuit, which is only about 2 micro-volts and may be neglected, and the inherent valve noise of the first valve. Assuming the first valve to be a frequency changer, the valve noise may be as much as 6 micro-volts. This is not a particularly large voltage, and vectorially combined with the noise voltage of the tuned circuit is only about 6½ or 7 micro-volts at most; contrasted, however, with the input of a very distant station, which may be as little as 30 micro-volts, it becomes of considerable importance. Taking the case of the station whose signal is only 30 micro-volts, the R.F. amplifier may be considered as raising that voltage perhaps 10 times. Three hundred micro-volts is then applied to the input of the frequency changer and that, compared with the noise level which is still only 6 or 7, will raise the signal well above its background.

Of course, the R.F. amplifier itself will add some noise to the signal, but it will only be about 2½ micro-volts when combined with the noise of the tuned circuit. This will be seen to be a great improvement on the previous case.

Two Solutions

So far only a weak signal has been considered. In the case of a powerful local station the increase due to the R.F. amplifier will make the signal so powerful that second-channel interference will occur. There are only two solutions to this problem: either to reduce the overall gain of the pre-amplifier until the second channel does not obtrude, or to include tuned circuits in the unit, supplementing the signal frequency tuning in the receiver. Then instead of allowing the R.F. amplifier to amplify all incoming signals, irrespective of their frequency, the pre-amplification is restricted by means of the additional tuned circuit to a narrow band of frequencies.

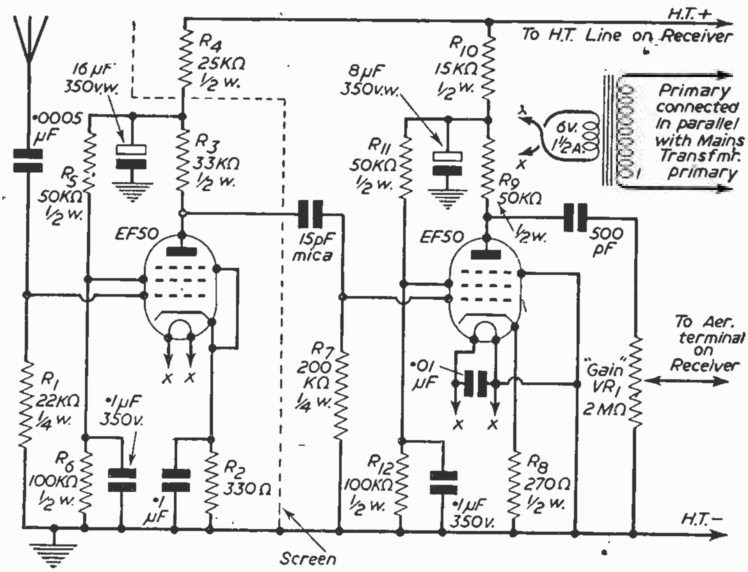
However, since it is manifestly inconvenient to have two tuning controls to adjust, the additional sensitivity has been sacrificed for the sake of convenience: once set up, the pre-amplifier needs no further attention.

From the circuit, it will be seen that the two stages are screened and adequately decoupled. EF50s were used in view of their cheapness, although SP41 or SP61s could be used. These two valves are identical except for heater voltages (4 volt and 6 volt).

If used, R2 and R8 should each be made 100 ohms, and R5 and R11 should be altered to 27 KΩ each. The anode load resistor, R9, would have to be rated at 1 watt and the H.T. consumption generally would increase by about 50 per cent.

Supplies

The first stage is very loosely coupled to the second, so reducing the load on the first stage. Negative (current) feedback has been attained in the second stage by omitting a condenser to by-pass the H.F. component of the current through the bias resistor. This tends to make the stage more stable, and also renders the valve less sensitive to hum in the H.T. supply. The H.T. required may be between about 180 and 350 volts, at about 8 mA. As this is so small, and not critical as to



The circuit of the pre-amplifier. No separate list of parts is given as all details are marked on the circuit.

voltage, it may be conveniently drawn from the H.T. supply of the set which is being modified.

The heaters require 6.3 volts at 0.6 amps, and this is too much to take from the mains transformer supplying the receiver, so a separate heater transformer must be used. These are available on the surplus market at about 7s. 6d., and are rated at 6.3 volts, 1.5 amps. The primary of this transformer is best connected directly in parallel with that of the mains transformer.

When finished, the unit should be installed in the cabinet of the associated receiver, well away from the frequency changer and I.F. stages. With the receiver switched on and the gain control (VR1) turned well up, it will be found that the BBC Home Service can be received at many points on the dial. Select a fairly weak one, in a place where there is normally no BBC transmission, then disconnect the aerial from the pre-amplifier and put it straight on to the aerial terminal of the set. If the signal is no longer audible, it may be assumed that the previous signal is a second-channel interference of the BBC. Then with the pre-amplifier again in use, the gain control should be turned down until the signal is just inaudible.

If a fairly good aerial is already in use, the pre-amplifier will not be required to give very much gain, but good aerials are few and far between. With the average aerial the improvement is most marked.

If, in the case of a receiver having rather poor input selectivity, it is desired to tune the first stage, R1 (22 KΩ) should be replaced with the usual .0005 μF tuning condenser, in parallel with a coil of 120 μH. Such a coil could be made by winding about 70 turns of 28 s.w.g. wire on a 1½in. diameter former. This would then cover the normal medium waveband.

In conclusion, it may be said that the unit has proved quiet, and has no tendency to instability.

Tuned and Untuned S.W. Aerials

ALTERNATIVES FOR THE LONG-DISTANCE FAN

By W. Nimmons

FROM time to time reports arise of phenomenal results having been attained in S.W. reception on a few feet of wire. On investigation it is found that the few feet of wire represent a tuned aerial.

What is a tuned aerial, and how does it differ from one of the untuned variety? A tuned aerial is one in which the aerial is included in the grid circuit of the first valve of the receiver, so that this circuit extends to the very end of the aerial.

An untuned aerial, on the other hand, is much more loosely coupled. It is usually coupled to the main grid coil by means of a primary or subsidiary coil, of a few turns only; though the classification also includes a circuit in which there is only one coil in the aerial circuit, the aerial being taken to the top of this coil (or tapped down it) through a very small condenser.

The aerial, in this case, can be of any length —even the normal broadcast aerial. It works by reflecting a certain amount of the H.F. energy present into the main coil, which selects the frequency required by means of the L./C. ratio to which it is set.

An aerial circuit of the untuned variety is shown in Fig. 1, while Fig. 2 is another variety of it. The circuit has a certain natural frequency of its own, which is normally masked out by means of the small number of turns of the primary coil or the small condenser; otherwise it leads to undesirable working conditions, such as "dead spots," etc. It is not particularly efficient at any frequency, but has the merit of working over a wide frequency range without any adjustments having to be made to the apparatus other than the setting of the main tuning control, or in the case of a straight receiver of the reaction control also.

Length Required

A tuned aerial circuit is shown in Fig. 3. It will be noticed that the aerial is taken to the top of the grid coil direct without the interposition of a condenser. This means that it must be close to the actual receiver—in the same room, in fact. The length of the aerial is important; it must not exceed about 6-8ft. A wide diameter aerial gives superior results to a plain wire, so a car or similar aerial is indicated. Good results can also be obtained from a pram handle or similar piece of ironmongery —it does not even have to be straightened!

Fig. 4 shows the frequency-changer stage of a S.W. superhet, or that of a S.W. converter, together with the tuned aerial system. It is essential that the natural frequency of the aerial, plus the oscillator frequency, should fall exactly into the I.F. spectrum of the receiver, and to achieve this some juggling with the aerial and oscillator trimmers is necessary. Final attention can then be given to the I.F. trimmers. The variable condenser, C1,

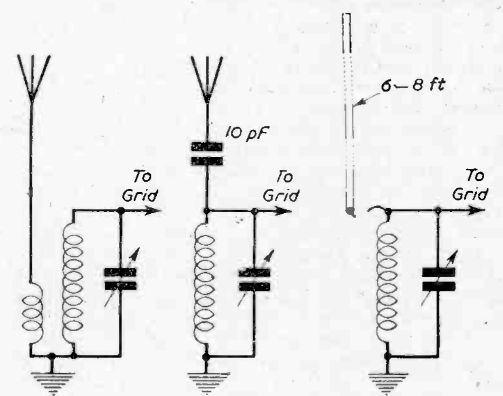


Fig. 1—An untuned aerial. *Fig. 2—Another form of untuned aerial.* *Fig. 3—A tuned aerial.*

in Fig. 4, is for the purpose of keeping the aerial tuned when the main tuning condenser changes frequency. It would be too much to ask the aerial to stay in tune while the main tuning condenser is swept through the arc from zero to maximum settings, so the auxiliary condenser is inserted to even things up. In the preliminary trimmings it should be set halfway, and it should have a capacity of about 50 pF.

This condenser is only necessary, however, if a ganged tuning condenser having properly shaped sections is used for tuning; if two separate condensers are used for signal and oscillator tuning,

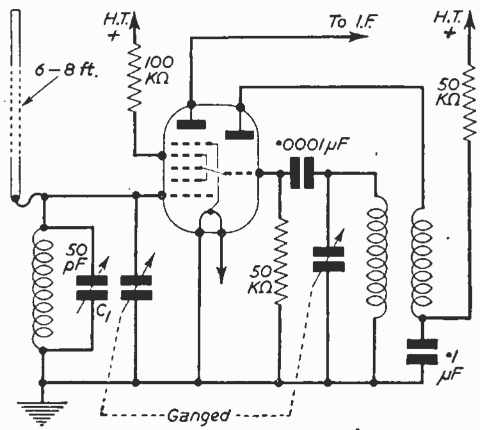


Fig. 4—Tuned aerial circuit in a frequency changer stage of a superhet or S.W. converter.

then it is obvious that the correction will be made when the station is tuned in, because the operator will set the controls to bring the intermediate frequency within the acceptance of the I.F. circuits.

Frequency

In the case of a straight receiver it is essential that the aerial circuit should be the same frequency as the inter-valve circuit or circuits, and the same considerations apply. As the main tuning condenser is swept through its arc the conditions for optimum working will gradually fall away, unless some means are provided for keeping the circuits in line. Thus we have the auxiliary condenser, which should be a real variable component and not a trimmer.

Another reason for using the auxiliary condenser lies in the question of wave-changing. If plug-in coils are used, or a coil-pack enabling several ranges to be obtained when changing over from one range to another, it would be unreasonable to expect the tuned aerial to "stay put" on several ranges. With an untuned aerial it is possible to arrange matters so that a fairly even response is attained on all wavebands, but this is not possible with a tuned aerial without compensation.

As before, these remarks only hold true when a ganged condenser is used; separate condensers find their own level.

What can we hope to achieve with a tuned aerial on these lines? As regards the phenomenal results, it is possible that phenomenal conditions obtained; but properly adjusted it can give results at least equal to those of a full-size aerial such as is normally used. A high, unscreened aerial is, of course, another matter. The normal aerial tries to compromise on all bands and succeeds in excelling in none. For amateur bands, especially, the tuned aerial is very useful.

A Test

As a test of whether the aerial is properly tuned, it may be touched at various points when signals should cease almost completely. If the signals are only slightly weakened when the aerial is touched, it is a sign that it is not properly tuned.

Another way is to try adding a short length of wire to that already existing, or to lengthen the aerial if it is an expanding one. Of course, it can then be retuned by means of C1, providing the length of wire added is not unduly great, and providing that the difference in frequency thus created between the signal and oscillator circuits is not greater than can be accepted by the I.F. circuits.

Large Sound Installation

ONE of the largest industrial sound equipment installations in Great Britain has recently been supplied to John Player & Sons, of Nottingham, by the General Electric Co., Ltd.

The installation consists of four 500-watt high-fidelity amplifiers, which feed "Music While You Work" programmes into some 500 loudspeakers distributed throughout the works of the world-famous tobacco firm, three amplifiers being normally in use with the fourth as spare.

The amplifiers and the associated control and gramophone-playing desk are located in the company's ex-A.R.P. control room. The desk was built by John Player's Works Department to designs prepared by the G.E.C.

Normally, music only is broadcast in the works, but a ribbon microphone is available for occasions when announcements are desired.

The wiring of this large installation required some 42 miles of wire, with a main 100-way cable leading up from the control room. The 80 loudspeaker circuits are grouped up and paralleled across the amplifier outputs, but there is also an elaborate cross-connection panel whereby any given loudspeaker can easily be connected to any amplifier. This arrangement allows changes to be made as a result of departmental expansion or rearrangement.

An interesting aspect of this installation is that it is linked to a small 60-watt amplifier which feeds 24 loudspeakers in a works situated in another part of Nottingham. The small amplifier is remotely controlled from the main installation and input is taken from the main equipment over lines rented from the Post Office, the level being attenuated to the point required by that authority.

A Low-power Hig

A FIVE-VALVE A.C. UNIT

By James

IN designing this amplifier the following points have been borne in mind : low power for small rooms, and restoration of the bass cut made during the making of records.

The circuit features include a bass amplifier circuit to amplify the bass with a maximum gain of 3 db at 400 cycles, increasing at the rate of 6 db per octave below 400 with a gain of about 18 db at 50 cycles. An amount of bass cut is incorporated in the main circuit so that the same control can be used for both loss and gain of bass within certain limits. Another point is that the circuit being primarily designed for bass cut, no treble lift is required, so a treble cut control is used.

The mains transformer used is an Elstone SR250 with an output of 250 volts at 80 mA. This limited the total mA of the unit, so those excellent little Mullard valves, the EL32s, were chosen, with

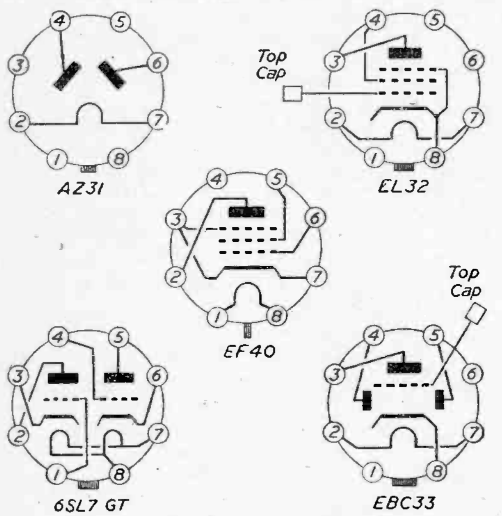


Fig. 1.—Valve-base connections.

a 6SL7GT in a Schultz balanced phase split circuit and an EBC33 as the bass boost valve. For sake of convenience an AZ31 was used for the rectifier but any other could be used equally well.

The Schultz phase split circuit lends itself very readily to amplifier design as it has two points of input at a phase displacement of 180 degrees between them. This means that the two points can be used with a single stage of frequency selective amplification between them, without any instability being introduced. Also, the stage so added does not load the other sections of the amplifier in any way, as do the more usual types of tone control where frequency selective amplifiers are used in parallel.

The bass boost amplifier consists of a 1 MΩ volume control in parallel with the variable part of the main volume control ; this ensures that the total amount of bass boost is varied as the volume is altered. The anode load of the valve (an EBC33 with the diodes connected to the cathode) consists of a 100 KΩ resistor, and a .01 μF condenser is joined between anode and earth. This gives an anode load that is inversely proportional to the frequency applied to the valve. The maximum gain of such a stage is about 18 with this type of valve, but as the impedance of the coupling condenser rises as the frequency falls, this high gain

The description and o
amplifier of very high
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rated at five watts for
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LIST OF COMPONENTS

V1 EBC33. V2 6SL7GT. V3 and V4 EL32. V5 AZ31.
Five octal valve holders.
One each potentiometers .5 MΩ, 1 MΩ, 100 KΩ.
Five 0.01 μF Metalmite condensers.
One 0.002 μF Metalmite condenser.
Two 1 MΩ ¼ W resistors. One 30 KΩ ¼ W resistor.
One 2 KΩ ¼ W resistor.
Three 100 KΩ ¼ W resistors, 10% tolerance.
Two .5 MΩ ¼ W resistors. One 330Ω 1 watt resistor.
One 30 KΩ 1 watt resistor.
One Elstone SR250 mains transformer.

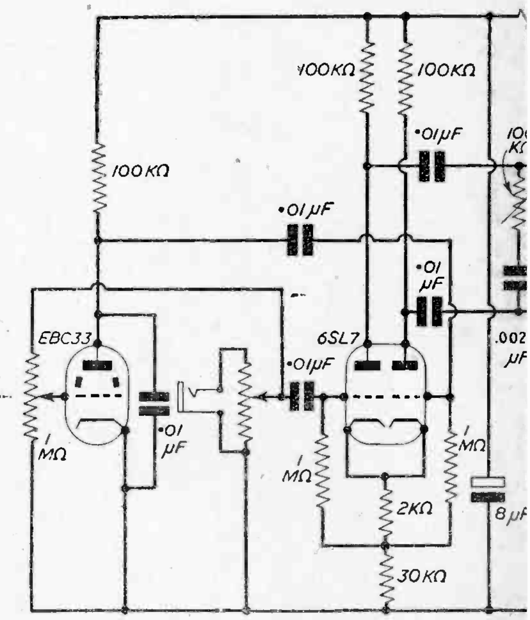

Fig. 2.—Theoretical circuit of the amplifier. Th

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RADIO OR RECORDS

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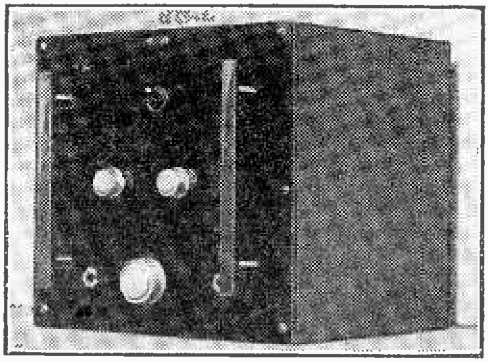
is to a certain extent lost in the later stages by the use of condensers which are of .01 μF so as to give an amount of bass cut when the bass boost stage is not in use.

Principle Involved

The Schultz phase split circuit can be used with any double-section triode so long as the voltage gain of the two sections is equal. In this amplifier I have used a 6SL7GT as they are readily available on the surplus market, but the Mullard ECC35 can be used just as well. The principle of the circuit, Fig. 1, is that the voltage applied to the control grid of one side causes a change in the anode current of one half of the valve. This current is turned to a voltage as it passes through RkL and a change of grid volts is applied to the second half by the grid condenser "holding" the actual grid at a steady potential, whilst the cathode potential changes in respect to the grid. This change causes a fall in anode current which tends



The completed amplifier for rack mounting.

to cancel out the change in the first half. The negative feed-back exerted by Rk and RkL to the first half of the valve is very nearly cancelled out by the positive feed-back from the second

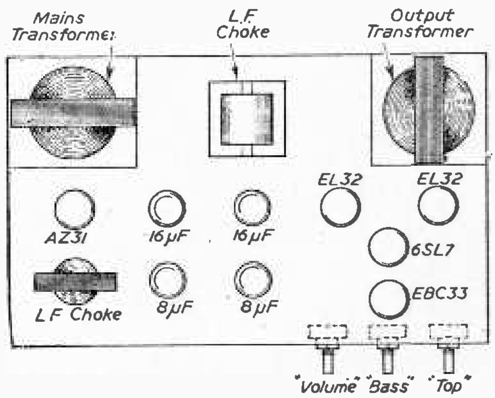
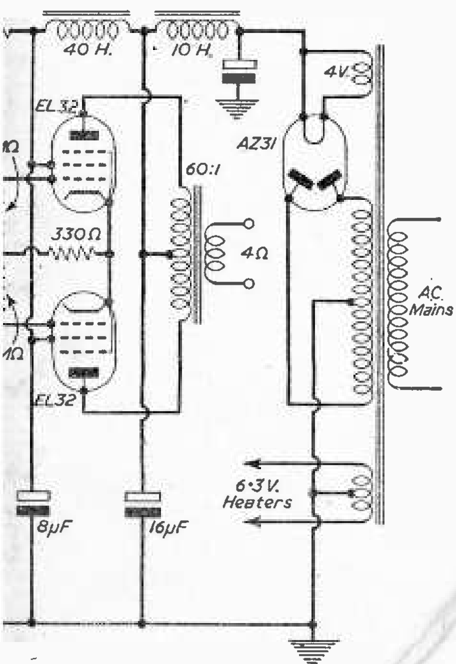


Fig. 3.—An alternative layout which may be used.

half of the valve. The output voltage from this circuit is taken from the two anode load resistors, which, by the way, should be as closely matched as possible. The circuit is of great use in all types of amplifiers including those for 'scopes, and gives an advantage of the harmonic contents being even at both anodes and, as the circuit is basically a negative feed-back one, very low.



nd volume control has a value of .5 MΩ.

LIST OF COMPONENTS (continued)

One Elstone MR/7 multiratio output transformer.
One 10 H 80 mA smoothing choke.
One 40 H smoothing choke (Radiospares).
Two 16 μF condensers (375V electrolytic).
Two 8 μF condensers (375V electrolytic).

FOR THE PREAMPLIFIER

One .22 MΩ ¼ W 10% tolerance resistor.
One 1 MΩ ¼ W 10% tolerance resistor.
One 2.2 KΩ ¼ W 10% tolerance resistor.
One 50 μF bias condenser.
One .1 μF paper condenser (350 volt).
One B8A valveholder. One Mullard EF40 valve.

The coupling between the 6SL7GT and the two EL32s is by means of two .01 μF. condensers; this, with a grid load of .5 MΩ on the final grids gives an amount of bass cut. For the bass fiend I would suggest that two .1 μF. condensers be used for coupling. The cathode resistor of the output valves is common to both valves and is of 330 ohms and one watt rating.

The output transformer is one with plenty of iron and was actually designed for a slightly more powerful amplifier, but was chosen as at very low frequencies more iron is required for a faithful reproduction. Whilst at this point I might add that in my opinion very many receivers and amplifiers are spoiled by the use of a transformer that has too little iron. It seems to be commonly thought that the maximum current referred to on output transformers relates to the value of standing anode current whereas it refers to the peak, i.e., the value when there are no volts on the grid of the valve. Take, for example, the EL32. The normal Ia is 32 mA., with a slope of 2.8, and a bias of -18 volts. This then gives a zero bias anode current of 32 plus (2.8 x 18) equals 82 mA. So that to be on the safe side, one with a maximum of 90 mA would be suitable, and such a transformer would be in order for either single-ended or push-pull stages using EL32 valves. Bearing this in mind, I chose the Elstone type MR/15 transformer as this has an ample current rating and is rated at seven to ten watts. I have been informed by the makers that these transformers are in rather short supply owing to the present armament drive and so may not be readily obtainable.

The speaker chosen was a 10in. one, as they are so readily obtainable these days, and for faithful reproduction of the low notes it should be mounted on a good baffle.

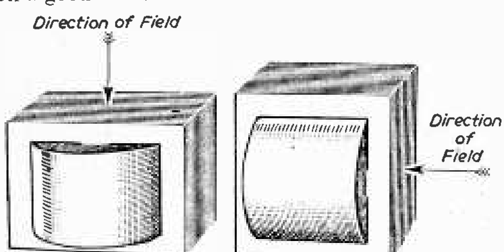


Fig. 4.—Mounting positions of transformers or chokes to avoid interaction.

Hum Level

In order to ensure that the hum level is low the amplifier is well smoothed with a pair of 16 μF condensers being used with a 10 H choke to supply the anodes; a 40 H choke is used on the screens with 8 μF, whilst the triode anodes (phase split and bass boost) are decoupled with a 30 KΩ resistor and an 8 μF condenser.

All the resistors used in the amplifier are of the ¼ W type with the exception of the 330 ohm and the 30 KΩ, which are 1 watt. As the mains transformer is of the 250-0-250 type, the maximum rectified voltage is 350 volts, so that all the condensers, including the electrolytics, can be of the 375 volt types. The actual condensers used for coupling and tone control were T.C.C. Metalmites, as these are very small and efficient and give the underside of the amplifier a neat appearance.

In order that any stray hum pickup may be avoided, the heater wires should be earthed as near the centre as possible on the SR/250 transformer. The valves should be well spaced and a layout as shown in Fig. 3 is very effective. The actual measurements will, of course, vary according to the type of chassis being used. Another point to be watched is, if you must place the output transformer next to or against the mains transformer, mount the latter on its end with the output transformer as shown in Fig. 4, and in the original model as shown in our cover illustration.

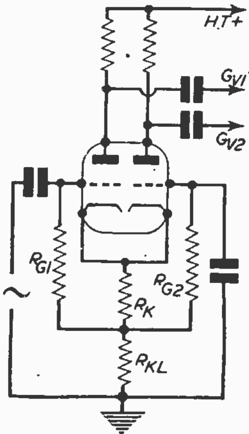


Fig. 6.—The phase inverter stage.

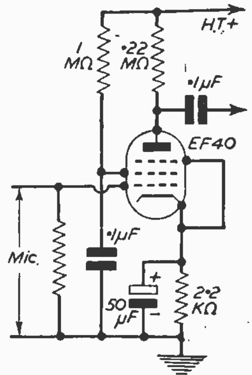


Fig. 5.—Circuit of a single stage pre-amplifier.

As the total drain of the circuit is 75 mA, a pre-amp circuit can be used if so desired; such a circuit is shown in Fig. 5 and draws about 1½ mA. The valve is one of the Mullard 40 series, which indicates that the base is a B8A. The value of the resistors is rather critical and should be within 10 per cent. and they can be of the ¼ W types.

The amplifier has an output impedance of 8,000 ohms, and to match this to a standard 4 ohm speaker a 66-to-1 (centre-tapped) output ratio is required. At 5 watts output the overall distortion at 1,000 cycles should be well under 0.25 per cent., which means that the amplifier is well in the High Fidelity class.

Compensated Volume Control

SOME ARGUMENTS FOR AND AGAINST TONE CONTROLS AND FOR A MODIFIED TYPE OF VOLUME CONTROL

By W. J. Delaney (G2FMY)

THE letter from Mr. Harding published in our October issue concerning the usefulness of building quality amplifiers has aroused an enormous amount of interest among our readers, which shows that the majority of readers do consider the problem of quality reproduction as a major issue. In past articles I have often stressed the problems of "quality," covering subjects such as the loudspeaker, the cabinet associated with it, tone controls, etc., and whenever any of these subjects crops up there is always a stream of correspondence to follow, and the division of opinions is very marked. The problem now arising is that concerning the general form of reproduction, or what might be termed "quality." We have published "quality amplifiers" and various tone control circuits, but always there is the question as to what "quality" means. One listener requires a receiver which gives heavy bass reproduction, whilst another requires a high-pitched output. A receiver designed to produce the latter type of reproduction might fail to satisfy another reader simply because the room in which it is used is heavily loaded with soft-furnishings and thus "damps" the reproduction and makes it sound lifeless. All of these are, of course, quite standard problems and can be overcome for those who do not object to them by tone-control networks. There is, however, quite a wide objection to tone controls as such because they have to be adjusted to each item, and one cannot sit back and enjoy a musical programme unless they are set to "normal," in which case they might just as well not be included. If they are adjusted to boost the bass on one musical item that might be too heavy on another tune, and so on. All of this may be adjusted by the individual but there is still one point which does not appear to have received the attention which it deserves.

Loudness Control

Listeners vary in their perception of the high notes—age playing an important part in this. Some listeners, as already mentioned, prefer a deep tone of reproduction, whilst others prefer a high-pitched quality. But all listeners appear to agree on one point, and that is the musical balance at various degrees of volume. For instance, suppose one has a really good 10-watt quality amplifier (without tone control) and sets this for maximum volume on some particular orchestral number. The reproduction will probably satisfy, but whilst the item is still being played turn down the volume and note carefully the balance between the top and bottom ranges. It will be found in practically every case that when at minimum volume the bass appears to be very much reduced compared with the top. In some cases, of course, this will be due to an electronic fault arising from the particular type of volume control used, but there is an effect which is due to the function of the normal hearing sense. This means that a different musical balance is required at varying levels of "loudness" and in turn this means that a "loudness control" is needed. It might be argued by devotees of the tone control that such a control will enable the required effect to be obtained without difficulty, but against this claim must be set the fact that instead of just turning down the volume control one also has to reset both tone controls (or perhaps four in a comprehensive top-lift, top-cut, bass-lift, bass-cut circuit). The normal volume control is simply a potentiometer in the grid circuit of an L.F. stage in which the signal is developed across the potentiometer and the grid of the following valve is connected to the slider so that any desired portion of the signal voltage may be tapped off the control (Fig. 1). Electrically, it will be seen that this can vary the grid circuit impedance unless special precautions are taken, and this in itself can cause bass cutting and other distortion. Obviously, then, we could avoid this trouble by ganging this volume control with one or other of the normal tone-control circuits, and it is a fairly simple matter to arrange the circuit of one's choice to obtain this desired end. Two-gang controls with various values are not difficult to obtain but the circuit does not appear to be very well known, or popular.

Triple Control

The I.R.C. of America have developed a very ingenious control of this type which lifts both bass and top as the volume is turned down, but unfortunately it calls for a three-gang control and this is not generally available, so far as we can trace, in this country. The circuit used in this arrangement is given in Fig. 2, and for those readers who wish to try out the idea separate controls could be used and adjusted carefully to more or

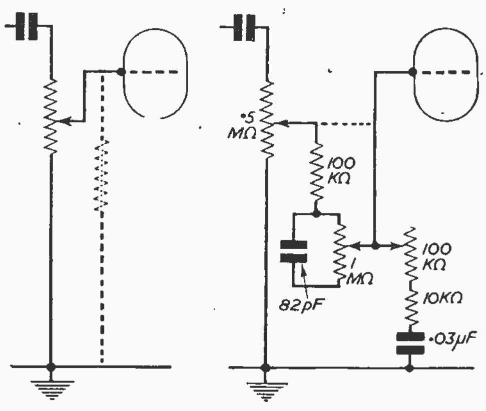


Fig. 1 (left).—Standard volume control. Fig. 2 (right).—Additional components for a compensated volume control.

less equal settings to see just what the effect is. I had a three-gang control of the required value made up for test purposes and it does make an audible difference to the quality at low settings of the volume control. As, however, with all tone controls in which bass boost is effected, great care is required to avoid hum. The moment the bass is lifted up comes the hum, and it was found that this particular circuit had to be totally enclosed in an earthed metal box, and—what proved the greatest drawback—it had to be mounted on the amplifier. Where one uses a separaté amplifier with combined power pack, and this is mounted on the bottom of a radiogram cabinet with the radio unit, pre-amplifier, etc., up at the top of the cabinet this proves a great drawback. Even using coaxial lead to connect the two sections together, the placing of the " loudness control " on the amplifier end of that lead cuts down the hum to an almost inaudible level, whilst it could not be tolerated when the control was at the other end of the lead. Another drawback is that some amplification is lost through the circuit, and a further stage of L.F. amplification may have to be added—which in turn may aggravate hum troubles.

Those who may try out the idea with separate controls and find it worth including in their equipment may obtain the desired " one knob " control by utilising some form of gearing to control the three potentiometers at the same time.

Perhaps other readers have experimented with similar ideas and may have found some arrangement which they would like to pass on to others. If so, we should be glad to receive details.

Industrial Vibration Generator

MESSRS GOODMANS INDUSTRIES are now producing a vibration generator (Model 390A) which was on show at the recent Radio Exhibition.

Briefly, it consists of a moving-coil armature operating in the field of a large permanent magnet. The neck of the armature terminates into a connecting rod having a ¼in. B.S.F. threaded hole for load fixing purposes. Provision has also been made for forced air cooling should the need arise.

This instrument can be used to apply controllable values of acceleration—commonly referred to as so many " g's " to prototype equipment, or instruments, either during the development stages or as a pre-production behaviour analysis. Inherent weaknesses, design requirements are made quite clear when such equipment or instruments undergo well defined values of acceleration.

One use is that in which radio valves are subjected to vibration during microphony examination; another enables a piece of radio equipment to undergo vibratory motion.

The reader will be able to visualise any particular product undergoing tests by means of this instrument. Modifications previously revealed only during the working life of the product can now be discovered in the laboratory during the prototype stage by the searching tests made possible by this instrument, the initial outlay being recovered many times.

Other applications come readily to mind:

(1) Material fatigue analysis.
(2) Hairspring torque inspection.
(3) Liquid agitation.
(4) Application of vibratory motion to move powders, small articles, etc., along ducts.
(5) Calibration of accelerometers.
(6) Biological research.
(7) Sieving of small articles for size.

The following technical details apply:

Size.—6½in. diameter (fixing flange 6½in. square). 6¼in. high, ¼in. B.S.F. threaded hole in armature.

Weight.—26 lb.

Finish.—Black Rivelling Enamel.

Stroke.—½in. total excursion up to ⅜in. sinusoidal wave form.

Impedance.—Varies with the frequency and load between 7 and 16 ohms.

Power capacity.—Force factor 4.8 lb. per amp. 2 amps. uncooled, 4 amps. with forced air cooling (continuous rating).

Natural frequency.—About 20 c.p.s.

Flux density.—11,000 gauss.

Stray magnetic fields.—Operating zone = less than 100 gauss. All other regions less 75 gauss at ⅛in. distance.

Safe overloading up to 2 mins.—Uncooled = 4 amps., cooled = 5 amps.

Driving equipment.—For laboratory use, a beat frequency oscillator and audio-frequency amplifier are required. Using the vibrator without air cooling, a 40-watt amplifier would be necessary, and with forced air cooling, 120-watt amplifier.

Locking device.—Provision has been made to lock the armature during load fixing. This takes the form of a steel rod inserted through the armature neck and held in place via terminal heads.

Dynamic mass of moving system.— = .29 lb.

Maximum " g " unloaded.— = 67 g (continuous rating) 84 g (peak rating).

" g " units per amp. (unloaded) = 17

" g " units per amp. (with a 2 lb. mass) = 2.1.

Two other models are in hand, one at the prototype stage, the other being finalised on the drawing board.

The prototype is a small unit model specially designed for hairspring torque testing and liquid agitation in optical cell experiments. The model at the drawing board stage will be twice the size of the present model No. 390A.

Delivery at the moment can be quoted as six to eight weeks upon receipt of order. Price, £65.

Radio Receiver Design at V.H.F.—4

MORE ABOUT TUNED CIRCUITS

By G. P. Lowther

(Continued from page 18 January issue.)

AN alternative to the use of a variable tuning condenser is to employ a variable inductance. By this means, full gain is maintained over the tuning range, while hand-capacity is eliminated. The simplest method of achieving this is to insert into the inductance a metal plunger which can be screwed in and out. This acts as a short-circuited turn and reduces the inductance when screwed in. It should be noted that if the Q is not to be reduced, the plunger must be of high conductivity material, e.g., copper.

If inductance tuning is used with both series and parallel-tuned circuits, so eliminating the tuning capacity C_t, and if $C_g = C_a$ the same performance as regards gain and band-width is obtained from each circuit.

Circuits employing inductive coupling as in Figs. 5b and 8 may be used at V.H.F., but their application is limited. In Fig. 5b, L_c and C_a tend to resonate, while the tuned circuit L_t, C_t, C_g is damped by the grid input impedance represented by R_g the performance thus deteriorating as the frequency is increased. The principal application of this method of coupling is to provide low-impedance input or output circuits, e.g., aerial coupling when it is not desired to "tap down" a tuned circuit.

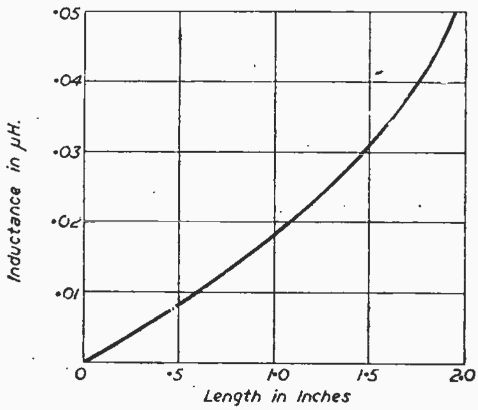


Fig. 16.—The inductance of a straight 20 s.w.g. copper wire.

Double parallel-tuned circuits as in Fig. 8 are usually unsatisfactory above about 70 Mc/s or so, as the required degree of coupling may be difficult to obtain owing to the small size of inductances used, and in any case is largely capacitive unless an electrostatic screen is inserted. Since the coupling is so indeterminate, theoretical analysis is pointless. This type of coupling finds its main use in high intermediate frequency amplifiers.

The couplings illustrated in Figs. 9 and 10 are suitable for wide-band amplification, giving band-widths of 20 Mc/s or more with the minimum of amplitude distortion. Design data will not be given as it is of interest principally to the professional engineer, but it is, nevertheless, quite straightforward.

Both series and parallel tuned circuits may be "staggered," i.e., spaced over the required frequency band in such a manner that the overall response is flat. For optimum performance the circuits should be spaced more closely together and should be of higher Q at the edges of the band. Fig. 15 illustrates this.

The disadvantage of this method is the more complicated alignment procedure involved, and the difficulty of obtaining sufficiently high Q circuits at the edge of the band.

Spurious Resonances

It is a somewhat disturbing thought that what are termed "parasitics" at lower frequencies are of the same order as the signal frequencies with which we are here dealing. Fortunately, the greater damping usually prevents oscillation, but the resonance curve may be seriously distorted and spurious peaks and dips may appear. The reason for this is that components tend to resonate with the wiring and with stray capacities. Fig. 16 shows the inductance of straight 20 s.w.g. copper wire.

The use of series-tuned circuits will, of course, obviate the problem of inductance in anode and grid leads, etc., as they form part of the tuning inductance. Where decoupling condensers are concerned, however, particular care must be taken. The following table shows the inductances required to resonate at 100 Mc/s with various values of capacitance.

Capacitance in pF	Inductance in μH
20	0.13
50	0.05
100	0.025
200	0.013

Normally it is all to the good if the decoupling condenser resonates with the lead inductance as the overall impedance is then practically zero, but if the capacitive reactance is considerably less than the inductive reactance (i.e., the capacity is too large) effective decoupling will not be obtained, e.g., suppose that a decoupling condenser of 300 pF is used at 100 Mc/s with a lead length of 2in. (a common figure at lower frequencies). The capacitive reactance $= 5\Omega$, and the inductive reactance $= 32\Omega$; hence the effective impedance to earth $= 27\Omega$, a value which would certainly not decouple a cathode or filament very effectively. This shows the importance of keeping all leads as short as possible and limiting the value of decoupling condenser to between 100 pF and 300 pF, depending upon the frequency. All condensers possess self-inductance and care must be taken to use midget types suitable for V.H.F. working. The minimum inductance of such condensers is about 0.01 μH.

Chokes may introduce spurious resonances and should be used as little as possible, the exception being to decouple filaments where series resistance is inadmissible. The rule of thumb which states that a choke should be $\lambda/4$ long is useful at V.H.F. but carbon resistors are to be preferred to chokes. A value of 1,000Ω or 2,000Ω is usually adequate. (Inductance of a 75Ω carbon resistor=approximately 0.01 μH.)

Losses

Apart from dielectric losses which have already been mentioned, the main source of loss in tuned circuits is low Q due to increased H.F. resistance. Coils should be made of large diameter copper wire or tube below about 100 Mc/s-150 Mc/s (large is, of course, a relative term; the small value of inductance does not permit the use of coils larger than about 1½in. overall diameter), while above this frequency copper strip is sometimes more convenient if the inductance is very small, as the inductance of strip is less than that of a corresponding length of wire. It is, however, quite possible to use single-turn coils of, say, 16 s.w.g. wire up to 250 Mc/s or 300 Mc/s with series circuits. If the highest possible Q is desired, the wire or strip may be plated with silver.

It is customary at lower frequencies for all earth leads to be taken to one point per stage in high gain circuits, but this is impossible at V.H.F. owing to the long leads that would be involved. All earth leads should, therefore, be taken to the nearest point, and differences in potential on the chassis (leading to feedback which may be either positive or negative) due to earth currents, may be minimised by making the chassis of copper; tin plate or steel is unsatisfactory above about 150 Mc/s. In professional apparatus it is sometimes necessary to silver plate the chassis.

Valve Design and Technique

1. Perhaps the most obvious factor in valve design at very high frequencies is the minimisation of input and output capacities, since these determine the highest frequency to which the circuit will tune. These capacities may be decreased by increasing the electrode spacing or reducing the size. In high slope valves the grid-cathode capacity is normally greater than the anode-cathode, or output capacity, since very close spacing of grid and cathode is necessary to obtain a high mutual conductance. As will be shown later, this is very necessary if reasonably high gain is to be obtained, and so, in practice, the reduction of inter-electrode capacities is achieved by reducing the area of the electrodes and by screening leads to the valve base, which are also kept as short as possible.

(*To be continued.*)

Mullard Sound-on-film Equipment

THE introduction by Mullard Ltd. of a range of highly efficient miniature valves and photocells has recently made possible notable advances in the design of 16 mm. sound-on-film equipment in this country.

In the design of 16 mm. (sub-standard) sound-on-film equipment there are three basic requirements to consider: the equipment should be as small and compact as possible, compatible with overall efficiency and ease of operation; it should be of the lightest possible weight for ease of transportation; and the amplifier should give adequate output, free as far as possible from hum and other forms of distortion.

Mullard valves and photocells, specially suitable to meet these requirements, comprise the following types:

EF40—A.F. Pentode (Amplifier).
ECC40—Double Triode (Phase Splitter, etc.).
EL41—Output Pentode.
EZ40—I.H. Full-wave Rectifier.
52CG, 55CG, or the new miniature 90CG Photocells.

The EF40 is particularly noted for its low microphony and low hum characteristics and is thus ideal for use in the first amplifier stage of the equipment for amplifying the minute signals received from the photocell. Another advantage of this valve is that it is of single-ended construction, thus avoiding the necessity of wandering and troublesome leads. This feature, coupled with the fact that the valve is of small size, helps to reduce the overall dimensions of the amplifier.

Hum Level

The average magnetic hum level of the EF40 is low, being of the order of 5μV. The good hum and microphony characteristics are due, among other things, to the bi-filar heater used and the rigid all-glass construction employed. In order to take full advantage of the low-hum characteristics of the EF40, however, it is desirable to use valve-holders made of materials such as silica-loaded polystyrene, ceramic or nylon-filled bakelite, which have a high insulation resistance.

A typical valve line-up consisting of a single EF40 as voltage amplifier, followed by an ECC40 double triode as voltage amplifier/phase splitter, driving two EL41 pentodes in push-pull, is capable of providing an output of 10 to 12 watts.

The EL41 is also suitable for use as an oscillator for energising an exciter lamp of the 6-watt class at radio frequency. Some makers of 16 mm. sound-on-film projectors use this particular system to reduce the weight of the equipment and at the same time overcome the possibility of hum being caused by the exciter lamp operating at mains frequency.

Some of the British 16 mm. sound-on-film equipments recently built around this series of Mullard valves and photocells measure less than 12in. x 6in. x 12in. Sound projectors of this kind are introducing a new phase in kinematography. They are extremely easy to erect, and the complete outfit, including projector, loudspeaker and reels, can be carried in two small, lightweight cases. This means that almost any room, hall or office can be converted into a cinema in a matter of a few minutes.

A U.H.F. Receiver

A THREE-ACORN-VALVE SUPER-REGENERATIVE A/C MODEL

By P. W. Moir

ALTHOUGH there are nowadays many interesting transmissions taking place at ultra high frequencies, the construction of an efficient receiver for these bands presents quite a problem to the constructor who has no access to expensive test equipment. As the superhet circuit is nearly always a tricky one to get going on U.H.F., many constructors use either the straight or super-regenerative type. The straight receiver suffers from various drawbacks at U.H.F. owing to the difficulty of obtaining sufficient amplification with the required stability, while the super-regenerative, though far more sensitive, has a bad name for creating interference. However, radiation of interference can be effectively got rid of by using an R.F. stage in front of the super-regenerative detector, when the result is a stable and extremely sensitive receiver.

Circuit

The circuit to be described consists, therefore, of an R.F. amplifier stage employing an acorn valve type 956, followed by another acorn type 955 acting as a self-quenched super-regenerative detector. The detector output is fed into an A.F. amplifier and passed to phones or speaker in the usual way. The first A.F. valve is a 6J5, which can be used on its own for headphone reception, or coupled to a second A.F. valve, i.e. a 6V6, for speaker reception, if required.

Components

The acorn valves were chosen for their low cost and high efficiency; they can be obtained as "new surplus" for as little as 2s. 6d. each. The tuning condensers are "butterfly" type split stator, with low-loss insulation and silver-plated vanes. In the original receiver they were taken from an ex-R.A.F. receiver type R1147B, but other types of equal capacity would serve equally well.

The other parts are perfectly standard in every respect; the R.F. valveholders, however, should be of the ceramic type. The plug-in coils may be tightly wound on a ½in. former, and then allowed to "open out" as the former is removed. They can be mounted on polystyrene or ceramic plug-in coil supports, or soldered on to the tuning condensers if only one band is required. It is recommended that a good slow-motion dial be used for the detector tuning—the R.F. stage tuning need only have a normal type of direct-drive dial.

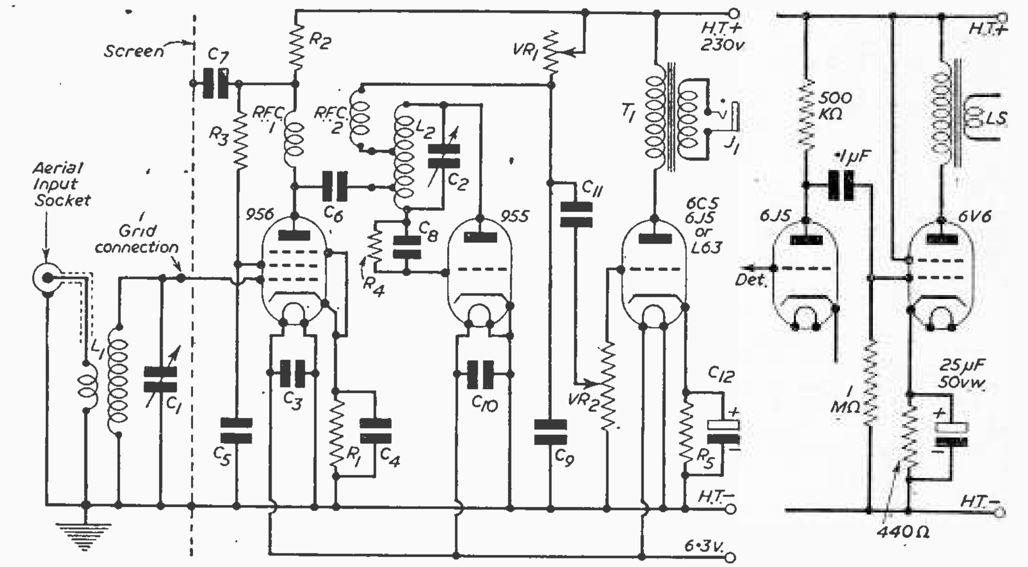


Fig. 1.—Theoretical circuit and alternation L.S. output.

LIST OF COMPONENTS

C1, 2=50 μμF "Butterfly" type.	C8=50 μμF S.M.	R1=150 Ω (½ W.).	VR1=50 k Ω.
C3, 4, 5, 7, 10=500 μμF mica.	C9=6,000 μμF mica.	R2=3-3 k Ω (½ W.).	VR2=500 k Ω-1 M Ω.
C6=10 μμF S.M.	C11=.05 μF 450v. tubular.	R3=150 k Ω (½ W.).	T1=Headphone matching trans.
	C12=25 μF 25v. wkg. elec.	R4=3 mg Ω (½ W.).	SK1 "Pye" socket.
		R5=200 Ω (½ W.).	

A good idea of the required layout can be gained by study of the sketch. It will be noted that the R.F. valve has its grid connection at one extremity of the envelope and the anode at the other. Use is made of this feature for screening purposes by mounting the valveholder vertically on the inter-stage screen. The detector valve-holder is mounted on pillars to bring it up to the same height as the R.F. valveholder, to obtain short leads. For the same reason, the two tuning condensers are placed as near as practicable to the respective valveholders. The cathode resistor and condenser should be connected as closely as possible, and the 10 pF. coupling condenser should not have more than about ¼in. of lead at each end when in position. All other components associated with the R.F. and detector stages should be connected with extremely short leads; the layout suggested will be found to assist in the wiring up of the unit.

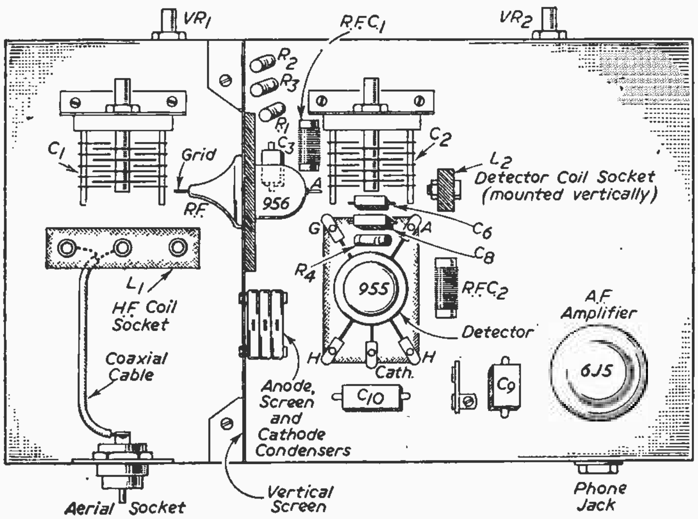


Fig. 2.—Pictorial layout of the receiver.

Wiring

Keeping all leads carrying R.F. current as short and direct as possible will be found to have an enormous effect on the performance of a simple receiver of this type, although it calls for far more care in design and construction. It has been found that earthing all earth leads for one stage at a common point tends to improve the stability of a receiver at these frequencies, and this procedure is quite easy with the layout shown.

No power pack is shown in the circuit diagram as this item can be of perfectly conventional design. It provides 6.3 volts at about 2 amps. for the heaters, and 230-250 volts for H.T. battery operation is quite feasible; and although it has not been tried with the original set, there should be no trouble about operating the R.F. and first A.F. valves from about 120 volt H.T. and a 6 volt battery for heaters, but this is provided that the reader does not require operation to be on at loudspeaker.

Aerial

With regard to the aerial, a simple half-wave type cut for the frequency most used is about the best scheme. This should, of course, be mounted as high as possible and well clear of any obstructions.

If the reception of television sound is required the aerial should be the normal vertical dipole plus reflector and directors if needed. It would be advisable to make the aerial lead-in of good quality co-axial cable, about 65 or 70 ohms. In areas of high field strength, fair results may be obtained by the use of a normal wire aerial, but it must not be too long.

Operation

When switching on the set, a loud hiss should be heard in the phones. This shows that the detector is "quenching", or operating correctly. The "quench noise" may be controlled by the 50 kΩ variable resistor. This should be set for maximum sensitivity. If the detector fails to operate correctly, a change of valve may be found to improve matters. The self-quenched type of circuit is rather critical and small variations in valve characteristics may be sufficient to prevent it functioning. The .006 μF condenser controls the quench frequency, and this may have to be altered slightly to obtain best results.

Range in Megacycles	40-70	70-100	100-150
Diameter	¾"	½"	½"
Number of turns L_1 Primary	4	2	2
Number of turns L_1 Secondary	10	6	4
Number of turns L_2	10	6	4
Anode tap (Turns from Grid end)	2	1	1
R.F.C. tap (Turns from Grid end)	5	3	2

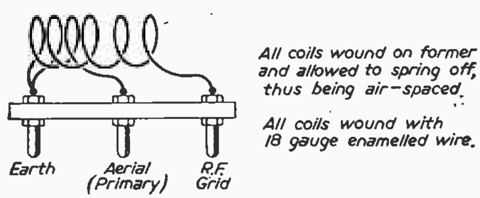


Fig. 3.—Method of winding L_1 and coil-winding data.

J/RA/2. 10-12 WATT'S CHASSIS AMPLIFIER
Uses an L63 feeding 2 KT61s in push-pull. Rectifier type U50. Size: 6in. x 17in. on 2in. chassis.
LASKY'S PRICE £7/19/6 Carriage and packing 10/- extra.
Send 3d. stamp for further details of J/RA/2 Amplifiers

FILAMENT TRANSFORMERS
All primaries 230 volts 50 c.p.s.

FIL/2. 6.3 v. 1.5 a.	... ... Price	6/11
FIL/3. 6.3 v. 3 a.	... ... Price	9/6
FIL/4. 2 v. 2 a....	... ... Price	4/11
FIL/5. 6.3 v. 4 a.	... ... Price	12/6

Special Transformer. 30 volts at 2 amps. with the following tappings:—3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 and 30 volts ... ... Price 19/6
All fil. trans. 1/- extra per item postage.

WEARITE I.F. TRANSFORMERS Type 550
Permeability tuned. 445-520 Kc/s. Type 551. Critically coupled, with top grid connection. Type 522. Closer coupling for feeding diode circuit. Q115, inductance 700 microhenries, at 465 Kc/s.
Band width of each of the above transformers is 7-20 Kc/s. at 2-20 Dbs. Size:—3½in. high. 1⅜in. square. Supplied with fixing screws and nuts.
LASKY'S PRICE 6/6 each. **12/6** per pair.

COLLARO AUTOMATIC RECORD CHANGERS
Model RC.500. Magnetic pick-up £11/15/7
Model RC.500. Xtal pick-up... £12/3/0
Model RC.511. 3 Speed, with dual purpose pick-up head ... £15/10/6

DECCA GRAM MOTORS
Single Speed £3/14/4
Three Speed £7/3/4

COIL PACK SCOOP
No. 1. 3 Wavebands. 12-35 metres; 35-100 metres; 200-550 metres. ¼in. spindle. 1⅛in. long wavechange switch. Completely assembled and wired. Size: 4in. x 4in. x 3in. BRAND NEW.
LASKY'S PRICE 19/11 Circuit available price 1/-. Postage 1/- extra.
No. 2. Midget Coil Pack. 3 wavebands. Standard long, medium and short. ¼in. spindle, 2in. long wavechange switch. Completely assembled and wired. Size: 3⅛in. x 1⅛in. x 2⅛in. BRAND NEW.
LASKY'S PRICE 27/6 Circuit available, price 1/-. Postage 1/- extra.

ALL OTHER TYPES AND MAKES OF COIL PACKS AVAILABLE
Osmor, Weymouth, Wearite, etc., etc.

EPICYCLIC DRIVES
For ¼in. spindle. Standard reduction.
LASKY'S PRICE 1/6 each. Post 4d. extra.

RECTIFIERS
Type RM1. 125 volts at 60 m.a. Price, 3/11. Post 4d.
Type RM2. 125 volts at 100 m.a. Price, 4/3. Post 4d.
Any number can be used together, either in series or parallel.

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3in.	12/11	8in. ...	14/6
5in.... ...	12/6	10in. ...	28/6
6½in.... ...	13/6	12in. ...	75/-

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AN ALL-WAVE RADIO RECEIVER
5 Valve s'het. Not a kit, but a factory-built job, fully assembled, aligned and tested. For A.C. mains, 200-230 volts. Features include:—5 new Brimar valves. 8in. p.m. speaker, variable tone control, large edgelit dial 7½in. square, 4 watts output, sockets for p.u. and extension speaker, 465 Kc/s. I.F., A.V.C., 2 speed tuning.
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Chassis, less valves and speaker,
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Walnut plastic cabinet. Size:—19in. wide, 10in. deep, 12½in. high.
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Send for full details, circuit description and photographs.

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8 mfd. 450 v.w. ...	3/-
8 x 8 mfd. 500 v.w. ...	5/3
12 mfd. 50 v.w. ...	1/3
16 mfd. 450 v.w. ...	4/11
16 mfd. 500 v.w. ...	5/3
16 x 16 mfd. 450 v.w. ...	5/6
24 mfd. 450 v.w. ...	6/11
25 mfd. 24 v.w. ...	1/11
20 x 40 mfd. 350 v.w. ...	6/11
32 mfd. 450 v.w. ...	5/11
32 mfd. 500 v.w. ...	6/6
32 x 32 mfd. 350 v.w. ...	5/6
50 mfd. 12 v.w. ...	1/9
50 mfd. 50 v.w. ...	3/9
50 mfd. 350 v.w. ...	4/11
55 mfd. 350 v.w. A.C. ...	17/6

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THE R1155 RECEIVER FOR A.C. MAINS
Receiver R1155 with 7 valves, 5 wavebands, 18-7.5 mcs. (17-40 m.), 7.5-3 mcs. (40-100 m.), 1,500-600 kcs. (200-500 m.), 500-200 kcs. (600-1,500 m.), 200-75 kcs. (1,500-4,000 m.), SM Drive BFO, etc., etc. Dim.: 16½ x 9 x 9ins.
POWER OUTPUT PACK with 2 valves 8in L.S., etc., etc. Dim.: 14 x 14 x 7 ins. Complete with linking cable and circuits.
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APS-13 CHASSIS
Less valves, and partly stripped by M.O.S. Transmitter section removed, contains 7 tropicalized 30 mcs. I.F.T.dynamotor, B7G and other valveholders, relay, etc., etc. Dim.: 15½ x 7½ x 7ins. Wgt.: 12½ lbs.
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COMMAND TRANSMITTER CHASSIS
Partly stripped by the M.O.S., less valves, coil winding, crystal and dynamotor, but otherwise fairly intact. A fine basis for ideas in V.F.O. or Tx. Original valve types 2/1625, 1626, 1629. Conversion suggestions and circuits supplied. In aluminium case. Dim.: 7½ x 5 x 8½ ins. Wgt.: 8½ lbs.
CLYDESDALE'S PRICE ONLY 15/- POST PAID

S-440-B V.H.F. TRANSMITTER CHASSIS
Partly stripped by the M.O.S., less valves, tuning coils and crystal, but otherwise fairly intact. A fine basis for V.H.F. Tx. or 144 mcs. rig. Original frequencies 85-98 mcs., valve types 3/RK34, 2/6N7, 6V6. Housed in louvred case, finished grey crackle. Dim.: 14 x 8 x 7ins.
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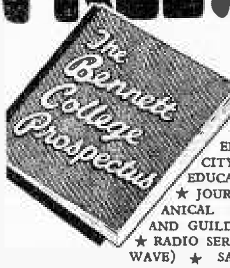

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TRADE NOTES

Southern Radio Tape Recorder

THE S.R. Magnetic Tape Recorder is designed to record sound on iron oxide coated tape ¼in. wide with a high degree of fidelity. The tape itself is obtainable direct or from any reputable radio dealer and is supplied in 7in. diameter reels of 1,200ft., giving a playing time of approximately 33 minutes.

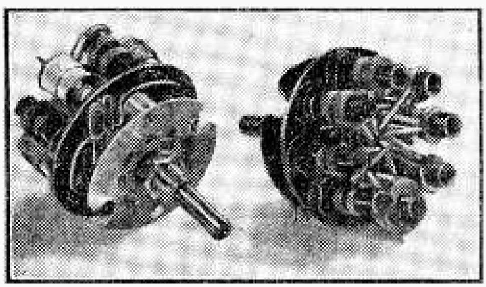
The S.R. Recorder will faithfully record speech via a microphone and, when connected to the extension loudspeaker terminals of a radio set, will reproduce the chosen programme of speech or music. In addition, when using a telephone attachment it will record both sides of a telephone conversation. Incidentally, this attachment does not involve interference in any way with the telephone itself, being simply a stand on which the telephone is placed.

Recordings made on the S.R. Recorder will keep indefinitely and chosen sections of the tape may be cut off and joined together to make up a reel giving 33 minutes of uninterrupted playing!

The well-made cabinet is finished in sycamore or walnut veneer and is highly polished. Measurements are: width 16¼in., depth 14¾in., and height 9¼in., and the instrument is designed to operate from A.C. mains of 200-250 volts only. Price complete, £45.0.0. Telephone attachment, £3.3.0. —**Southern Radio (Worthing) Ltd., Dominion Road, Worthing, Sussex.**

Midget Coil Turrets

TWO novel midget coil turrets are illustrated below and are ideal for the construction of midget receivers. They are intended for use in a superhet circuit, and one is designed for use with a ganged condenser of the usual type, whilst the other is intended to provide four pre-set signals and does not, therefore, call for a ganged condenser. The four coils on this unit are wound to cover the following four bands: 1,000-1,620 kc/s, 680-1,220 kc/s, 568-850 kc/s and 150-280 kc/s, so that any three medium and one long-wave station may be pre-selected. The other unit is a three waveband arrangement covering 150 kc/s to 410 kc/s, 620 to 1,560 kc/s and 6 to 19 Mc/s. The I.F. for these coils is 465 kc/s and it is recommended that the Polar C7302/7A 2-gang condenser be used with the three-waveband unit. The complete units measure only 2in. overall diameter and the behind-panel clearance required is approximately the same. The spindle provided is roughly 1in. in length. The coils are wave-wound Litz (except for the bare wire air-spaced short-wave ranges) and are of the dust-iron core type. They lend themselves ideally to the construction of midget receivers, and the four-station unit, type C.T.9, costs 39s. 6d., whilst the three-range unit, type C.T.10, is 52s. A complete receiver circuit and leaflet of instructions is supplied with each unit, which is neatly packed in a cylindrical container.—**Stern Radio Ltd., 109, Fleet Street, E.C.4.**



The midget coil turrets as supplied by Stern Radio Ltd.

Improved Nife Inspection Lamp

A NEW and improved version of their well-known self-contained portable inspection lamp has just been produced by Nife Batteries, of Redditch, Worcs. Capable of projecting a long-range, high candle-power beam, the equipment, type P.6, was designed primarily to meet the rigorous working conditions encountered in the inspection of overhead power transmission lines.

Many improvements in detail have been made, and the new lamp is a worthy successor to those already in use all over the world by railway and constructional engineers, police and fire services, transport, water, electricity, gas and sewage undertakings, and in industry and agriculture generally.

The equipment consists of a 6-8 volt nickel-cadmium alkaline battery of miner's lamp design, carried on the back of the operator and connected by flexible cable to the compact, robustly constructed projector using a double-filament high-efficiency bulb. Of all-steel construction and, therefore, virtually indestructible, the battery comprises six cells of sufficient capacity to provide three to four hours' light on the major 18-watt filament, and about 20 hours on the 3-watt reserve. It can be left for indefinite periods in a charged condition without risk of deterioration.

A push on-off switch is positioned by the projector handle to allow for easy one-handed control.

In use, the battery is contained in a stout leather case, and this, together with a leather bag for the projector, is attached to a carrying harness to give the maximum comfort and minimum fatigue when covering rough ground.

The weight of complete equipment is under 14lb. and the maximum candle power 15,000.—**Nife Batteries (Publicity Dept.), 6-10, Whitfield Street, London, W.1.**

Plessey Enclosed Transformers and Chokes

TO meet the demands of manufacturers for transformers and chokes designed to give greater climatic protection than that provided by those of open commercial construction, the Plessey Company has introduced a range of new, totally enclosed, semi-sealed units particularly suitable for use in industrial and test instruments and in communications equipment. These are vacuum impregnated with bitumen varnish, and enclosed in one of five basic sizes of bitumen-filled cases. The electrical properties of the units may be varied in manufacture over a wide range to meet manufacturers' operational requirements.—**Plessey Co., Ltd., Ilford, Essex.**

Programme Pointers

A MONTHLY CRITIQUE BY MAURICE REEVE

THE BBC, as with the film and stage censorship, is apparently determined to remain the despair of its friends and the joy of its enemies. One day we can listen to a "joke," the sexual implications of which must be apparent even to an adolescent; whilst the next a prunes and prisms item is put over in a manner calculated to offend the hard-boiled listener in Putney or Cockfosters. But surely the nadir of logic, common sense and the proper relative proportions in entertainment values were reached recently when, of all people, Mr. Gillie Potter—than whom no broadcast entertainer is less likely to offend both Battersea and Belgravia, and who is one of a small handful of wireless artists who can legitimately claim to be a "fireside man"—was asked to delete "from B.C. to BBC" in his "review" of an imaginary book called "The Mouth Organ—Its Use and Abuse," by Sir Adrian Boult, on the grounds that the letters B.C. were a religious term.

Holy Smoke! Hell's Bells! Is a Reith lecturer going to be adjudged irreverant because the context of his subject compels him to say that Plato, or who you will, was born in 500 B.C.? Or a Regius Professor for saying that Julius Cæsar invaded Britain in 55 B.C.? Why not censor any reference whatever to "sacred" persons, events or dates—of which there must be many hundreds over the air every year—in any script other than one specifically dealing with those subjects. One of these days we won't be able to call our "home" our own.

Plays

"Black Chiffon" and "This Happy Breed" were two good plays given good performances and productions. The former, by Leslie Storm, in which Flora Robson played so outstandingly in the West End recently, is a psychological study of the mental aberration of a woman of unblemished character, with a husband of substance, and a grown-up son and daughter, being irresistibly and fatally tempted, in a store, to steal a luxury black chiffon "nightie." Never having pinched so much as a raisin from the groceries in her life, she was perfectly able to buy it legitimately, and had probably bought similar garments before. Whether the extreme rarity, in real life, of such an event justifies the play or not, I won't say: neither will I wholly defend the tragic reactions the lady's lapse had on all concerned. The husband was equally filled with outraged *amour-propre* and a loathing for his son, whom he practically accuses of incest with his mother, under the well-known Oedipus law, and her jealousy of, and desire to compete with, his young and attractive fiancée. Not a word of sympathy or help is offered to the poor woman who, after considering various "not guilty" defences, decides to plead guilty and gets six months in consequence.

The role suited Gladys Young very well, and Ivan Samson revealed the husband's wounded self-esteem perfectly. The young people were as young people always are in radio drama; just young people almost indistinguishable from play to play.

Noel Coward's "This Happy Breed" is the slightest of slight stories, a sort of family saga of a '14-'18 soldier up to the outbreak of the second world war. Everybody in the plot seems to spend their entire life quarrelling with somebody or something; rancour and petty jealousy are rife; whilst concord and family ties show up conspicuous by their very absence. Anything but a "happy breed," one would imagine. One supposes that the author has used the unit of the Gibbons family and its various branches and connections to symbolise the country, which, between its wars, spends its time squabbling and quarrelling, and fighting out the rights and wrongs of party claims. Reginald Purdell made a sturdy begetter of the breed of not-so-contented islanders, with Betty Baskcomb, Roger Snowdon, Michael Harding, Stanley Groome and various others aiding and abetting ably.

"Running Water"

This, from A. E. W. Mason's story, was a slight affair of mountaineering and the daughter of a long-separated couple; one of the less satisfactory pieces with which we are sometimes regaled under the portentous headline, "Saturday Night Theatre."

I regret I was unable to listen to "Arms and the Man," which doubtless spelt this weekly feature in large capitals.

A Hotch-Potch

The Sunday evening feature, "Athens" (am I, by the way, being irreverant in thus speaking of the Sabbath?), was a hotch-potch affair of street cries, café talk, newspaper headlines, street noises, church bells and what you will, interspersed with quotations from Plato, Aristotle, etc.—or it might have been Thucydides and Socrates, etc., I really forget. Chef: Louis McNeice.

Miss Grete Scherzer gave one of the most cold-blooded performances of Chopin's glorious B Minor Sonata it would be possible to imagine. At present, this young pianist seems wholly occupied with speed and the most superficial kind of finger work. The fire and dash of the music were wholly neglected. On the other hand, Dame Myra Hess played Beethoven's most massive sonata, the last, and Schubert's scarcely less so in A minor, with lovely poetry and ripe maturity, even if her technique is less fleet these days than of yore.

Miss Rose Macaulay, speaking in "The Critics'" Sunday morning programme, spoke what "should" be definitive word against studio audiences.

BATTERY SUPERSEDER.—Will save battery users pounds. Operates from a 2-VOLT ACCUMULATOR and delivers constant H.T. of 67 volts at 4.7 m.a., 130 volts at 13-25 m.a., and 1.4v. L.T. if required. American made, and originally intended for Walkie-talkie equipment, this unit is easily adapted for use with any battery set, and fully illustrated details are supplied. ONLY 60/- (postage, etc., 2/-).
PYE 45 MC/S I.F. STRIP.—Ready made for London frequency vision channel. Complete with 6 valves EF50 and an EA50, and details of very slight modifications required. ONLY 59/6 (postage, etc., 2/6).
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10-VALVE 1½-METRE SUPERHET, ZC8931.—For long-distance TV results. Valve line-up is 6 of VR65, 2 of VR92, and 1 each VR136 and VR137, and the 12 mc/s 6-stage I.F. Strip gives tremendous amplification with ample bandwidth of 4 mc/s. Easily modified, full details supplied. ONLY 59/6 (carriage 5/-).
RDF1 RECEIVER.—The unit described in October 1951 issue of *Practical Television* for conversion into a 2-CHANNEL TELEVISION RECEIVER, giving SOUND AND VISION ON THE ONE CHASSIS. In excellent condition, and complete with 14 valves ; 5 of SP61, 2 of P61, 3 of EA50, and 1 each CV63, EB34, EC52, 5Z4, and a reprint of the above article. ONLY 49/6 (carriage, etc., 5/-).
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100-MICROAMPS METER.—2½in., flush-mounting. Widely calibrated scale of 15 divisions marked "Yards," which can be re-written to suit requirements. These movements are almost unobtainable to-day and being BRAND NEW IN MAKER'S CARTONS are a "snip" at ONLY 39/6.
CAR OR STORAGE BATTERIES. By famous American makers. BRAND NEW AND UNUSED, these have genuine hard rubber cases. 6 v. 77 a.h. "PHILCO" size, 10½in. long, 7in. wide x 8½in. high. ONLY 82/6. 6 v. 90 a.h., "THOR," size 8½in. long x 6½in. wide x 7½in. high. ONLY 87/6 (carriage 5/- each battery).
EX-W.D. TRANSFORMERS.—All Heavy Duty, with 230/250v. Primaries. Type A has Secondaries of 330-0-330v. and 4v. 3 amps. ONLY 22/6. Type B is an E.H.T. Transformer with Secondaries of 2v. 1.5 amps., 300v. 10 m.a., 520v. 10 m.a., 1,400v. 2 m.a. ONLY 21/-. Type C is a Filament Transformer with Secondaries of 6.3v. 7.7 amps., 4.2v. 2.5 amps., 4v. 1 amp. ONLY 19/6. Also available is a companion CHOKE of 30H 150 m.a. at ONLY 12/6. ALL ABOVE ITEMS BRAND NEW AND UNUSED. Postage on each item 1/8.
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CONDENSERS.—Paper, metal cased.—1 mfd., 3,000 volts, 4/6 : electrolytics (cans unless stated) : 8 mfd. 450 v., 2/6 ; 8 x 8 500v., 4/9 ; 8 x 16 450v., 5/9 ; 16 500v. cardboard, 6/- ; 16 450v. can, 5/6 ; 16 x 16 500v., 7/- ; 24 350v. cardboard, 4/6 ; 25 25v., 1/6.
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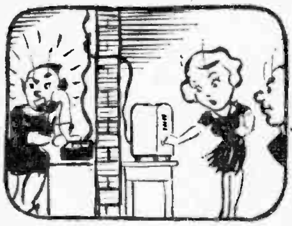

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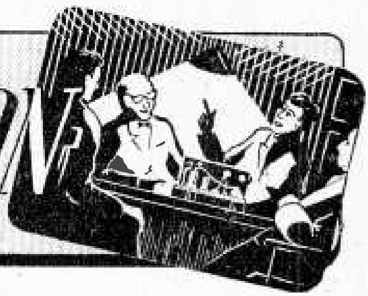

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Disc or Tape?

SIR,—There is one thing which has never appeared in your pages, and that is a complete constructional article on direct disc recorders.

Although many articles have been printed concerning tape recorders and details have shown how actually to construct an efficient unit, this type of instrument is in itself very limited when it comes to keeping a list or record of all recordings on tape, apart from the expense of storing tape, particularly if a special item happens to be in the centre of a reel and one wants to play it without delay or listening to the rest of the tape.

Also, even if a particular item on tape suits the amateur, what happens if a friend would like to have a copy ?

Tape transcription on disc is, of course, the answer, but there are not many amateurs who have disc recorders or even simple substitutes.

Most amateurs feel the urge to do a little recording using an ordinary gramophone unit and pick-up, but usually the results are not too good.

There is, first of all, trouble with the tracking, even if this is cleared up by using two pick-ups, their arms joined together and one pick-up playing on the outside of a 12in. record and the other, weighted, recording on a 10in. blank disc placed on top of the other record. Trouble is usually encountered by the turntable slowing down every time the pick-up starts recording.

The problem of good tracking is not as simple as a tape drive. First of all these following points are required : (a) stability, (b) the most simple system for tracking, bearing in mind the tools which the amateur can make use of and the materials available, and (c) the easiest way for driving the tracking gear. A suggested means is using the drive from the centre of the turntable. Finally, a properly designed unit that is not using weights or any kind of improvised system described using two pick-ups, but a simple overhead traverse tracking gear. For the cutting head a modified magnetic armature pick-up.—Z. M. E. PREECE (Harlington).

Breakthrough Wave-traps, etc.—Correction

SIR,—With reference to my article, "Breakthrough Wave-traps and Short-wave Adaptors," in the December, 1951, issue ; to those who follow the text the printer's error under the theoretical diagram should be obvious. The circuit shown is that of a short-wave adaptor, and not an H.F. stage, as described.—A. W. MANN (Middlesbrough).

Half-wave Rectification

SIR,—In PRACTICAL WIRELESS for December is a letter on "Half-wave Rectification," by Malcolm Mackenzie.

In this he states that manufacturers do not make transformers for H.W.

The reason is, surely, that double-anode rectifiers are simple enough to obtain and, besides, with H.W. rectification more capacity for smoothing is required, 40 μF + 20 for H.W., and 16 μF + 8 μF for full-wave.

The only reason for using half-wave rectification is when an A.C./D.C. set precludes the use of a mains transformer.

On the score of saving space and money, the extra capacity required for half-wave would take care of any gains in these directions.

So I advise Mr. Mackenzie to stick to the conventional arrangements for power supplies.—A. WEBB (Cfn.) (B.A.O.R.5).

A.C. from D.C.

SIR,—In PRACTICAL WIRELESS for November, 1951, under the heading "Open to Discussion," you published a request from me, with a circuit diagram of an inverter, in which I was asking for information concerning same.

I have since received dozens of letters which have been very helpful and I thank you, and also for the space you gave my request. Wishing you and PRACTICAL WIRELESS all the best for the future.—J. VAN NIEKERK (Co. Durham).

Progress (?)

SIR,—I heartily agree with A. C. Heath (Dec. issue) on the indifference shown by manufacturers to the battery-set user. It appears that the industry is stagnant for want of ideas. Not only are high prices a disgrace to the battery-set manufacturers, but television has done little better. Twenty years ago Baird showed us a picture on a full-size theatre screen, yet to-day we are offered for home use a puny 10in., or at best a 15in. picture. Now designers, why not a 2ft. or 3ft. projected picture on a flat wall-screen ?

Meanwhile, I carry on with my 14-year-old nine-stage battery superhet which, even to-day, is in advance of anything I could find at the show !

Yes, P.W., up and at 'em ! Let's have a really good medium-wave chassis design (who wants long-wave, anyhow ?), preferably, I suggest, with 1.4 volt tubes and voltage-dropping for the accumulator user.—A. E. ATTWOOD (S.E.2).

T/R9 Conversion

SIR,—I am writing to let you know what a success the TR/9 conversion set which appeared in the April, 1951, issue has been. I have recently been able to log quite a few DX stations with a fairly small aerial. The principal DX stations are: CSW5, HBR-5, HBU-3, Ankara (TAP ?), VUD-2, WRCA, WRUL, OFD (Brazzaville), Leopoldville (OTC ?), most of which have been logged on the 25- or 31-metre bands. Incidentally, I find the set tunes from 20-46 metres and not as printed from 18-24 metres.—B. PICKRELL, aged 16 years (S.E.3).

High Fidelity

SIR,—Like Mr. Purdy, who writes in your December issue, I am inclined to disagree with the theorists who claim that two speakers are necessarily better than one. But your correspondent is not quite correct in suggesting that because the adult ear cannot detect frequencies above 10 kc/s, it is wasteful to build amplifiers with response up to, say, 20 kc/s. Frequencies beyond the limits of the human ear can produce different tones within the audible range, and my inexpert understanding of musical sounds is that it is harmonics and the different tones they produce that distinguish the tone and character of individual instruments. Surely, all instruments producing the same note, say, middle C, would otherwise be indistinguishable ? If this is correct, there is every justification for wide-range amplifiers in the quest for realism. Whether the search is helped or hindered by two speakers is another matter, although on the face of it there would seem to be logic in expecting a big speaker to deal more efficiently with bass, thereby compelling a small one for treble.

Perhaps as a musician Mr. Brain, who also wrote last month, could throw some useful light on these fundamental and arguable problems. In general, it seems to me that high fidelity is too much a matter of personal taste to be reducible to theoretical niceties, and that satisfaction lies only at the end of the hard path of trial and error.—J. R. HODSON (Hayes, Kent).

Loudspeaker Design

SIR,—I have been intrigued by the recent correspondence on quality reproduction, and am wondering if there is any point in raising something which has for long been in my mind. I refer to the loudspeaker. Design here appears to have stood still, and I am doubtful whether a cone driven as in all present-day models is the answer to good reproduction. Surely there are many sources of distortion introduced by the current idea. What about the impedance variation of the speech coil ? What about inertia ? What about flexibility throughout the cone material ? There are dozens of other points—the corrugated surround (as compared with a free-edge) ; variation in magnetic "pull" in different parts of the gap ; intermodulation between cone, speech-coil unit and the actual speech coil itself, etc. I remember a long time ago an attempt to produce a flat diaphragm, and there was the Primax speaker, the Marconiphone double-cone, etc. Why have manufacturers remained aloof from speaker developments in the search for quality ?—H. G. PREEDY (N.W.9).

Negative Feedback

SIR,—Looking through the August issue of "P.W." I noticed that a Mr. George E. Briddon (S.W.3) had submitted a negative feedback circuit. He claims that negative feedback is minimum at full volume control setting and that it increases as the volume control is reduced.

Surely the percentage of negative feedback is the same at all volume control settings ?

Because the feedback from the secondary of the output transformer is entirely dependent upon the amount of signal reaching the output stage, and as this is controlled by the volume control, the feedback must, therefore, always be a constant percentage of the output.—J. R. RUTLAND (Dagenham).

Long-wave Reception

SIR,—We thank you for the space given to our letter in January, 1952, issue on long-wave reception.

We regret to say that an error crept into the diagram on page 41 with the result that we have been already "found out" by one of your fast-working readers who has tried the modification without success.

The anode section of the switch has the selector on the I.F. screened lead and *not* on the anode itself. The result being that the trimmer is shunted across the primary which is correct, and not in series as shown in the diagram.

Our apologies for the error.—S. F. HOOK (Ebley, Stroud).

Car Static

SIR,—I have recently been experimenting with a home-made car radio and have come across an interesting point which I have not before seen mentioned. After installation (temporary) I tried several aerials but on several trial runs I had a most distressing background of crackles. I repeatedly took out the set and checked for loose connections, etc., but could not get any crackles on the "bench." I went over the car electrical equipment and again found no cause for trouble, and when discussing this one day with a friend he told me that he had heard that cars accumulated quantities of static and that he had read that dogs were susceptible to this static and that a car in which a dog was taken for a ride should be provided with a static discharger. Can this be the cause of the crackles in my radio, and, if so, has any other reader experienced the trouble ? If so, how can a "static discharger" be fitted ?—G. REYNOLDS (Edgware).

[*We have heard of people getting a shock from the static electricity accumulated by a car body, and normally a trailing chain attached to a convenient part of the chassis will keep the static down. Usually such a charge is only accumulated during thundery, very wet or very dry weather and we do not think it responsible for your experience. However, perhaps other readers may have some experience in this direction and would care to pass it on.*—ED.]

Impressions on the Wax

Review of the Latest Gramophone Records

RACHMANINOV composed not only the world-famous "Prelude in C Sharp Minor" but 23 others—the same number that Chopin wrote. Together they form the finest collection of piano-writing that has appeared during the present century. Rachmaninov, himself one of the greatest pianists of his time, had a more extensive vocabulary of his instrument than any other living composer, and in his isolated pieces—particularly the Preludes—he provides a wide range of expression.

The famous "Prelude in C Sharp Minor" was written when Rachmaninov was 19, and is a dramatic little poem—although nothing to do with a dead man trying to get out of his coffin! This piece, coupled with the "G Major Prelude," has been recorded on *Columbia LX*1464, by the Philadelphia Orchestra conducted by Eugene Ormandy.

Tchaikovsky's "Casse-Noisette (Nutcracker)" Suite makes a welcome reappearance on three 12in. records—*H.M.V. C*4133-5, played by the Philharmonia Orchestra conducted by Igor Markevitch. You should certainly hear these records.

L'Orchestre National de la Radiodiffusion Francaise, conducted by Edouard Linderberg, have recorded "Danse Macabre," by Saint-Saens, on *Parlophone R*20598. This is the first time this orchestra and conductor have appeared on Parlophone and what an auspicious debut! Apart from the excellent performance the French engineers are to be admired. It is a first-class recording and the balance is excellently maintained.

Other orchestral recordings this month include "Traumere" and "Abendlied," played by the Boston Promenade Orchestra conducted by Arthur Fiedler, on *H.M.V. C*4137; Haydn's "Symphony No. 94 in G Major," played by the Royal Philharmonic Orchestra conducted by Sir Thomas Beecham, Bart., on *Columbia LX*1499-1501; and finally, "Intermezzo" and "Coronation March," played by the Philharmonia Orchestra conducted by George Weldon, on *Columbia DX*1801.

Instrumental

The violin played by Gioconda de Vito and the harpsichord played by George Malcolm are featured in Handel's "Sonata No. 4 in D Major," on *H.M.V. DB*9696-7, whilst under the heading of "Memorial Edition," Artur Schnabel (pianoforte) played Beethoven's "Sonata in E Flat Major," on *H.M.V. DB*9898-9. As an interpreter of Beethoven Artur Schnabel was supreme, and remained the composer's greatest exponent on the pianoforte during his lifetime. This recording is a further tribute to the memory of a great artist.

"Waltz (from Suite No. 1)," by Arensky, and Bach's "Sheep May Safely Graze," are played as a pianoforte duet by Cyril Smith and Phyllis Sellick on *Columbia DX*1806.

Vocal

The prodigious success of Mario Lanza's recordings is well known. Nothing for a long time has surpassed the popularity of his selections from the film "The Great Caruso," in which he plays the title role.. His latest release, "The First Noel" and "Silent Night," on *H.M.V. DA*1998, should certainly be a best seller. On both sides of this recording he is accompanied by orchestra and Jeff Alexander Choir, conducted by Ray Sinatra.

"Ave Maria" and "The Holy City," both of which are equally famous, have been recorded by the Melachrino Strings with the Peter Knight Singers conducted by George Melachrino on *H.M.V. C*4141.

Walter Midgley, the brilliant tenor, who hails from the Yorkshire village of Bramley, has sung frequently at Covent Garden, where he was highly praised for his Des Grieux in "Manon," as now sung on *H.M.V. DB*21358.

A complete recording of "La Traviata," conducted by Toscanini, includes the following singers: Licia Albanese (soprano), Robert Merrill (baritone), Jan Peerce (tenor), Arthur Newman (bass), Maxine Stellman, Johanne Moreland, John Garris, George Cehanovsky and Paul Dennis. It is sung in Italian on thirteen 12in. records—*H.M.V. DB*21360/72.

This great Verdi opera needs no introduction, but the significant point about the issue is that this is the first recorded opera to be released here under the direction of Toscanini. The cast is a typical New York Metropolitan one and the whole set is a musical feast for opera lovers.

Variety

The hits of two London musical shows have been recorded by the original artists. The first, "And So to Bed," the tuneful score of which has been written by Vivian Ellis, is featured on *H.M.V. B*10176-8, and the other is "Zip Goes a Million," featured on *H.M.V. B*10179-81.

The resourcefulness of present-day recording methods (on tape) is shown in a new light in the release of "There's a Small Hotel" and "The Moment I Saw You," on *Columbia DB*2982. American Jo Stafford and English Teddy Johnson sing a duet, but in so doing remain 6,000 miles apart. Stafford sang her part in America and Johnson sang his in the London studio. The two performances were then wedded together.

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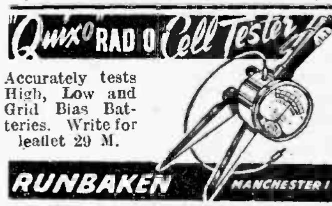

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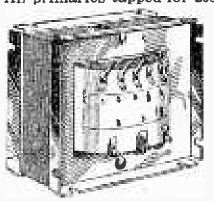

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